Foreword by Herb McCormick, *Cruising World* magazine

Second Edition
Completely Revised and Expanded

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–*Blue Water Sailing*

The *Voyager's* Handbook

"If you are serious about that extended voyage, read it."
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The Essential Guide to Blue Water Cruising

Beth A. Leonard

The *Voyager's* Handbook

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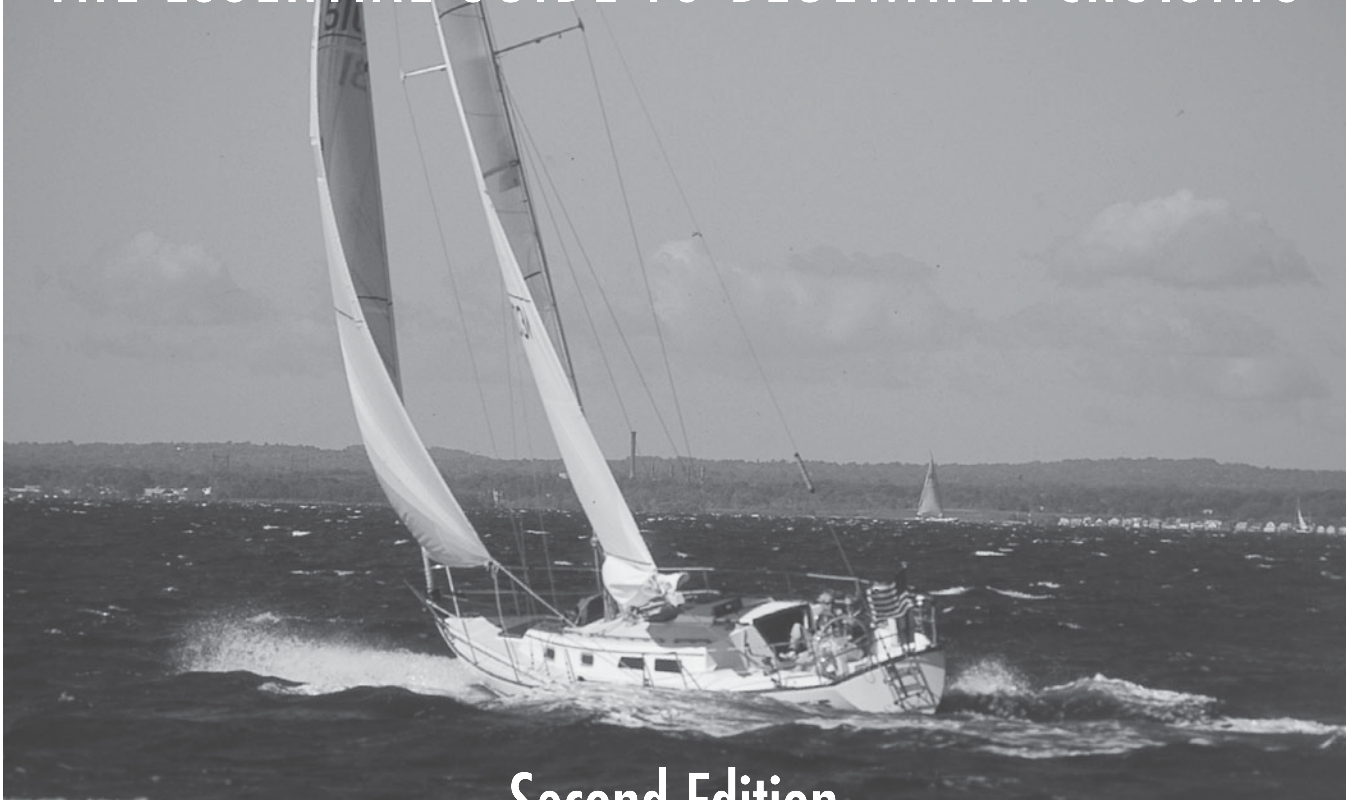
The *Voyager's* Handbook

THE ESSENTIAL GUIDE TO BLUEWATER CRUISING



Second Edition

Beth A. Leonard

International Marine / McGraw-Hill

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To my father
who gave me the courage to dream,
and to Evans
who gave me the strength to live my dreams.

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Foreword
to the Second Edition

by Herb McCormick

WHAT IS IT about offshore sailing, extended cruising, and long-range voyaging that makes the pastime so very appealing to such a vast range of people from so many walks of life? That's a question to which I've given an inordinate amount of thought over the years (it's an especially appropriate topic to ponder on a midnight watch hundreds of miles from the nearest speck of soil). I've come up with a few answers.

Sure, there's the incredible beauty of it, particularly when you're creaming along before a fresh breeze and beneath a sky full of stars on a perfectly balanced boat, or when a lush, green island looms on the horizon after many miles and days on the blue, blue sea. And, of course, there's the challenge in it, for there's no other activity on the planet quite as testing, unique, or fulfilling as guiding a small vessel across a vast body of water safely and efficiently. Finally, there's the wonderful harmony to it, for there are few things more enjoyable—and, in this day and age, more relevant and important—than harnessing the clean, fresh power of the wind and currents to propel our dreams and ambitions.

Cruising sailors are, by nature, both engaged and engaging, or at least that's the way it seems to me. They are people who've made a conscious choice to set forth into the world with open eyes, hearts, and minds—travelers, if you will, who are bound and determined to take the road less traveled. That may be one of the less-kept secrets about cruisers: Sure, they may come from various places and backgrounds and stations, but when all is said and done they're not very different at all. On the one hand, self-sufficiency and independence are their bywords; on the other, they're part of a grand community that relies upon all its members for advice, guidance, laughter, and friendship. It's this wonderful dichotomy that makes the cruising world go round.

But what about our initial query: Why the appeal? I reckon the ultimate answer is pretty basic. Quite simply, the best thing about voyaging is that it's a lifelong pursuit of knowledge and understanding. No two passages are ever the same. Even the most experienced sailor among us some day will be faced by something he or she has never seen before. At that point, they'll employ their wits and wile to address the matter, and another chapter in their personal history will be in the books. The best part of sailing? It's a journey, a quest, which never, ever ends.

And that brings us to the book you now hold in your hands.

Over the years, I've had the distinct pleasure of assigning and editing numerous sailing stories from Beth Leonard. Whether crafted at sea or in port, they've always been written in crisp, clear, straightforward prose that always delivers. Her voice is clear, eloquent, straightforward, and authoritative. Naturally, she and her partner, Evans Starzinger, have sailed far and wide; it's a prerequisite for tackling a tome such as this. More important, they stopped and looked and listened all along the way.

I know all this because I've come to realize that, in her own journey, Beth Leonard has not only become a wonderful sailor, but also a fine teacher. I know this because I've learned so much from her.

Now, with this terrific, wide-ranging resource, so can you.

Herb McCormick
Cruising World

Foreword
to the First Edition

by George Day

Ocean cruising and world voyaging have a way of changing a person, or a couple, in ways that never occur ashore. Once you have sailed across an ocean, watching the moon move through a whole cycle and meeting the great sea mammals on their own turf, you never see our home planet and our little place in it quite the same way again.

And when you get to the far islands and continents at the end of a long passage, when you drop the anchor off a white coral beach and stroll through coconut groves where you have to guard your toes from the claws of coconut crabs, you begin to forget the things that were once so important at home. You happily exist without phones, fax, and e-mail, without a daily mainline of news, without road rage and Prozac and attention deficit disorder. You become a self-sufficient citizen of the sea. You realize the importance and beauty in small things. You become, in a way, less civilized and more human as you develop voyaging skills and a cruising state of mind.

But the leap from casual coastal sailing to world cruising is a long one that demands the acquisition of a certain body of knowledge and a new attitude. The life aboard a small ship is not for everyone, yet it is one that can be adopted successfully by the most woods-bound landlubber if his or her attitude is right. Making the leap does not require an expensive boat, the latest electronics, or a million dollars. It does require an adventurous spirit, a flexible mind, and a persistent willingness to learn.

In the pages of this book, Beth Leonard will open many doors for you. Being a comparatively recent convert to the world-cruising life who jumped in with both feet by setting off immediately on a circumnavigation, she brings a fresh zeal to the subject, tossing out tired old notions and reinforcing practices that really work. An international management consultant, she has a gift for seeing into the heart of a problem, while organizing solutions in simple, logical ways. There are many chapters in this book that you will want to keep as ready reference, even after many years of bluewater sailing.

When I think of the transition a sailor makes from coastal to offshore cruising, I always think of the Maine yarn about an MIT mathematics professor who adopted cruising as a summer pastime. One afternoon he found himself hard aground on a submerged ledge off his harbor entrance and had to hail a nearby lobsterman for help. After being hauled off the ledge, the professor exclaimed, "How illogical of them to put the buoys over there, when the ledges are over here!"

The lobsterman looked the man in the eye and said, "You know, professor, you sure do know a lot, but you don't realize nuthin'."

In the pages of *The Voyager's Handbook* you'll find a lot of knowledge that will help you prepare for offshore cruising. You'll also find many realizations that are keys to really enjoying and being successful in the voyaging life.

Fair winds,

George Day
Publisher, *Blue Water Sailing*

Preface

WHEN I AGREED to do this revision three years ago, I vastly underestimated the task I had set for myself. I knew that the book was in need of updating, that things had changed since we had started cruising in 1992. But I hadn't considered just how much they had changed. Looking back on it, I would say that offshore boats and equipment changed more in the last decade than they had in the hundred years prior, from the time Slocum took his Spray and sailed her around the world alone.

It wasn't just that the boats got larger, though average length has increased 10 feet since we ended our first voyage in 1995. But the range of boat types out cruising expanded exponentially as well. The 30- to 35-foot heavy-displacement traditional cruisers that typified offshore boats through the 1970s have been joined by lighter, more modern designs, and in the past few years multihulls have made big inroads into the cruising fleet. New low-stretch, high-strength materials for sails and lines facilitated the increase in boat size as did new sail handling techniques adapted from the shorthanded round-the-world racers. Satellite technology revolutionized communications and navigation aboard, while the Internet and cash machines greatly simplified managing life from abroad. Improvements in just about every aspect of technology from watermakers and refrigeration to solar panels and batteries made it possible for long-distance voyagers to bring along most shoreside comforts. Mass marketing of these new technologies brought the costs for all these comforts and conveniences within reach of the moderately well-to-do cruiser. From sail handling to communications, from sail materials to navigation, much of what we have aboard our 47-foot sloop, *Hawk*, did not exist or was prohibitively expensive a bit over a decade ago when we outfitted our Shannon 37 ketch, *Silk*.

All of this means that the cruising community has become much more diverse. In any harbor in the world where cruising boats congregate, 1970s traditional cruisers equipped with little more than a GPS and a depth sounder lie at anchor next to multihulls and modern performance cruisers carrying watermakers, generators, refrigeration, washer/dryers, and air-conditioning. This incredible diversity of boats proves there is no single right way to go cruising, but that each crew must find a balance between luxury and simplicity that reflects their priorities as well as their budgets. To be useful, the revised *Voyager's Handbook* needed to address the needs and concerns of crews at either end of this spectrum.

I hadn't really considered all of this when I sat down and started to write. For the first few months, I approached each chapter believing that this one would require some simple editing, just a little bit of revision. Instead, I ended up rewriting almost every word in the first two sections of the book and adding three new chapters. While I was able to keep a substantial amount of the material in the second half of the book, much of it got reorganized to make it more useful, and I added another four chapters of new material on subjects ranging from dealing with business and bureaucracy from the boat to managing heavy weather at sea. The revision ended up taking me two and a half years.

In the process, I tried to remain true to the original vision of the book: What does an experienced coastal sailor need to know to make offshore passages and live aboard in foreign lands for a period of several years? These pages contain everything I wish I had known when we first set sail. I hope they will help you to cast off the docklines and begin a new life.

Acknowledgments

MANY MIDWIVES HELPED this book along its journey and into your hands, and I owe a debt of gratitude to all of them. First, I have to thank Evans for his support and understanding as well as his technical expertise, fact checking, and hard-nosed editing through the three years of this revision. This book is as much his as mine.

I also want to thank those who offered their advice, enthusiasm, encouragement, and support through two editions of this book, with special thanks to: Ginny Vought, Scott and Kitty Kuhner, and Clive Shute and Laila Stjerndrup. Steve Corenman provided an offshore racing perspective as well as technical assistance on everything from onboard communications to weather forecasting. Dr. Pat LaFrate and Dr. Susan Kline assisted on medical issues. I am grateful to Jon Eaton and the team at International Marine for their professionalism, support, and patience, as well as for their willingness to juggle publishing deadlines and sailing schedules.

Close to two hundred crews contributed to this second edition. They shared everything from detailed accounts of their first year of cruising to detailed records of their finances. Several dozen experienced voyagers gave me comments on the first edition and reviewed sections of the second edition. Without their contributions, this would be a less informative, less useful book. For their willingness to be interviewed multiple times and answer endless questions, I'd like to thank Mel and Jackie Cohen; Steve and Dorothy Darden; Ellen, David, Eric, and Jason Ernisse; Chuck and Kathy Hall; Beth and Kevin Hansen; Jim Houston and Patti Sutter; Susanne Huber-Curphey; Karl and Jill Matzke; Lin and Larry Pardey; Peter Robinson; Bradley Rosenburg and Kathy Clark; Ken and Janet Slagle; and Louise and Gary Wollman. Thanks also to Stephanie Hammill for editing the first section and providing me with many valuable comments; and to Debra Cantrell, Christine Meyers, and Tom and Christine Harper for letting me quote them at length.

I wish I could thank every person by name who contributed to this volume, but I would have to list a majority of the people with whom we have crossed wakes in our decade cruising aboard *Silk* and *Hawk*. Instead I will say thank you to all the inspiring voyagers we have been privileged to meet who have shared their wisdom and their joy. In the spirit of their giving, I pass this book on to you, the reader. May you too discover that the beauty of the dream does not even begin to compare to the magic of the reality.

Introduction: Is This the Life for You?

On a brilliant June day in 1992, my partner, Evans Starzinger, and I boarded our Shannon 37 ketch, *Silk*, untied our docklines, and sailed out under the Newport Bay Bridge. Like the dozens of other crews out on pleasure boats that day, we could have turned back to our snug berth as sunset colored the water and an evening chill arrived. But we had spent the last two years preparing for that day. We kept sailing—to the horizon and beyond—and began a three-year odyssey that would take us to three continents.

For the five years before our departure, we spent almost every waking minute living the life of successful 1980s baby boomers. As international management consultants, we worked 70-hour weeks, traveled to different cities and countries weekly, and saw each other for only a few hours each weekend. When we were asked to stand for partnership election in our firm, we both took a hard look at ourselves and considered what we wanted to do with the rest of our lives. Despite the applause and accolades, neither of us had ever accomplished anything we considered worthwhile. We knew we were on the wrong track. With that realization, we took the first step toward a new life.

No one can be completely prepared for a change of such magnitude, and we were less prepared than most. Just two months before putting to sea, we left our jobs in Sweden. We came back to the United States in April, to a boat we had purchased but never seen. *Silk* had been refit during the winter for offshore sailing, and we started sailing her less than two weeks before our departure. We had taken some liveaboard courses, but we had almost no offshore sailing experience. On that June day, we sailed under the Newport Bridge for our shakedown cruise to Bermuda. Our journey had begun, but we had not left our old lives behind.

Three days later, we were in the worst weather of our entire voyage. We ran under bare poles dragging warps while the wind shrieked in the rigging and waves crashed on the coach roof. The motion below felt like a roller coaster jumping its tracks. For the preceding 36 hours, we had both been so seasick we couldn't keep water down. My jaw ached from clenching my teeth against the tension. All I wanted was to get off that boat. Only then did I understand what this was all about. I wasn't hiking in the woods or sailing on a lake where rescue was never far away. I had chosen this, and no one could come and take me back to shore. I had to live with my choice.

I didn't recognize the person thinking that way. I had never thought of myself as brave, but I hadn't considered myself a coward either. I thought I took responsibility for my actions. But there in *Silk*'s belly—as I fought nausea, apathy, and fear—I took a hard look at myself. For perhaps the first time, I understood the true meaning of responsibility. I saw clearly the person I had been and got a brief glimpse of the person I hoped to become.

When we returned three years later, on the Sunday of Memorial Day weekend in 1995, a different person sailed back under the Newport Bay Bridge. The person who left had viewed time as something to be constantly filled or lost forever; the person who returned understood that time is the only space within which the soul can expand. The person who left was too busy earning money to do simple tasks such as cleaning the house or baking bread; the person who returned had learned that no amount of money can compare with the value of self-sufficiency. The person who left had never spent more than 48 hours alone with her partner over the course of their four-year relationship; the person who returned trusted her partner with her life and had been trusted with his.

As we sailed up Narragansett Bay, most people would have seen one of hundreds of boats enjoying the late spring sunshine of a holiday weekend. But a few people would have taken a second look.

They would have noticed the battered hard dinghy lashed securely to *Silk*'s coach roof and the rust-spotted wind vane on her transom. They would have noted the sea-silvered teak, the plastic jugs lashed to the mizzenmast, and the gooseneck barnacles growing just above the waterline. They might have looked closely enough at the sailors on board to see deeply burnished tans and sun-bleached hair. They would have wondered where we had been, what places we had visited, and what tales we had to tell.

If you are one of those people who would have noticed us that Sunday and thought even fleetingly of your own dream, this book is written for you. When other boats scurry back to their berths just ahead of the setting sun, you want to keep sailing. You want your tracks to be the only ones on a perfect sand beach of a deserted tropical island. You want to see the green flash, taste coconut milk from the husk, watch the fish dance at dusk, and share a feast with new friends from other cultures.

This book can help you get there. It is written for coastal and limited offshore cruisers who want to make the transition to long-term voyaging. I have tried to capture everything I wish I had known on that June day when we first sailed out from under the Newport Bay Bridge.

Within months of returning from that first voyage, we realized that we had changed too much to fit back into our old lives. In 1996 we began building a new boat, a 47-foot aluminum Van de Stadt Samoa sloop that we named *Hawk*, and we left again in 1999. We have lived aboard *Hawk* for the last seven years and sailed her more than 50,000 nautical miles. We have cruised along the Arctic Circle on Midsummer's Eve and spent Christmas in Puerto Williams less than 50 miles north of Cape Horn. We have spent sixty days on passage in the Southern Ocean between the Beagle Channel and Fremantle, Australia. This book was written aboard that boat, at a writing desk specifically designed to be my floating office.

Having done it not once, but twice, we know that stepping aboard your boat and heading off to sea takes a leap of faith. You must have faith in your vessel, in your partners, and most of all in yourself. To some extent, the act requires blind faith—for no one can fully understand such a different life before they live it.

What is it really like? If you want only to travel, you would be well advised to look for a simpler, less risky, and less time-consuming way to visit exotic places. Voyaging is not even primarily about sailing. Sailing is only one element of the life, and you cannot understand the nature of voyaging from a two-week charter in the Caribbean. Voyaging is not temporary, and that makes all the difference.

Voyaging is a way of life. It changes everything: from your interactions with other people to how you think about time to the value you place on convenience and comfort. Most people take a year or more to begin to understand these differences—to slow down and live life. You may sun on deck and snorkel in exotic waters, but other activities will take priority. A typical day mixes the following activities, depending on whether you are on passage or in port:

- **Keeping the boat going.** For every person aboard, this is a key focus that includes everything from engine repair to reprovisioning. Most boats lack the basic household conveniences we have come to take for granted ashore, such as clothes washers and dishwashers. Household chores take longer, and in addition to that, we spend an average of 20 crew hours per week fixing and maintaining the boat.
- **Seeing the places along the way.** When you travel as a tourist, you are insulated from the frustrations and fascinations of everyday life. When you travel by boat, you must interact with the people you encounter as you buy food in the market, get diesel fuel at fishermen's wharf, and check in with the local police and customs. These interactions can lead to rewarding relationships and insights into rich cultures. But the very best experiences take additional effort. Once you arrive in paradise, you still have to make the magic happen.
- **Enjoying the cruising community.** The crews of offshore boats form a tightly knit, small community. Because of the hurricane seasons, cruising boats tend to travel in waves; you will see the same boats in key crossroads, such as New Zealand or Australia, the Mediterranean, or South Africa. The relationships among cruisers are based on shared adventure, which makes them intense and lasting. The ties begin in one anchorage and get strengthened over the course of many landfalls and entire oceans.
- **Passagemaking.** Few long-term voyagers spend less than four weeks at sea annually. Most make a minimum of two major passages a year in order to be out of the tropics during tropical storm season. Passagemaking is a life unto itself where everything is more difficult, and the wear and tear on the boat is more extreme. When you are on a passage, your first priority is to keep the boat moving well. Then you can consider the needs of the crew and enjoy the solitude of being at sea.

- **Unwinding red tape.** Logistics and bureaucracy took more time and effort than we ever imagined before we left. When entering different countries, we spend a minimum of a half day clearing in and a half day clearing out, plus a day or more arranging visas when they are required. We also have to manage the logistics of functioning in a foreign place so far from home. In most ports, we need to receive mail, get caught up on e-mail, and pay bills.
- **Entertaining yourself.** When not otherwise occupied, you must rediscover the art of entertaining yourself. In developed countries, we have lost this talent under the onslaught of television, VCRs, video games, computer networks, and movies. At sea, we get reacquainted with old friends—books, handicrafts, radio, and nature. It is a wonderful chance to free your imagination and stimulate your creativity, but we know more than one crew who quit because they found the life boring.

Voyaging has its share of work and worry. But it is a way of life, and its rewards make the glossy photos in the magazines pale in comparison. Our initial image of tropical beaches and swaying palm trees is not what we came to love, nor why we spent four years building a boat and set off again. So what are the rewards and challenges?

A never-ending series of extreme highs and intense lows. The essence of voyaging lies in trading the comforts of shore life for a wide range of vivid experiences. Voyaging is a life of extreme highs and intense lows—from drinking French red wine in the cockpit as the sun is setting behind the twin peaks of Bora-Bora to being hove-to in a gale off Durban while seawater drips into your bunk. Distilling these extremes into words like "fun" or "pleasant" misses the essence of the life.

Emotional extremes are the antithesis of what we strive for ashore. The average American or European equates success with security, stability, comfort, and convenience. Extremes are kept to manageable and predictable levels. But when you cut out the lows, you also truncate the highs. When we headed offshore, we put aside the adult quest for financial and physical security and rediscovered the intoxicating euphoria of youth. Most voyagers become addicted to the extremes, to the emotional intensity and vividness of the life. When they return to land, most find shore life sterile in comparison. But this transition does not occur overnight, and some never adjust to the unpredictable nature of the voyaging life.

If you expect to find a tropical paradise and a carefree existence, you will find both. But if that is all you expect, the more stressful times will come as a bitter disappointment. If you can accept that voyaging poses unique challenges and rewards, and if you can appreciate the highs and work through the lows, then you too will end up living the dream and loving the reality.

A simpler, cleaner, more self-sufficient way of life. There are no smoke and mirrors at sea. Sailors are impressed by good seamanship and sailing accomplishments—not by job titles, possessions, or wealth. When you arrive in Durban, South Africa, and see a foreign flag flying from a salt-scrubbed yacht, you won't care what the crew did in their previous lives. But you can be fairly certain that they will be accomplished, self-sufficient sailors—people you will enjoy getting to know.

Mastering new skills is one of the most thrilling aspects of voyaging. As you start to manage everything in your own small world, you will experience a tremendous sense of satisfaction and a burgeoning confidence. You will eventually achieve a degree of self-sufficiency that very few people ever dream of, let alone attain.

Voyaging even changes how we interact with our world. In an age when environmentalism has become a fashionable cliché, voyagers are a living demonstration of how to tread lightly on the planet. We generate virtually all our electricity, primarily by pollution-free solar panels. Our water consumption, even when we have access to shore water, rarely exceeds 5 gallons per day, per person. On *Silk*, we consumed less than 500 gallons of fuel while circumnavigating the globe (about what an American family uses for a single car in a year).

Whether you go for three years or thirty, voyaging frees you by offering an alternative. Your newly acquired skills let you make choices about how you want to live your life. Your increased sense of responsibility allows you to deal with your choices realistically. Your newfound simplicity frees you from the misconception that material goods make you feel productive or fulfilled. Your view of yourself and your place in the world radically alters, and you tread more lightly, think more deeply, and breathe more easily.

A voyage of self-discovery. Voyaging is not just about physical travel. As you voyage, you move deeper and deeper into your own heart and soul. But at times you may not like what you see. Nothing can prepare you for coming face to face with your true self.

At some point, everyone on board a small boat at sea must come to terms with their deepest fears. We all possess a cherished image of ourselves, of how we will behave when tested. That image can be tarnished by reality—laid out for you in stark relief in a moment of fear. Then the process begins as you work to change those aspects of yourself that you do not like.

We also come face to face with our true selves in the desert of unstructured time that surrounds us at sea. Only a lucky few are fulfilled by work alone. For most of us, what we choose to do with our free time gives us depth as individuals. When there are no other demands, the demands of your own heart and soul can be heard. Some people are disappointed to discover they would rather read a mystery novel than devour great literature, do a crossword puzzle rather than write a book.

A few people find themselves uncomfortable with who they really are. But most learn to love the solitude of the sea and appreciate the infinite vistas of their hearts. The literal voyage, with its pulling up of roots, is accompanied by a figurative voyage and the pulling apart of the self. Both teach you what defines you and fulfills you. If you are ready to face yourself as you are, then you will find this spiritual growth to be vastly satisfying and energizing.

A process of growth and change in relationships. When we first left aboard *Silk*, Evans and I didn't really know one another at all. Our demanding careers allowed us to see each other for a few hours on the weekends; we often went weeks without seeing each other at all. We spent more time together in the first four months after we set sail than we had in the entire four-year history of our relationship.

That we survived that first year as a couple seems a miracle of sorts. Take two type A overachievers who both know they are right all of the time. Squeeze into a space smaller than most studio apartments, regularly reduce sleep to one-third normal levels, add copious amounts of water, shake well. Expose to stressful situations. Bake for months at a time. Not a recipe one would think would lead to domestic tranquility. And it didn't for us, not for a long time.

Over the course of a circumnavigation, four years of building a boat, and seven years of cruising aboard *Hawk*, we have built a relationship based on trust and respect. Our relationship isn't perfect, and it never will be. But we've learned to laugh at ourselves and to count to 10. We've learned never to "discuss" something before the tension has melted away, and we've learned to say "I'm sorry" and "I didn't handle that well at all."

But there's far more to it than that. On the one occasion when I came on deck and thought Evans had gone overboard, I cannot begin to describe the mind-numbing, gut-churning sense of loss. In the instant in which I thought he was gone, I glimpsed how much my life would change, how much more difficult it would be without him to be the person I want to be and live the life I want to live. I was shocked and shaken by how dependent I am on him, not for sailing the boat or completing a passage, but for the sense of connection that has spread its roots into the very depths of my being and would destroy a bit of me if ever ripped away.

Voyaging has strengthened and defined this most important relationship in my life. But it has also deepened my relationships with all those I care about, family and friends. On *Silk* and on *Hawk*, I have been blessed with the luxury of time to share with those who matter most to me, and the desire to make sure they understand this strange vagabond life of mine. Though we are often thousands of miles from those I love, I feel supported by a web of connections that quite literally spans the globe.

Is this the life for you? If you have done some extensive coastal cruising or offshore passagemaking, you have a sense of what the voyaging life is like. You may have dealt with some of the issues outlined above and tasted the rewards. Don't make the mistake of believing that voyaging will be easier. When cruising changes from being your time-out to being your life, the rewards and challenges become more intense—not less so.

Voyaging is not for everyone. If you take your shoreside values with you when you head off to sea, you will find yourself burdened by unrealistic expectations and impossible goals. But if you are able to let go of your old values and open yourself to unexpected challenges and rewards, then voyaging offers you a new and different way of living.

The decision to embark on a major voyage in a small sailing boat should not be taken lightly. The dangers are real and should never be underestimated. Almost every element of preparing for and undertaking a voyage involves decisions about the risks and hazards you will face at sea. Like every sailor before you, you will have to accept responsibility for your decisions and live with the consequences. The reward will be a self-sufficiency and independence that will change your life.

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PART I
The Essential Ingredients

IF YOU WANT to sail away someday, there are only three things you can't do without—a crew, some money, and a boat. Each ingredient will be considered in a separate chapter in this part. An enthusiastic crew and a strong, solid boat can make up for a serious shortfall in money. And sufficient money and enthusiasm can overcome most shortcomings in the boat. But a luxurious boat and lots of money won't transform a sullen, reluctant crewmember into an eager, committed one. So make sure every member of your crew is on board—figuratively *and* literally—before you move on to refitting and upgrading whatever boat you plan to take cruising.

CHAPTER 1
Committed Crew

THE MOST EXCITING—and terrifying—thing about voyaging is that so much depends upon you. To head off on a small boat for far horizons and return happy, healthy, and fulfilled with the boat in one piece and your relationship intact depends very little on what boat, what equipment, or even what skills you take with you. It depends almost exclusively on you, the crew: your attitudes and interactions, your ability to learn new skills and deal with your fears, your willingness to grow and change together. Successful crews manage to transform workable relationships on land into fulfilling voyaging partnerships.

To make that transition, each crewmember must be willing to invest in the dream. You must embark on a journey together before the actual voyage, evaluating yourself and your relationship with other crewmembers, planning your dream together, and supporting each other every step of the way. You will need to agree on how to fit voyaging in with careers and family, and for how long you want to pursue the liveaboard life. By the time you begin your voyage, each crewmember should be committed to and enthusiastic about a future afloat.

WHAT MAKES FOR SUCCESSFUL CREWS?

We have met hundreds of people from more than two dozen nationalities voyaging aboard sailboats in all different parts of the world. They have ranged in age from less than 1 to over 80; in economic situation from ultrarich to technically impoverished; in profession from wooden boat builders to executives of large corporations; in sailing background from hotshot Grand Prix racers to confirmed landlubbers. On the surface, these crews seem to have almost nothing in common.

Yet, a closer look offers some insights into what makes for a successful voyaging crew. How do I define success when it comes to voyaging? I consider any crew successful that completed a planned voyage with boat and crew intact and relationship(s) strengthened. The 55 crews we know who have circumnavigated form a clearly defined and representative subset of the larger group of successful crews we have met. They help illustrate a few of the elements common to all successful crews.

Composition of Successful Crews

Successful crews tend to be families, and if they don't start out that way they're quite likely to end up that way. Of the 55 crews who circumnavigated, 78 percent ended the voyage as either couples or parents with children (Figure 1-1), up from 62 percent at the start of the voyage. This increase came as single-handed sailors found partners.

Families form the natural unit for crewing a small boat. Two to four people can comfortably live in and easily manage the average cruising boat. Families share a common approach to everything from cleanliness to values; they have the same goals and are on the same timetable. Few people invite nonfamily members—even good friends—to live with them ashore for weeks or months. Aboard, with less space and greater stress, close-knit families and well-established couples succeed where other types of relationships often fail.

Nonfamily crewmembers complicate life aboard. When arriving in a foreign port, the captain becomes legally re-

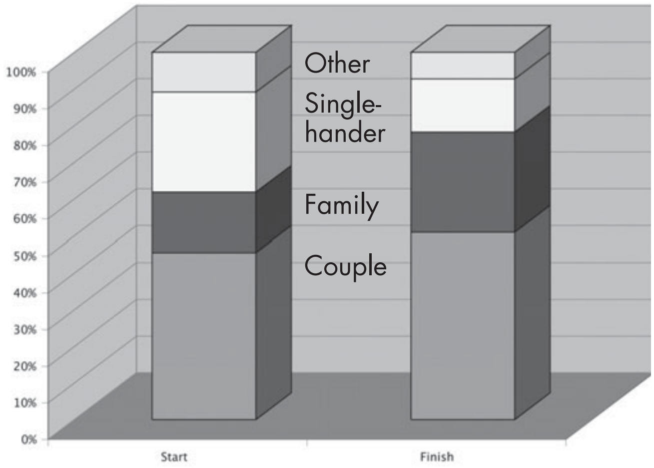


Figure 1-1.
Composition of 55 crews that circumnavigated.

sponsible for each member of the ship's crew. That means ensuring they have entered the country legally, they commit no crimes while in the country, and they leave—on your boat or otherwise—before their visas have expired. Unscrupulous crewmembers can be difficult to get rid of when they are no longer welcome. In addition, relying on outsiders limits your options by tying you to their schedule.

In a few specific cases, outside crew may make sense. Participants in cruising rallies often take on additional crew so they can be more competitive. People heading out on their first passage will sometimes take an experienced offshore sailor along, usually a professional hired to show them the ropes. Single-handers, older couples, or couples with larger boats may regularly take on extra crew for long offshore passages. But most crews on most boats doing long-distance voyaging continue to be couples or families. Of the group of 55 crews that circumnavigated, only 4 regularly took on outsiders as crew; 3 of these were single-handers.

More than a quarter of the 55 crews that completed circumnavigations started out as single-handers (see Figure 1-1); all of these were men sailing alone. This leads to a second observation: women are underrepresented on cruising boats. Of the hundreds of cruising boats we have come across, only half a dozen were sailed by a woman alone, and only two were crewed by two or more women. In contrast, dozens of boats were crewed by a man alone or by a group of men.

Even on boats crewed by couples and families, the man is almost always the captain, and the woman often came along reluctantly, after a long period of coaxing by her partner. In her book *Changing Course*, Debra Cantrell examines the transition from living ashore to living aboard from the perspective of the partner who did not initiate the change. To find cruising couples, she wrote a letter to the editor of *Cruising World* magazine. Her letter requesting that first mates contact her was carefully worded to be gender neutral. Of the 110 people who responded, only 2 were men. In all but a handful of cases, the man had come up with the idea of going cruising, and "80 percent of the women whose partners proposed the cruising life were initially resistant to the idea of living on a boat."

There is no reason why women should be less common or less competent than men aboard offshore boats. Voyaging does not require great physical strength or a masculine approach. So why are women less likely to initiate the cruising dream than men and more reluctant to take up the voyaging life? I have put that question to dozens of women who have become accomplished and committed voyagers, and most of their answers fell into one or more of the following categories:

- **I don't want to leave my home/family/career behind.** Men who want to go cruising are often dissatisfied with their shore lives. If they have defined themselves primarily in terms of a job/career, then when boredom or disillusionment sets in they may be left with little beyond that. But in addition to managing a career, most women have many other important and fulfilling roles ashore—as sister, caretaker, friend, daughter, wife, colleague, mother, active community member, and so on. I've asked many women what they had to give up to go cruising, and much of it comes down to relationships. The men I ask rarely mention relationships at all. Women have to extricate themselves from a web they've woven ashore, and that can be difficult and painful. Their partners rarely realize what they're asking the women to give up, and rarely value the sacrifice sufficiently.
- **You want to do *what*?** When Evans first told me he wanted to buy a small boat and sail around the world, I reacted exactly the way I would have if he had suggested building a rocket and flying it to the moon. Like many women, I hadn't grown up sailing and couldn't even conceive of long-distance voyaging. Like many men, Evans had spent years reading sailing magazines and books, studying boats and equipment, and dreaming of exotic landfalls. I would never have come up with the idea of going cruising because I didn't even know such a possibility existed. Once Evans introduced me to the concept, I still had virtually no idea of what voyaging entailed or what kind of a life I would lead.
- **But what if something goes wrong?** Women tend to be more risk averse than men, which makes them less likely to jump into a new lifestyle they perceive as risky. This is even truer when children

are involved. The hundreds of women I have met at boat shows and cruising seminars were eager to talk about their fears—losing somebody overboard, medical emergencies, and heavy weather being the most common. Their partners, focused on convincing them to go cruising, were often reluctant to bring up these issues. But women who have become accomplished voyagers say they needed to address their fears, to reduce the risk to an acceptable level, before they were comfortable heading off to sea.

- **I don't even know how to sail.** Today, more girls are learning to sail, which means more women will be competent sailors in the future. But like many women over 35, I had almost no sailing experience when Evans suggested we go cruising. I couldn't enjoy voyaging until I developed sufficient skills to feel I was pulling my weight and, more important, to believe I could manage the boat if something happened to Evans.
- **But what about *my* dreams?** Just because women aren't dreaming about cruising doesn't mean they aren't dreaming. But heading over the horizon represents such a huge lifestyle change that many women believe it will keep them from realizing their own goals. Until they find ways to integrate their dreams into a future of voyaging, these women will remain reluctant to commit to the liveaboard life.

As a first step toward cruising, successful crews found a way to address whatever it was that made the woman reluctant. In so doing, they began to transform their shore-based relationship into a full-fledged voyaging partnership. As Debra Cantrell found, "In just about every instance, this change in lifestyle evolved from one that was externally imposed (by him) and initially resisted (by her), to one that was embraced by both partners."

Successful offshore crews also provide insight into when to go cruising. Cruisers come in all ages, but long-distance, offshore voyagers fall into a narrower age range. Close to 70 percent of the crews that completed circumnavigations (not including children) fell between 35 and 55 years of age. They were old enough to have built up enough assets to buy and outfit a boat and cruise for some years in comfort, but young enough to be healthy and fit.

This age distribution reinforces an important point. Don't wait. If you want to go, then go. Every year we hear dozens of heart-wrenching stories of people who dreamed for years of going cruising, fit out a boat, and then were stopped in their tracks by a stroke, a heart attack, or cancer. You're far more likely to really make it out there if you leave at age 40 than if you leave it until you're 60.

Don't feel you have to wait until the children are grown, either. Over a quarter of the 55 crews that circumnavigated had children aboard by the end of the voyage. These 22 children ranged in age from newborns to early 20s, with the majority distributed between 4 and 15 years of age (see the Cruising with Kids: What Age Is Best? sidebar below). Most children thrive on cruising, and most families end up strengthened in ways that last a lifetime.

CRUISING WITH KIDS: WHAT AGE IS BEST?

All the cruising parents we have met found the experience of voyaging with their children very positive, and the ties established during several years of voyaging built the foundation for a lifetime of intense and fulfilling family relationships. Though some parents worried about the risks to their children initially, most ended up feeling cruising was better for their children physically and mentally than life ashore. In fact, cruising with kids is harder on the parents than on the children. In addition to the things all of us have to deal with while voyaging, cruising parents spend a good deal of their time educating, entertaining, and worrying about their children.

We've met children aboard ranging in age from infants to young adults. Any age can work, but most parents say the children get the most out of it if they are old enough to remember the experience but young enough not to want to be somewhere else. Toddlers and teens tend to create the biggest problems aboard.

Babies fit well into shipboard life. They sleep a great deal, stay where you put them, and keep hours that are consistent with changes of the watch. For many women, the worst aspects of being pregnant while living aboard were morning sickness compounded by seasickness in their first trimester and finding a place with high-quality, affordable medical services to have the child.

But infants turn into toddlers quickly, and toddlers are not as well suited to life aboard. Toddlers are too young to understand why they can't play with the gimballed stove and too old to stay where you put them. Their mobility is astonishing, their curiosity unquenchable. To keep toddlers safe, you must childproof an area of your boat and never leave them unattended on deck. Several of our friends chose to have a baby during the last year of their voyage so they could return to the relative safety of shore before the child reached the "terrible twos."

Preschool-age children are more flexible and often adapt more quickly than older children. They can be taught to swim and understand the word "no!" You don't need to worry about schooling, but you will spend time inventing ways to keep them entertained. Preschool-age children are more work and worry and are less help than older children. They are too young to get the full benefit of voyaging and may not remember much of their trip. Still, going with children this age is preferable to not going at all.

If you can work out the logistics of schooling, most voyaging parents agree that the ideal ages to take kids cruising are between 6 and 12. The children are old enough to get the most out of the voyage, but young enough that they can be back in school ashore in time for university preparatory work and standardized tests. With the increasing popularity of homeschooling, an array of high-quality programs has become available (see the Homeschooling section in the resources for this chapter in Appendix 1). With only one or two students, teaching can be focused, and kids learn in much less time than in a normal classroom. Homeschooling takes discipline, especially in paradise. On most "kid boats," the first 2 to 4 hours of every day are devoted to school; then kids are free to do whatever they please. Homeschooled children generally score well on standardized tests.

We met only a few boats with teens aboard. Some teens loved it, and some hated it. On boats with unhappy adolescents, no one has a good time. The excellent homeschooling courses now available combined with the resources on the Internet have made university preparatory work possible for disciplined teenagers living aboard a boat. Teenagers need to decide if this type of program will let them fulfill their long-term goals and then need to commit to making their schooling work. If your older children don't buy in, wait until you can go on your own.

After an extended period voyaging, most children returned to school and did well academically. Some children's social development suffered due to a lack of interaction with peers. While most cruising kids moved effortlessly into new situations and made friends easily even where there was a language barrier, they had less experience with the ins and outs of long-term friendships and the on-again, off-again nature of schoolyard popularity. This made integrating into life ashore at the end of the voyage a challenge for some children. To provide as much socialization with peers as possible, boats with children aboard tended to travel together, even if the parents were not the best of friends (see the Tips for Cruising with Kids sidebar below).

Somewhere between ages 65 and 70 seems to be the upper limit for long-distance voyaging for most people. Although we've met dozens of crews older than that, most had given up long offshore passages and were doing extended coastal cruising around their home country. The need to be close to health-care providers and the desire to spend time with grandchildren kept them from venturing too far afield.

This age limitation means that for most of us, voyaging is not forever. Of the 55 crews who circumnavigated, only 2 have been sailing for most of their lives and have no shore-based home or any intention of getting one. The rest returned ashore, and most sold their boats. Part of being successful involves planning for that transition and having an exit strategy when the time comes to swallow the hook.

On the other hand, almost half of the crews that returned ashore after completing a circumnavigation left again for another extended voyage after a period of several years; 4 of these 24 crews have completed a second circumnavigation, and 3 more are in the process of doing so. Most of the people who make voyaging a permanent part of their lives don't do it all the time. Rather, they alternate extended offshore voyages with periods ashore pursuing their careers, and they structure their lives to make it possible to live in both worlds.

Characteristics of Successful Crews

While the composition of successful crews can be quantified, the characteristics that make crews successful cannot be drawn on a chart or a graph. These are much more subjective, but we believe most crews share certain personality traits and attitudes that contribute to their success.

Evans likes to say that successful crews consist of an optimist and a pessimist: without the optimist, the crew would never leave the dock; without the pessimist, they would lose the boat. All successful crews we have met (including single-handers) have found a balance between believing everything will be all right and knowing the worst will happen. In some cases, one crewmember always plays the optimist and the other the pessimist; in other cases, the crewmembers change roles in different situations.

Every one of the 55 crews who circumnavigated included at least one person who could keep the boat and its systems operating. In most cases, these people truly enjoyed working with their hands. They found it a pleasure and a challenge to tackle the necessary maintenance and repairs that form an integral part of the voyaging life. Where this wasn't the case, crews simplified their boats to minimize the maintenance required. In many cases the person responsible for maintenance had almost no mechanical skills when they left but learned what was required as they went along.

The more experience crews have, the more self-sufficient, inventive, and flexible they become. A problem that would have seemed insurmountable when they started cruising becomes routine after they have been out for several years. On *Silk*, our maintenance and repairs were limited to basic things like servicing the engine and rebedding deck fittings; we hired professionals for everything else. On *Hawk*, we installed most of the systems ourselves, and we have made major repairs in remote ports and at sea. The experienced cruisers we met in Chile undertook repairs on everything from ice-damaged rudders to blown engine head gaskets in places where no yachting or boating facilities existed, and they treated it all as routine.

This inventiveness and flexibility also applies to constantly evaluating alternatives in any given situation. All too often, inexperienced sailors lock in on their original objective and pursue this long after it makes sense to change plans. When we rounded Cape Leeuwin in Australia, we sailed in company with a new-to-cruising couple aboard a 39-foot cutter. We had spent a week waiting for a favorable forecast, but we came around Cape Leeuwin to find 20-plus-knot winds right on the nose and a combined sea and swell of 10 to 12 feet. We spent a miserable 36 hours aboard *Hawk* making the 175 nautical miles to Albany, the next good port. In that same period, our friends had taken a considerable battering and made good only 65 miles. When I asked why they hadn't turned back or hove-to as we would have done if we'd been on a smaller boat, he said, "Once we got around Leeuwin all I could think of was to keep going to Albany. Doing anything else just didn't occur to me."

Successful crews also share a sense of adventure, openness to new experiences, and willingness to learn. While the desire to travel and see new places draws most people to cruising in the first place, the romance of travel soon wears thin as the reality of trying to deal with a strange culture in a foreign language sinks in. Successful voyagers find these challenges fascinating and fulfilling instead of frustrating and frightening.

Finally, successful crews all transformed workable relationships ashore into tightly knit voyaging partnerships. That's not to say there are no disagreements aboard; that voices never get raised, and tempers never flare. But crewmembers know and respect each other in ways they never would have had they stayed ashore. They have seen one another at their best and at their worst; they have trusted each other with their lives.

For those who meet the challenge, voyaging strengthens and deepens their relationship in ways that are very difficult to explain. In a February 1996 *Outside* article, filmmaker Michael Hoover, who lost his wife Beverly in a heli-skiing accident, captured the essence of this kind of relationship: "Beverly and I did everything together. On our trips to Antarctica, we wouldn't be more than a rope-length apart for three months. Something happens when you're together like that. You become infused, like in metallurgy when you meld a chunk of iron with a chunk of brass. The molecules combine and they become one."

BUILDING VOYAGING PARTNERSHIPS

The human element most often determines whether a long-term voyage is a success or a failure. Yet this is usually the last thing considered by would-be voyagers and marine writers alike. Of the dozens of crews we knew who quit, almost none of their dreams foundered on anything as solid as a tropical reef. Most lost their dream to such intangibles as poor communication and unrealistic expectations. They failed to make the transition from a workable relationship on land to a successful voyaging partnership.

Creating voyaging partnerships takes time and effort no matter how strong the land-based relationship. It begins with a solid relationship between willing partners and a shared commitment to learning more. On this framework must be laid skills and knowledge, as well as agreement on both the goals and the form of the upcoming voyage. This entire process often takes years, but with all these elements in place before the voyage even starts, you will be well on your way to becoming full-fledged voyaging partners.

Critical Elements

The road to voyaging began for me in 1990 when Evans told me he wanted to sell up and sail away. We were at the apex of our careers as management consultants, about to stand for election as partners in our firm. My sailing experience consisted of day sailing on Lake Ontario, only once with Evans. I had no way to visualize the life Evans wanted to live. I knew I was neither fearless nor a risk-taker, but I enjoyed traveling and nature. I knew Evans had worked as a charter skipper in the Caribbean, but I had no way to judge whether or not he was a competent captain. I had no idea what demands living on a small boat at sea would put on our relationship. How could I evaluate whether or not we could succeed as voyagers?

Since then, I have met hundreds of couples in similar situations, trying to feel their way through a decision that will change every aspect of their lives. Although no one can predict who will take to the cruising life and who won't, four critical elements make it much more likely a crew will not only head over the horizon but will also end up stronger as individuals and partners if they do. These include a competent and communicative captain, willing and realistic crewmembers, relationships based on mutual respect, and a shared commitment to exploring voyaging as a way of life.

Competent, Communicative Captain

Being captain means more than having the skills to manage a boat. It means accepting ultimate responsibility for the safety of the boat and her crew. But accepting responsibility is not the same as being given that responsibility. The final measure of your ability as a captain is the crew's confidence in you. Until they believe you are capable, you will be captain in name only and uncertain whether your crew will respond calmly to your orders in an emergency.

Most people who have only crewed underestimate the burden they will shoulder as captain, a burden that cannot be shared. The "loneliness of command" extends to all captains, including those whose only crew is themselves. You must judge when you, your boat, and your crew are ready to leave. You must decide if you have adequate resources and know-how to manage an emergency. You leave certain that one day the sea will judge you, but until that day you can never be sure how you will react.

Unless you are going to sail alone, you will also need to convince your crew of your competence. Although you can go to a sailing school to acquire basic boat-handling skills, these will not help you if you cannot think clearly in an emergency, make good decisions, and keep your crew from panicking. These leadership skills will ultimately determine whether or not your crew come to trust you, which is exactly what they must do if you are to be a successful captain.

Are you a good leader? Leadership at work or in your community doesn't necessarily translate into leadership in a life-or-death situation on a small boat hundreds of miles from land. The following questions will help you evaluate your own leadership style:

- **Do you handle stressful situations aboard calmly?** Crewmembers will never trust a captain they think might panic, and yelling often comes across as panicking. Good captains plan ahead, quietly inform their crew, and then react calmly and confidently. If you have a tendency to yell or are unsure of your reactions in an emergency, get some offshore experience by crewing on a passage or taking a bluewater sailing course. If you find that you are not susceptible to panic, start acting like it. You'll be amazed how willingly people follow a competent skipper who is calm and confident—and doesn't yell.
- **Can you support your crew and help them grow?** Good leaders build the skills of their team members and delegate responsibility to them when they have gained competence. If you want your crew to be comfortable voyaging, you should want them to know as much as you do. Encourage less skilled crewmembers to take a sailing course. Listen to their suggestions when they return, and incorporate their ideas aboard the boat. As they build skills, give them additional responsibilities and trust them when they're alone on deck. I took a large step toward believing in my own capabilities the first night Evans slept soundly through a squall during my watch.
- **Are you willing to make your crew partners in the adventure?** Although the captain always has the ultimate responsibility for the boat and crew, good leaders share both the highs and lows with their partners. In this way, the captain makes voyaging an adventure that brings the crew together—not a wedge that drives them apart. Next time you're head down in the engine compartment, let your crew know why your vocabulary is causing the paint to blister! By including your crew and turning them into active and competent partners, you leverage yourself and your skills. When you find yourself trying to decide whether or not to deploy a drogue in a gale, your crew can help you think through the pros and cons, sharing the decision without diminishing your leadership role.

As these questions illustrate, good leadership involves communicating with and supporting the members of your team. This applies equally to convincing your partner to join you in the voyaging life. This is your first test as a future captain, the first step toward creating a voyaging partnership, and if you want your partner to be part of your adventure, you will have to use those leadership skills to communicate with and support him or her.

Some partners will respond to the idea of voyaging with only one question: When do we start? But they're in the minority, no more than 20 percent, as Debra Cantrell's research for *Changing Course* and our experiences with successful crews illustrate. Most will be reluctant initially for one or more of the reasons already discussed.

I have been asked dozens of times by men from many different backgrounds, "So how do I *make* my wife go cruising?" The simple and obvious answer is, "You don't." If that's truly the question, you and she will both be better off if you leave her on the dock. But what most of those men meant was, "How do I show her that this will be a good life for her and a great thing for our relationship?" That's a question worth answering.

When their partners first told them they wanted to sail off into the sunset, many women interviewed for *Changing Course* felt they were being given an ultimatum. They believed their partner would choose between them and cruising if they did not agree to go along. That left them feeling angry and helpless, and even if they ended up going, they were bitter and alienated. They hadn't been given a choice.

But most men don't want to end up single-handing, and they're not willing to sacrifice their relationship for their dream. They truly want their partners to come along and are willing to do almost anything to make that happen. If that's the case for you, tell her. Take the pressure off and give her back the right to make her own choice.

Then look at voyaging from her point of view. Why should she give up her home, her friends, that comfortable network of relationships, just to be with you? If you can't see anything she is going to get out of it except you, then ask her what her goals are in life and see if in any way they could be met while cruising. Whatever it is that she might get out of it, make sure she actually gets it! If she wants to be a photographer, don't moan and groan about the expense of a good camera. If she wants to make jewelry, figure out how to put a workshop on board. Give her something she couldn't get if she stayed at home (again, other than you), and I'll guarantee she'll be a whole lot more willing to give cruising a serious try.

Don't press for an absolute commitment from the beginning. Be patient and give her time to learn enough to figure out what else she needs to know. It took me almost two years to decide voyaging would allow me to take the next step toward becoming the person I wanted to be. In Debra Cantrell's study, it took an average of four and a half years from the time the man raised the idea until the woman committed to the concept of voyaging. By being supportive and communicative, you will be proving to your partner that you will be a good captain, and that voyaging will strengthen your relationship.

Willing, Realistic Crewmembers

Skills and experience have far less to do with being a good crewmember than they do with being a good captain. Skills can always be gained and experience obtained. But personality and attitudes change slowly, if at all. Good crewmembers combine an enthusiastic attitude with a cheerful nature; they possess a lively curiosity about the things around them and a strong desire to learn.

If you are wondering if you will make a good crewmember, ask yourself one question: Do you possess a sense of adventure? If you hike into the mountains with a smile on your face even in the rain, love traveling and meeting local people, don't mind a certain amount of discomfort in exchange for seeing wild places and creatures few others get to see, enjoy sailing and are willing to learn by stepping forward and pitching in, and seek out change and new experiences, then you will make an excellent crewmember.

If you have children, they too will be crewmembers, and they also need to be both willing and enthusiastic, and to possess some sense of adventure. Since these things come naturally to most children, it's not surprising that most kids we meet thrive on voyaging. The outdoor life keeps them healthy physically, and the close relationships with their parents and other adults make them more mature and outgoing than their shore-based peers. Cruising kids are often entrusted with serious responsibilities early on, and they learn to respect their parents and have confidence in themselves. If you're considering cruising with kids, the Tips for Cruising with Kids sidebar opposite offers some insights from Christine Myers, who has cruised with her husband and three children for five years.

As with any crewmember, children need to be involved in the planning process. Their needs, expectations, and fears need to be addressed. Children are every bit as individual as adults. Some will take to the idea naturally; others may find leaving their playmates and life ashore frightening. Just like adults, children need to feel as if they have some say over their future and some idea of what they're going to get out of cruising.

Children need only be good crewmembers, but for adults that's not enough. To build strong voyaging partnerships, adults also need to be realistic, not just about themselves and the voyaging life but also about their partners. Adult crewmembers do not need to be physically strong, but at times they need to be mentally tough. They must have a sense of personal responsibility and an

TIPS FOR CRUISING WITH KIDS

Christine Myers on *Delos*, a 53-foot Amel ketch, has been cruising with Stephan Regulinski and their son and two daughters for five years, covering four continents and 40,000 miles (Figure 1-2). When they left in 2000, Drew was 13; James, 10; and Avery, 8. They began their adventure in the Mediterranean, cruising Turkey, Europe, the British Isles, Scandinavia, the Canaries and West Africa, then the Caribbean and Panama, and finally the Galápagos, Polynesia, and New Zealand.

Figure 1-2.
The crew of *Delos* (left to right): James (15), Stephan, Drew (18), Christine, and Avery (13). (Kelcey Chandler photo)

Four issues have been critical in making cruising with her children a success. These include homeschooling, socialization, health and safety, and teamwork. Christine put together the following thoughts to help adventurous parents who follow in her wake.

Homeschooling

The first question all over the world has been "What about school?" The idea of homeschooling can be daunting when planning a cruise. Few of us are teachers, and parental attitudes range from it being a necessary evil to an opportunity to explore the world together.

For younger children, the challenge is to teach them reading and basic skills. Some parents wait until the children are able to read, and can entertain themselves during passages, before setting off. Kids of primary and middle school age usually need several hours a day of intensive school time, which includes answering questions, working on time management skills ("no snorkeling until the week's work is finished"), supplying resources for research, and satisfying insatiable curiosity. When your crew is in high school, your concerns are whether they are being sufficiently prepared for college and where to find help for subjects in which the parents are weak. Often you can arrange tutoring exchanges when wintering or waiting out the cyclone season.

When I asked George Day, publisher of *Blue Water Sailing*, about cruising with kids, he replied, "If you have a difficult kid on land, you'll have a difficult kid on the boat; if you have an easy kid on land, you'll have an easy kid on the boat." As far as personalities are concerned, I agree, but school performance has been less predictable. The transition to homeschooling can take six months, which is approximately how long it took us to adjust to family cruising. If possible, get the children used to one new environment before introducing the other.

These suggestions will help make boat-schooling a success:

- **Pick an appropriate curriculum.** To find a curriculum you are comfortable with, attend a homeschooling conference, where vendors demonstrate texts, enrichment tools and techniques, and a wide range of distance-learning options. Talk to your kids' teachers about what issues you can anticipate in their learning trajectory. If you have a firm end date, be aware of the environment they will return to and plan accordingly. Calvert, the traditional cruiser's school, ends at eighth grade and may not provide the breadth or creativity many modern kids crave. Several correspondence schools, such as Oak Meadow and Laurel Springs, offer Internet- or text-based options through secondary school. Sonlight Curriculum offers a Christian elementary option. The Universities of Nebraska, Texas, Missouri, and California, among others, provide a challenging secondary curriculum for general education or college preparation (see the Homeschooling section in the resources for this chapter in Appendix 1). Whatever the choice, one conclusion is certain: your child will not be behind in school when you return (no matter what the anti-cruising in-laws predict). Boat kids who transition to a land

(continued on next page)

high school or college use the resilience and flexibility that they learned while cruising to rise to the new challenge.

- **Share the teaching load.** Too often, the mom ends up burdened with all the teaching responsibilities, which contributes to female cruiser burnout. Parents need to teach to their strengths or at least divide the work fairly. On *Delos*, I supervise social studies, English, and Spanish; Stephan does math and science.
- **Adapt schooling to the realities of cruising.** Schooling is traditionally carried out in the morning, with swimming and exploring done in the afternoon. Field trips are the soul of family cruising. Whether visiting Ephesus, discovering a pearl farm, or participating in Carnaval, you can incorporate your milieu into writing assignments that enrich your lessons. During physical education the whole family might hike, swim, snorkel, or windsurf. Create a system that suits the style of your boat. Our friends on *Gambit* use a credit system; every five days of work completed earns the child two days off, to be "spent" on interesting activities like scuba diving or goofing off when other kid boats are around. Other parents work on a six- or seven-day system. For some kids, passages are a great time to catch up on work; for others, especially older kids standing watches or those prone to seasickness, reading and writing will be problematic while underway. For passages, try books on tape or CD, or Audible's iPod downloads.
- **Bring lots of good books.** Books are precious possessions for most cruising kids. Stock lots of good ones that can be reread or traded and worry about the waterline later. Invest in high-quality reference books, such as *The Usborne Book of World History*, *The Usborne Illustrated Dictionary of Science*, and the *World Almanac for Kids*, and buy books such as the Smithsonian guides for any special interests your kids have. In port, use local libraries. At least a few books in English can be located anywhere. When you are finished with books, you can enrich the life of an island child by passing them on.
- **Share the knowledge.** Some of our friends have organized able seaman classes. Other crews have set up an orienteering course or taught jewelry making and traditional crafts. Be generous in sharing your knowledge with other people's kids—you can teach anything from bread baking to fiberglassing to guitar—and trust other cruisers to do the same.
- **Enroll the kids in local schools.** Parents on kid boats regularly enroll their children in local schools, more for the social-cultural experience or language facility than for education. It's often not difficult to arrange and offers a pleasant respite from homeschooling. Don't worry about kids falling behind. Drew is still friends with kids from her school in Spain in addition to being fluent in Spanish.

Social Life

Social issues become crucial as kids get older, when they begin to play a huge role in decisions about where to cruise and with whom. Depending on the child and his or her social needs, that can mean anywhere from ages 6 to 11. While there are opportunities to interact with local kids and play with visiting friends and family, the nexus of social life will be other cruising kids. Their age is nearly irrelevant; it's the fact that they are not adults that counts.

The golden rule of social life is: *When you find a compatible kid boat, be willing to jettison your plans and spend time together.*

Yes, you are cruising for family time together, but in the interest of sanity, be flexible and creative. The original cruising plan is only the idea that gets you out there. Making the cruise work is about recognizing the needs of all concerned parties and embracing spontaneity. Though we will not promise any visitor that we will be in port to meet them, we will brave gales to make a kid's birthday party.

Finding other kid boats is worthwhile work. Keep checking in on the marine nets and the Internet. Track cruising families via the Noonsite family page, Seven Seas Cruising Association (SSCA) letters (see the Cruising Associations section in the resources for this chapter in Appendix 1), and by asking at marinas. Check in with rally organizers to see who's on the roster. When you do find kid boats, exchange e-mail addresses and keep in touch.

Cruising on a buddy boat for a day or a week makes the most of limited time with friends, with the bonus that they do more schoolwork on other boats than they do at home. Visits from cousins and friends are a wonderful way to share your lifestyle, keep up important relationships, and get that all-important social time. A kids' radio net during passages will let everyone stay in touch on a transoceanic voyage. Riddles, contests, stories, and complaints are all welcome during a special time for junior crew that gets them comfortable with the radio while improving morale.

Health and Safety

You can recognize a boat with dogs or toddlers by the netting around the guardrail. Cruising with little ones takes patience and vigilance. As they grow, safety issues are more about horsing around on deck, on land, or in the water. When we are underway, our kids are tethered on deck and during watch, and we use good sense elsewhere. Their health is usually much better than on land, as they aren't in contact with as many germs and generally are living a healthy lifestyle. We haven't encountered exotic illnesses or life-threatening injuries, and our medical chest is overstocked for our worst health crises: tonsillitis, cuts that needed stitches, and a close encounter with a sea urchin. Still, we keep track of boats with doctors on board for radio advice, just in case.

Teamwork

The transition to cruising is bumpy, with moments of despair as well as elation. So it's like life was before, with a change of venue. What's different? For one thing, the maid is permanently off duty. Our teens placed a hotel sign on their cabin door: *Please have this room made up as soon as possible.* They're still waiting after five years at sea. Stowage and strewage are ongoing issues, both in terms of comfort and safety. Rules are the same as on land. Make the rules together and hope for the best.

The crew needs to be a team, which means that everyone contributes according to his or her abilities. One of my best time investments was ensuring that all the kids learned to cook. Yes, it's more efficient to do it yourself, and you may sit through a few bad meals, but it's *worth* it. Kids who aren't old enough to stand watches are proud to contribute on a passage by feeding the crew, even if it's by cutting up fruit or heating an already prepared meal. And while you moms are at it, make sure dad learns, too.

Living in close quarters magnifies issues of personal space and time. There isn't room to nurse hurts or grudges, or space to sulk, so you have to cope. Siblings who may not have spent a lot of time together have to learn mutual respect and to share space. Respecting a parent as captain is important, but so is respecting the crew. Barking orders when you're stressed doesn't necessarily teach what you would wish your kids to learn. You will need to explain *why* and *how* and keep your sense of humor. Some day your patience will be rewarded with a crew that can Med moor to make the yacht club proud, or weather a nasty storm and still be able to dance on deck. Remember: It's not about the sailing, it's about the family.

ability to act if the situation demands it. The following questions will help you evaluate how you will deal with the more difficult aspects of voyaging:

- **Do you trust your captain with your life?** To answer yes, you must trust not only your captain's sailing skills but also his or her courage: the ability to act rather than react. If you have any doubts about your skipper's competence, you will always be a little afraid, and in reality, you may be in physical danger. If trust is an issue, learn as much as you can to determine if your fear is justified. Get your captain to take an offshore sailing course or act as crew on a delivery. Above all, share your concerns. Don't head offshore until you can answer this question positively and without reservation.
- **Can you deal constructively with fear?** Long-distance voyaging, like any adventure, has an element of risk. If you are truly prone to hysterics or to freezing in an emergency, then you should not head offshore. But for most people, clear, well-thought-out plans to deal with emergencies prevent panic. The Addressing Fears section below discusses ways to resolve your fears. If after trying the suggestions found there you still find yourself liable to panic in an emergency, voyaging may not be for you.

- **Can you manage the lows?** When things are not going well, a single person aboard who whines and complains or who doesn't share equally in the work will destroy crew morale. Conversely, a crewmember who continues to smile and finds something funny in any situation will keep everyone else going. If you are able to maintain a positive attitude even when you've had too little sleep, when you're frightened, or when you're cold and wet, you will always contribute to the well-being of the boat. But if you want everyone to be miserable with you, you'd be better off not heading offshore.

Don't despair if the person you see described in the paragraphs above is not the person you are right now. If it's a person you would like to be, that's enough for the time being. Like most people I know, I approached my voyaging life one step at a time. The first few times we were in scary situations, I was not proud of how I reacted. But as I gained skills and confidence, my fear became secondary to doing something constructive. I reacted as the situation unfolded, and only later was surprised by what I had done. Voyaging takes strength and demands realism. In return, it gives you self-confidence, skills, and satisfaction.

Deciding you will make a good crewmember is not the same as deciding you are ready to trade one life for another. As Evans and I readied for our voyage, I often felt overwhelmed by the choice I had made. How could I weigh the trade-offs between two different futures? I knew what to expect ashore, but voyaging remained an abstraction. I couldn't picture what this new life would offer, despite the books I had read and people I had talked to. Since that time, hundreds of people have asked me, "What's it really like?"

I've tried to answer that question in the Introduction and Chapter 27, but to a certain extent no one can tell you what it will be like for you. You cannot know what the voyaging life will offer until you live it, and if you absolutely have to know, you probably shouldn't go. I can tell you that if you feel the need to make a change in your life, if you're dissatisfied with the person you are and the path you're on, any amount of time spent cruising will head you in a new direction.

We have met hundreds of women whose lives and relationships have been transformed by voyaging. Almost everyone we know who voyaged for a period of two years or more, including the most reluctant first mates, wanted to go again. Debra Cantrell found the same thing in her survey. Though 80 percent of respondents were reluctant at the outset and 88 percent were "very" or "fairly" satisfied with their land life before leaving, all the women studied "reported experiencing an 'enormous' increase in their overall happiness and life satisfaction because of the change they eventually made." Ninety-one percent of the women surveyed were still with their partners at the end of their voyage; 84 percent of those who had returned to land at the time of the survey were out cruising again five years later when *Changing Course* was published. So don't dismiss the cruising idea out of hand, even if at this stage you, like me and many other women before you, have little experience and a lot of questions.

Relationships Built on Mutual Respect

When some couples dream about a future life with no outside demands, they envision a continuous honeymoon. For those who make the transition, the reality far exceeds the fantasy. But before that happens, their relationship will be tested aboard a small boat in ways it never was ashore, and the first year often proves difficult even for the most stable and long-standing of partners for a wide variety of reasons.

First, most couples living on land see very little of each other—a few hours each evening after work, a smattering of longer periods over the weekend. Most of us find it a challenge to spend 24 hours a day with anyone, even the person we have pledged to spend the rest of our lives with. Many cruising couples complain of being "joined at the hip" until they develop ways to give one another privacy despite their physical proximity.

Second, the mobility of life aboard a sailboat means social networks are constantly in flux. When things are not going well in the relationship, you can't hop in the car and go for a long drive or vent to your close friends. For much of the time, the boat exists as a self-contained world, and the other crewmembers aboard will come to assume all the roles formerly filled by a large number of people—work colleagues, buddies, close friends, relatives. This creates much greater dependency between partners, which in turn demands much more trust.

Third, couples rarely need to deal with life-threatening situations as a team ashore. Aboard a boat, when you go off watch on a passage, you will be entrusting your partner with the safety of the boat. If a freighter comes too close or a squall brings 50-knot winds, you could be trusting him or her with your life. In your first year cruising, you will most likely face many more challenging and stressful situations than you have encountered in a dozen years of marriage. Dealing well with these situations takes more than trust—it also takes a deep-seated, honest respect for the other person's judgment and capabilities. If that respect isn't there, you will both know within a few weeks of heading offshore.

For these reasons, relationships afloat must be even stronger than ashore. Voyaging will not fix a deteriorating relationship. Thinking otherwise is not only foolish but potentially dangerous. If there has ever been any type of abuse in your relationship, don't even consider isolating yourself on a small boat far from social services, friends, and family. On the other hand, we know several voyaging couples who had drifted apart but still liked each other and enjoyed being together; cruising gave their relationships a new lease on life.

So how do you know if your relationship is strong enough to make the transition to life afloat? In *Changing Course*, Debra Cantrell found that most successful voyaging partnerships started with solid, long-standing relationships on land characterized by open and honest communication, supportive interactions, and trust in one another's skills and decision-making abilities. In addition, Cantrell found that successful cruising couples shared the following attributes:

- **Joint ownership of the plan.** Although voyaging most often starts out as the dream of one partner, to be successful all partners must come to embrace it. The transition from shore to sea then becomes one of joint cooperation and mutual investment. The chances of creating a voyaging partnership increased when each of the partners was involved with every aspect of their new life, from picking and equipping the boat to deciding how they would stay in touch with those left behind.
- **Equality aboard.** Although the relationship may have been equal ashore, one partner will likely have more sailing skills or experience than the other. Restoring the sense of equality while still recognizing the need for a skipper often proves one of the biggest challenges during the first year or so of voyaging. Successful couples supported each other's efforts to acquire additional skills. They appreciated the difficulties of each person's role, respected each other's contributions, and moved as quickly as possible to build an equal partnership aboard.
- **Individual identities.** At the same time they are working to become a team, the partners need to bring to the boat and to their new life those things that mark them as individuals. If the dream is the man's, the boat embodies that dream and reflects many aspects of his personality. Women need to establish their own identity aboard and, in the process, make the boat their home. Successful couples took along the items that defined each person. That might mean stoneware dishes and crystal wine glasses, or computers and cameras.
- **Sense of independence and control.** Living together in a small space can be confining, and being together all the time can lead to a loss of independence. Every crewmember needed to maintain a sense of control in his or her personal life. Each person needed private stowage spaces, some personal money, and an area where he or she wouldn't be disturbed. This does not have to be a separate cabin, only a place that is recognized as a "do not disturb" space.

Among the crews who failed to make the transition to voyaging partners, Cantrell found several contributing factors. In cases where one partner never took ownership of the plan, that person had nothing to lose if the dream failed. Where risk tolerances differed markedly, safety became a source of conflict. When one partner's efforts to increase skills were not recognized or rewarded by the other partner, that person often gave up and played a passive role. When expectations were unrealistic, couples found it difficult to share their fears and misgivings.

Finally, Cantrell found that couples who spent little time together on land had difficulty making the transition. Once alone on the boat, some couples discovered they couldn't tolerate one another's company. If you would enjoy a weekend alone with your partner locked in a studio apartment without power and water, then you will love voyaging together. If careers and kids mean that you don't really know each other anymore, spend as much time alone together as you can before you go.

Commitment to Exploring Voyaging as a Way of Life

Having taken a look at yourself, the rest of your crew, and your relationships, you'll need to take one more little step to begin the journey toward a voyaging partnership. You must commit to investing in the dream, to investigating whether or not this life might be one you can embrace. To remain committed over the long term, each crewmember must get something of value from cruising. For now, the only commitment necessary is a willingness to figure out what that something might be by learning more about what cruising would be like.

Voyaging offers different things to different people. Some cruisers value the peace and solitude of anchoring in remote lagoons or being on passage. Others study marine life, local cultures, or ancient history. We have friends who love scuba diving and travel in search of the perfect reef, and others who are accomplished mountaineers and use their boat as a base camp. We know people who have carried medical supplies to needy areas through Doctors Without Borders or rebuilt local communities after earthquakes or cyclones. Some people develop creative skills they would never have discovered on land—writing poetry, drawing seascapes, making jewelry. Other people find satisfaction in some sort of work ashore that they alternate with "vacations" out cruising. Writing was the hook that convinced me to try voyaging, and it has become the anchor that provides both fulfillment and challenge in our life afloat.

For many people, the final commitment to move aboard and go cruising will come later—after they have learned new skills, addressed whatever fears and concerns they might have, figured out how they can afford to go, and, in some cases, bought and outfitted the boat. But unless this initial small commitment to learn more, to explore the cruising option, is made by every crewmember, the rest will never happen. Once it becomes clear exactly what a reluctant crewmember can get out of this new life, the commitment to voyaging follows naturally for most people.

Laying the Groundwork

Having committed to learning more about voyaging, I was still several years away from climbing onto a boat and setting off to sea. Before you and your crew will be ready to do that, you'll need to lay the groundwork for cruising by defining the parameters of your new life. This includes developing realistic expectations, agreeing on a liveaboard lifestyle, building necessary skills, defining shipboard roles, addressing fears, and setting goals. Communication is critical. In each of these areas, you will need to discuss your approaches to voyaging and determine where they are compatible and where you need to compromise.

Don't start by worrying about exactly when you will go and for how long. Too many people talk about this first, and their fragile dream gets smashed against the hard reality of careers and caretaking. If you set about laying the groundwork, your dream will take on some substance, and you'll begin to see how it might fit into the rest of your life.

Adjusting Expectations

Most people draw their image of the voyaging life from glossy magazine photos, boat show advertisements, and a few charters in paradise. While golden moments exist and are wonderful beyond description, voyaging consists of more than these spontaneous highs. Having been sold on the dream, many couples find the reality less enchanting. Some quit. Others learn to love the reality and end up living the dream.

You cannot know what the life will be like before you go, but you can begin to develop a realistic view of what voyaging is and is not. Picture yourself drinking a rum cooler anchored off a sand beach fringed by swaying palm trees. Then picture yourself sweating over a hot diesel engine, trying to figure out why your batteries aren't charging. Both pictures are accurate. Cruising is a vocation, not a vacation. If you make the mistake of selling yourself and your crew on the vacation, conflict will follow when reality intrudes.

The best way to build a realistic picture of the voyaging life is to talk to those who have done it. Experienced voyaging sailors are not hard to find, and they are always eager to share their insights. Attend liveaboard and cruising forums at boat shows and talk to the panelists. If you have access to the Internet, visit the websites of those out cruising and participate in online sailing discussions. Join one of the worldwide cruising associations and read their updates and bulletins. If you live close to the ocean, walk the docks at large marinas and watch for foreign-flagged vessels. For more ideas, see the Cruising Associations, Crew Resources, and Online Cruising Forums sections in the resources for this chapter in Appendix 1.

Learn about the joys and challenges of voyaging and build a realistic picture of what the life entails. Talk about the aspects of voyaging that attract or concern you with your partners and with others who have been out there. Discuss the pros and cons for each of you as individuals and for your relationship. If you create realistic expectations before you leave, you will avoid investing in an unachievable dream and minimize the conflict between crewmembers while you adjust to your new life.

Agreeing on a Lifestyle

There are almost as many ways to live the cruising life as there are crews out there doing it. At one extreme, you may choose a simple boat with basic accommodations and 1960s conveniences. In return you will have more time to explore your surroundings and enjoy the people along the way. Alternatively, you may choose to invest more time, energy, and money so you can take along twenty-first-century conveniences, communications, and safety equipment. Your decision will affect every aspect of your voyaging life—from the length of your boat to the size of your budget to the type of gear you carry.

The best way to help you decide what lifestyle will work for you is to illustrate the alternatives. To that end, I will introduce the crews of three fictitious boats at the end of this chapter—*Simplicity*, *Moderation*, and *Highlife*. In the following chapters I will compare these boats and their equipment as well as the crews' lifestyles and budgets. Although none of the three will exactly reflect the trade-offs you will end up making, they offer a way for you to discuss lifestyle issues with the other members of your crew and to help define your preferences.

Dividing the issue of lifestyle into the following categories will help frame your discussions as you consider these alternatives. Initially, you'll probably find that you don't even agree on what falls into each category.

- **Comfortable surroundings.** What kind of an environment do you need to be comfortable? A burrow or a luxurious featherbed? A utilitarian space or a designer interior? Almost everybody feels strongly about the surroundings they live in, yet most crewmembers do not define their requirements until their own assumptions collide with someone else's. A person with a high tolerance for discomfort rarely minds if things are luxurious and comfortable, but the person with a low tolerance for discomfort will feel resentful if comforts are absent. You need to come to agreement on a minimal level of comfort acceptable to all and decide what that implies in terms of the layout, level of finish, and accoutrements for the boat.

- **Conveniences.** Like comfort, everyone defines convenience differently. Will you carry a GPS? Do you want radar? How about refrigeration? A watermaker? Will you need a generator? How about an outboard motor for the dinghy? All these items make life easier aboard a sailing boat, but they are not equal. Experienced sailors will have already divided this list into necessities and luxuries, but the line each one draws will not fall in the same place. Therein lies the potential for conflict. You will need to come to agreement with the rest of your crew on which items you cannot do without and which you would like to have if money and space allow. These decisions will determine how large a boat you'll have to have and how much money you'll need to outfit it.
- **Safety.** Individual views on safety and acceptable risk levels vary a great deal. Discussions over safety can get highly emotional; after all, each decision may have life-changing consequences. Choosing to voyage at all means accepting a certain amount of risk. You and your crew need to agree on an acceptable level of risk and what that implies for your boat and equipment, as well as for your voyaging plans and the rules aboard.

Finally, you will need to consider what you want to get out of cruising and how that will affect your lifestyle. During cockpit cocktails one evening in the Caribbean, we got into a discussion with friends on what we found most rewarding about voyaging. Two couples valued their interactions with other voyagers and the fellowship of the cruising community. They talked of the magical bond they felt with cruisers in every ocean and of deep, lasting friendships. For the other two couples, independence and self-reliance topped the list. They described the freedom of voyaging, their increasing self-confidence, and their joy in the solitude of the sea. These answers illustrate opposite sides of the voyaging coin, and most cruisers find some mix of the two suits them best.

If you're attracted to the idea of community, you can participate in amateur radio nets, buddy cruises, and cruising rallies. But such activities compromise what others view as the essence of voyaging: independence, isolation, adventure, self-reliance, and interactions with people of foreign cultures. If one partner wants to be the Lone Ranger and the other partner wants to be the life of the party, compromise will be essential. Be honest about your feelings from the start and find a balance everyone can live with.

To build a strong voyaging partnership, you will need to come to a common vision of your ideal liveaboard lifestyle. While this process will take time and will continue long after you move aboard, defining each person's preferences and boundaries early on will smooth the transition.

Building Skills

To function at sea, every boat needs a captain, cook, engineer, electrician, navigator, sailmaker, meteorologist, ship's surgeon, and watch captains. In port, you'll need all of these at different times as well as a cruise director, cultural ambassador, naturalist, and interpreter. The number of skills that need to be mastered can be mind-boggling. Many of these skills can be developed as you go, but some you will need from the very start. So where do you begin?

The last three parts of this book cover all the skills you will need to make your voyage a success, along with the ways you can go about acquiring those skills. If you are an experienced sailor, you can start there. But if sailing is new to you, you'll want to learn something about how to manage a boat first.

For most couples, teaching a spouse to sail is worse than teaching a spouse to drive. Consider taking a coastal or dinghy sailing course from a qualified instructor to learn the basics and find out whether you like sailing. Courses exist in all parts of the world, for all levels of experience, for all types of boats, for children and adults, and for women who wish to learn to sail from other women. A quick search on the Internet will turn up dozens of options.

If you're comfortable with the basics of coastal sailing but haven't been offshore, try to get some experience. If you know any voyaging crews, ask if you can join them for a passage. If you can find a reputable skipper who is willing to give you some instruction en route, join a delivery crew. But don't go with anyone on any terms, or you may end up sitting in port for weeks waiting for parts or in a dangerous situation at sea. Check references and talk to other crewmembers before signing on, or pay for an offshore course from a reputable instructor (see the Offshore Sailing Instruction section in the resources for this chapter in Appendix 1).

In addition to learning as much as you can and seeing how you like passagemaking, use your time offshore to evaluate yourself and your skills. See how you react to boredom and stress at sea. Watch how the skipper handles the crew and evaluate the general level of morale, safety, and comfort aboard. Figure out if you're likely to suffer from seasickness, and if so, whether any medications can control it.

While building your sailing skills, you and your crew should also invest in two other areas as soon as possible—learning a language and spending time together. If you have studied another language, brush up by taking an adult education class, or find a native speaker and start practicing. If not, start learning one. If you're thinking of a trade wind circumnavigation or a few years in the South Pacific, focus on French. For South America, study Spanish or Portuguese. For Europe, either French or Spanish helps. Yes, you can get along with English almost everywhere in the world, but talking to local people in their native tongue pays off in a thousand different ways.

Spend as much time with your partners as you can, preferably aboard a boat. Whether installing new gear, doing maintenance, sailing in heavy weather, or just socializing, you will learn about how you interact on board. Work on resolving conflicts that arise. Learn to discuss problems calmly and recognize situations that lead to tension. The better you function as a team before you leave, the better you will manage the adjustment to the voyaging life.

Defining Clear Roles

Defining clear roles and areas of responsibility is a practical approach to managing life aboard. Given the number of skills that need to be mastered, dividing responsibilities allows each crewmember to focus on a few areas of expertise. In addition, some responsibilities can be almost impossible to share—if each crewmember does some of the provisioning or handles some of the spare parts, you'll have no way of knowing what is on board and where it is stored. By the time you leave, one crewmember should have taken initial responsibility for each of the skills discussed in the last three parts of this book.

Before that, try your hand at the different tasks on board. You'll soon discover which you do well, enjoy, and care about. Don't be surprised—or dismayed—if you end up dividing many of the chores along traditional gender lines. It's a standing joke in the cruising community that chores aboard get split into "blue jobs" and "pink jobs." Men tend to take responsibility for maintenance, women for provisioning and cooking. On most boats, men take care of cosmetics and cleaning on the outside, and the women do the same on the inside. Over time, both become skilled at sailing and handling the boat. Whatever tasks remain get divided up based on interest and experience.

Some shore-based skills translate directly to voyaging. Does one of you enjoy sewing? That person should handle sail and canvas repairs. Does one of you have some medical training? That crewmember should manage the medical kit and see to health issues aboard. Hopefully, one of you will have some mechanical aptitude, and one will have the patience necessary to deal with bureaucracy.

Addressing Fears

Fear can be the most destructive of shipmates. It can reduce morale aboard and erode trust between crewmembers. In the extreme, it can endanger the yacht and her crew by causing someone to freeze or to panic at a critical moment.

Every sailor, no matter how experienced, fears something. It's okay to be afraid, and it can be valuable to talk about specific fears. It's also important to distinguish between fear and worry. Skippers who respond with the same intensity to every threat create crews whose anxiety level is unhealthy and whose reaction to serious emergencies may be panic.

Fear begins where control ends. To manage our fear we must minimize the range of conditions and situations within which we feel helpless. Building the sailing and boat-handling skills of each crewmember will do more to reduce the amount of fear aboard than anything else. Increasing confidence will turn many unmanageable fears into a healthy—and even exhilarating—sense of alert awareness.

Knowledge, skills, and experience will increasingly keep things from moving beyond the crew's control, but the crew's very competence will make them more aware of it when it does happen. To prevent fear from taking over, a basic trust in your boat and your partners must underlie all else. Beyond that, most experienced cruisers believe it is essential to designate a captain with ultimate responsibility. In most emergencies, doing something is infinitely preferable to doing nothing, and decision making must be instantaneous. To prevent disagreement and delay, there has to be one person whose authority is absolute.

But before an emergency actually occurs, few decisions need to be instantaneous. In these situations, most crews have a rule that one person can veto the risky alternative. If one person is uncomfortable entering an anchorage when making landfall at night, then the crew heaves-to and waits for daylight. If all crewmembers agree to the riskier course, it should be a safe one to pursue. This single rule has probably saved more offshore cruising vessels than any single piece of safety gear.

Whenever possible, seek out controlled situations to increase your skills and your comfort level. Involve your partners and be sure to talk about the experience afterward. Here are some suggestions for ways to gain experience without taking serious risks:

- **Crew on a race boat.** Joining a racing crew will give you the opportunity to understand how hard a boat can be pushed and to see firsthand what happens when gear breaks. With lots of crewmembers aboard, situations can be resolved that would be much more serious on a shorthanded boat. The lessons you learn from racing will make you sail your boat better and will help you accurately assess the safety margin you sail with on your own boat. This will increase your sense of comfort when conditions deteriorate.
- **Stretch yourself aboard your own boat.** Take your own boat out in slightly worse conditions than you normally would. People react differently to stress aboard. Some get seasick, some get angry, some get icy calm. Learn to detect the early signs that you or your partner are moving out of your comfort zone. Being aware that one of you feels anxious will keep you focused on the reason for the tension, rather than reacting to its symptoms. Make sure to discuss what's making you uncomfortable and why. If you're worried about reefing in windy conditions, go back to the dock and reef there a half-dozen times until it becomes automatic, or change your reefing system to make it easier to use in heavy weather.
- **Exchange positions aboard.** The single most common fear among even the most experienced first mates is losing the skipper overboard. Most first mates have never had to take charge of the boat and cannot be sure if they can really do so. Though it can never replicate having to actually be skipper, allowing each crewmember to act as day skipper can help alleviate this fear. The day skipper should be allowed to make all decisions—and to make mistakes. The most valuable part of the exercise revolves around responsibility—learning to manage the unexpected and experiencing the real pressures of keeping the vessel safe. The usual skipper will need to curb the inclination to instruct or take the helm, but the benefit will be increased confidence for the rest of the crew.
- **Experience disasters from your armchair.** I can't stress enough the importance sea stories play in fear management. Read as many stories as you can, from those of the early seafarers to recent books on storms at sea. Recalling examples of others who've survived worse conditions or tactics that others have used to handle emergencies has gotten many circumnavigators around the world. Almost every crew has their role model, the person to whom they can relate and about whom they can say, "If they could do this, I can do this." Two-time circumnavigators Scott and Kitty Kuhner were rolled through 360 degrees while lying ahull in the Gulf Stream in their 30-foot ketch at the end of their first circumnavigation. Knee deep in water after the boat came back upright, Kitty found herself thinking of Beryl Smeeton, whose ketch, *Tzu Hang*, was pitchpoled off Cape Horn with her husband, Miles, and a crewmember, John Guzzwell, aboard. Kitty thought, "If Beryl Smeeton can survive this, then so can I." With that she picked up a bucket and started bailing.

To translate the experiences you've gained into an increased comfort level aboard your own boat means developing rules and procedures for dealing with the things you fear and equipping yourself with the skills and your boat with the equipment necessary to keep you from feeling helpless. That starts by identifying and sharing your fears, then using your imagination to explore ways to overcome those fears. The following steps will help you as you work out your own procedures:

- **Agree to basic safety rules.** Most successful voyaging crews work within well-defined boundaries. These boundaries, however, vary widely from crew to crew and reflect differences in risk tolerances and crew capabilities. You and your crew will need to decide when you will wear safety harnesses, if the on-watch person can leave the cockpit, whether you will reef with only one person on deck, what safety gear you will carry, and in what circumstances you will make use of it. These rules need to be clearly communicated to and accepted by any additional crewmembers who come aboard.
- **Develop specific procedures.** In the face of a sudden emergency, many people will freeze unless they've been drilled on how to react. An established procedure that has been practiced repeatedly both in real life and in each crewmember's mind will greatly reduce the likelihood of panic taking hold. On most boats, safety procedures are agreed to verbally and reviewed several times during the first year at sea. For larger crews or where crewmembers change over time, these procedures are written in full detail; new arrivals are asked to read the procedures and are told what their role would be.
- **Make logic a habit.** When an established procedure doesn't exist for an unexpected emergency, disciplined logic makes the best defense against an encroaching sense of helplessness. In reacting to fearful situations, experienced skippers describe a logical process of examining and rejecting alter-

natives until they find a solution. As long as they were thinking, they weren't helpless, and their fear remained subsidiary to an orderly thought process.

- **Don't leave with any nagging doubts.** If there's something you don't trust, fix it before you go. Even small doubts can breed major fears in deteriorating conditions. Whether you're heading out for a weekend's cruise or a thousand-mile passage, take care of the frayed wire or the weeping seacock before you leave the dock.
- **Build in a safety margin.** Experienced sailors automatically consider how much safety margin they have when the weather deteriorates or an engine won't start. Many tried and true rules of basic seamanship are designed to create or maintain a margin of safety: reef early and often; always have an anchor ready to deploy and a sail ready to raise when the motor's on; never depend on a single aid to navigation. All are common sense, but they illustrate an attitude that views a safety margin as one more weapon in the arsenal of defense against running out of options.

Don't let your preparation become paranoia. Once you have done everything you can to prepare for emergencies, fear should no longer prey on your crew. If you are still plagued by a particular anxiety, you need to either do more planning or find a way to let it go. When we were living aboard *Silk*, I was particularly fearful of lightning at sea. Even after talking to the boatbuilder about the grounding system aboard, terror overwhelmed me whenever we were in a storm. Then we met a couple whose boat had been hit by lightning, and I realized that they hadn't been vaporized off the face of the globe. The damage was serious but fixable. After that, being struck by lightning became one of those uncontrollable risks we could prepare for but never eliminate. I never really got over the fear, but I have accepted it and even learned to appreciate the wild and awesome beauty of a thunderstorm at sea.

As with anything worth doing, sailing includes an element of risk. No amount of preparation can change that. At some point, each person has to accept that not everything can be controlled. Experienced sailors combine a realistic sense of the risks with an optimistic fatalism. I've had more than one accomplished veteran remind me that we're all far more likely to die in a car crash than a storm at sea.

Finally, as you gain confidence, don't let yourself be lulled by the benign face the sea so often wears. Many dangerous situations we either saw or experienced ourselves resulted from complacency or inattention (see the Summary of Lessons Learned section in Chapter 15). When everything is new and strange, you will be more cautious than you will be once these activities become mundane. The safety factor you give up may mean the difference between a close call and a serious incident. You must keep each other vigilant and continue to abide by the safety rules you've agreed upon. Managing fear means not becoming fearless, but finding that delicate balance between courage and caution that sends you forward to douse a sail in a gale but makes you clip in before you step out onto the side deck.

Setting Goals

Once you've decided you're going to explore voyaging as a way of life, agreeing to goals at each step of the process will keep you on track and reinforce communications. At each stage, you should be working toward shared objectives and personal ones, toward small goals and major milestones. Keep your goals realistic with respect to your current life, but start putting a priority on voyaging.

The first commitment most people make is financial. Using the information in Chapter 2, create a financial plan and determine how much money you should be saving. For most people, the saving will take years, so there is plenty of time for all the other things you'll need to learn and do. Saving will also help you begin to develop a voyaging mind-set.

The mind-set starts by freeing yourself from consumerism. Don't move into a bigger house, buy a new car, upgrade your computer, or replace your washing machine. Stop eating out, going to movies, and buying non-boat-related books. Rediscover your local library, factory outlet stores, and consignment shops. Instead of watching television, read books about sailing and practice your splicing skills. Learn to do without wherever possible, or learn to do with less where you cannot do without. With the money you save, pay off your debts. If you can invest 50 to 60 percent of your take-home pay, you will be able to afford your dream. Learning the self-discipline necessary to live frugally in our consumer society and freeing yourself from debt may be the most difficult—and rewarding—things you do en route to becoming a full-time voyager.

In addition to saving money, your early goals will revolve around finding ways to answer the questions you each have and to explore voyaging as a way of life. For most people, that means reading about sailing, attending boat shows and seminars, talking to experienced cruisers, and spending time on a boat, together and apart.

For most crews, a turning point will come when the reluctant partner embraces the dream and starts to participate actively. That moment is so memorable that many couples can describe it years after the event. My turning point came at the helm of a charter boat running before a half gale between the Scilly Islands and Land's End off the English coast. That experience convinced me I could become a sailor, and after that I was the one pushing for us to leave as soon as possible. From that point on, your focus will shift to building the skills you'll need and finding and equipping the boat.

In the course of all this, don't listen to naysayers. Any experienced sailors who met Evans and me as we were preparing *Silk* to head offshore wouldn't have given us more than one chance in a hundred of making it through the first passage, let alone the first year. But no one can predict who is going to succeed and who is going to fail, in part because of how much the very act of breaking away from land and going cruising changes people. Just stay focused on your goals, and ignore the people worrying about whether you're crazy or not.

When you leave the dock for the last time, you should have agreed upon realistic goals for your first year of voyaging. You might want to complete a fast-paced Atlantic or Pacific circle or make a leisurely cruise to Mexico or through the European canals. A common goal helps get you through some of the early lows. The chance to recommit after the first year lets you assess what is working and what isn't. Once you slip into the voyaging mentality, you may no longer need to set goals. After our first year, goals became more like reference points—important as beacons, less important as milestones.

DECIDING WHEN TO GO

There is no such thing as the perfect time to go cruising. Everyone who eventually makes it out there has had to take into account the very real constraints of careers, family, and money. Each crew has found their own balance between these realities and their desire to set sail. By understanding how the majority of people manage these trade-offs, you'll be better able to frame the discussion with the rest of your crew about exactly when to go.

But don't leave thinking that you won't return, and don't set it up so you can't. Especially in the first year, you need an escape hatch—both financially and emotionally. Many would-be voyagers want to free themselves from the tyranny of time clocks through early retirement and a low-income, low-cost lifestyle. But you may discover that voyaging is not for you. Even if you love it, any number of things from health to relationships could make voyaging unattractive in the future. If your income just covers voyaging expenditures, you will face a serious financial shortfall if you are forced to move back ashore.

You also need an emotional escape hatch. As we moved aboard *Silk*, a friend who had been a lieutenant commander in the Coast Guard told me, "Never feel you can't come back. The sea can be a terrifying place. We won't think any less of you if you return earlier than you expect." The more time went on, the more I appreciated the wisdom of those words. You need goals to get you through some of the low points, but you also need the reassurance that those you left behind will still take joy in your accomplishments if you quit. If the escape hatch exists, you are less likely to use it.

No one we met had originally thrown it all in and left permanently, though some never got around to going back. Assume you will return to a shore-based existence and make sure you have the resources to do so. Then take it year by year, as most successful voyagers do.

Timing Issues

If you wait too long, time or health may preclude your ever leaving. Too many couples have lost their dream to an unexpected illness or sudden death. You will pay a financial penalty if you leave too early and must return because your kids are too young or your parents too old. But you'll still have time to realize your dream. Leaving your voyage for last means you get no second chance.

Health is the only true constraint, and for most of us that translates into age. Physical strength and agility are required to raise an anchor or douse a mainsail, especially if equipment fails. Life becomes much more complicated aboard a boat when one crewmember suffers from diabetes, crippling arthritis, heart disease, or cancer—although we've met people out cruising with each of these disorders. No one can know when a crewmember will face a life-changing disease, but by going early you increase the odds of being able to live your dream to the fullest.

Health aside, most of us must juggle three major constraints to determine when we can go:

1. **Caretaking.** Most people who choose to have children spend the majority of their adult years caretaking. They finish raising their children only to find that their parents require care. If you have children, you have to decide whether or not to take them along, and if so, at what age (see the Cruising with Kids: What Age Is Best? sidebar above). But you may have little choice if you seriously want to go voyaging. If your parents are already approaching their golden years, you should take your children, regardless of their ages, and go while you have the opportunity.
2. **Careers.** Can you afford to leave your job for an extended period of time? The answer depends upon your field, ambitions, success, and skills. If you are in a technology-driven field, you

probably cannot afford to be gone for more than a few months. Unless you can take your career with you, you may have to wait until retirement to live your dream. If your field changes more slowly and depends on skills rather than cutting-edge concepts, you risk little in leaving for up to five years. Beyond that, no matter what the field, your résumé will be stale, and you will have to start over.

3. **Cash flow.** If you are serious about voyaging, you will make the adjustments in careers and caretaking. For most people, cold hard cash determines when they can leave. In addition to buying and outfitting the boat, you'll need enough money or a source of income to meet your cruising budget, which will reflect your voyaging preferences. Yet money is the most flexible constraint. While every voyager would love limitless resources, you can voyage successfully on very little money. To minimize the budget, keep the boat small and simple, figure out how to work along the way, and leave with no debt.

You can always find a reason not to go. The children are either too young or too old. When the children can take care of themselves, elderly parents cannot. If your career demands attention early on, then you won't be able to leave later without risking your status and position. If you keep saving for one more contingency, you will never be satisfied with your cruising kitty. But somewhere at the interface between these three constraints, every crew out there has found room for a meaningful period of time at sea.

Timing Options

How do you juggle these three elements to come up with a time period when you can live your dream? Up until a decade ago, almost everyone out there resolved these constraints in one of three ways: by leaving before they started a career, by taking a sabbatical, or by waiting for retirement. Today, technology and communications have opened up new alternatives between the "all or nothing" of the traditional "sell up and sail" approach. An increasing number of people live two lives, spending part of each year on their boat in an exotic location and the rest of their time in their home ashore. Others take their careers with them, doing business from the boat.

Each option has its trade-offs. The choice you make will dictate almost everything about your voyaging life—from the boat you sail, to how much money you spend, to whether or not you sail with children.

Precareer

Fewer than 10 percent of the circumnavigators we have met were young people voyaging before or after university. They were taking a break before settling down to careers and kids.

These people had no children and little money. They went in small boats, often 30 feet or less, with almost no gear. Most of them worked part of the time while they were voyaging. They accepted a lower level of comfort and convenience than most of us, but they anchored in the same harbors, saw the same sights, shared the same beach barbecues, and learned the same lessons about themselves and their world.

Some people leave as precareer cruisers and never get around to going back. We have met such people after they had been voyaging for several decades. Generally, they were aboard the same boat, working three or four months of the year, living modestly, and enjoying life.

The major advantage of this option is simplicity; cash flow requirements are minimal, and there is no need to juggle caretaking and careers. This approach requires only minor resources, but it demands adaptability and flexibility. Precareer voyagers tend to be young or young at heart—people who have not learned to love their creature comforts. For those who returned to the "real world" within four or five years, college admissions officers and potential employers alike viewed their adventures favorably.

Unfortunately, in the decade we have been cruising, we have seen the number of crews who fall into this category decline. Increasing safety regulations for boats and equipment, higher costs for visas and other fees, the need to show funds before being allowed to stay for several months in most countries, and the requirement for boat insurance in many places have raised the cost and complexity of cruising for all of us. But the perception has changed far more than the reality. It's still possible to go voyaging with a simple boat, little equipment, and a minimal amount of money, as *Simplicity*'s crew will illustrate.

Sabbatical or Job Change

Fewer than half of the circumnavigators we met had taken a sabbatical from their career. Most of these people had no guarantee of reemployment, but they assumed they could resume their careers when they returned. Some people had been laid off during corporate restructuring, and their severance pay played a key role in financing their voyage. Perversely, this option is most difficult for the self-employed and small-business owners. Many single-owner businesses run down in the absence of the entrepreneur; selling the business seemed to be the best alternative. We have met several dozen crews who had built up profitable companies and traded them in for a boat and the voyaging lifestyle.

Those on sabbatical tended to be between 30 and 40 years old. A few left with children on board, and many had children during their voyage. Their resources varied widely, and their boats reflected this range. But their boats were almost always larger and better equipped than those of the precareer crowd. They left with more money than that group as well, and most of them did not work along the way. None of them became permanent voyagers. Having invested a decade or more in a career, they didn't want to leave the work force completely. They also wanted their children to receive secondary school education ashore to safeguard their university opportunities and future careers.

Upon returning, most people who took a sabbatical experienced few problems in finding new jobs. We were offered several interesting opportunities in consulting and the corporate world within weeks of returning from our first voyage. Friends of ours in marketing and stock brokerage found their way back into their old fields. Those with a trade returned to employment even more easily. But although most people had work within a few months of ending their voyages, only a handful jumped back on the career track. For the rest, the jobs they got were at the same level or a bit below what they had left behind. Very few of them regretted this. Their priorities had changed, and reaching the top of the corporate ladder no longer appealed to them.

As the crew on *Moderation* will demonstrate, a sabbatical provides a much higher level of comfort and financial security than precareer voyaging—but at a price. You are unlikely to reach the very top of your profession after taking three to five years off in the middle of your career. Only you can decide if voyaging is worth that trade-off.

Early Retirement

About one-third of the circumnavigators we knew had taken early retirement and headed off to sea somewhere between ages 45 and 55. Many of these people had worked in fields where retirement on partial pay is possible after twenty or thirty years of service, such as in the military, firefighting, or policing. Others had accepted severance pay and early retirement as part of corporate downsizing. None of the circumnavigators we have met waited until their 60s to retire, though many people in their 60s and older do extensive cruising, generally within one ocean.

As with precareer voyaging, a major advantage of this option is simplicity. Career issues no longer exist for retirees. Most of these early retirees found themselves in that comfortable in-between time with newly independent children and not-yet-dependent parents. Financially, they were at least on a par with those taking a career sabbatical with the added benefit of continuing income. Retirement income, though less than what they might have been used to, stretched a long way aboard a cruising boat and ensured that they did not need to work as they voyaged. Early retirees' boats had many comforts and conveniences, and these voyagers had invested much thought and money to reduce the physical demands of handling the boat.

Health risks represent the largest downside to this option. These are the people whose voyaging dreams may come to a sudden end after a stroke, a heart attack, or a diagnosis of cancer. You will need to evaluate your own health and physical condition honestly if you are thinking about waiting until you retire. If you choose the early retirement option, go as soon as you can, as did the couple on *Highlife*. Those who waited until their early 60s were far more likely to have an unexpected health issue end their voyaging before it began.

Part-Time Voyaging

Modern communications, increasing ease of travel, and more flexible jobs have combined to create a new class of cruisers: people who spend from three to six months of each year living aboard their own boats in exotic locations and the rest of the year living "normal" lives ashore. These people have opted for parallel lives with two homes and two quite different lifestyles. They've managed to achieve the cruising dream without giving up their economic security or pulling up their roots. In the last few years, their numbers have increased until they now make up close to 10 percent of the voyagers we meet.

It takes flexibility, creativity, and desire on the part of each crewmember to make part-time cruising work. We now know several couples who circumnavigated this way and a dozen who completed extensive voyages through the Mediterranean, Pacific, and South America. For the periods when they return ashore, part-timers leave the boat hauled out in a safe boatyard. The increase in the number and quality of boatyard facilities worldwide has contributed to making part-time cruising a viable option even in less traditional cruising grounds like Chile and Alaska.

In addition to seasonal professions like teaching and tax accounting, a variety of careers can be adapted to this dual lifestyle. We have met consultants who only accept client work for a few months of every year and doctors and nurses who arrange part-time work through agencies that supply practices with temporary medical personnel. One person we met ran a landscaping service on Long Island in the summer and sailed the tropics in the winter. Another was a professional ship's captain; he and his wife sailed their own boat in the periods between commissions.

There are downsides to this approach. Part-time cruisers live a divided life, which means they have to be more efficient with what time they have aboard than their full-time equivalents. They spend a significant amount of their cruising time commissioning and decommissioning, and it often takes them weeks to shift gears and change their mind-set from life ashore to life on a boat. Full-time cruisers spend a lot of time working on the boat while sitting in port, but part-time cruisers can't afford to do that. Instead, they pay to have work done while the boat is on the hard, but good boatyards capable of doing extensive work unsupervised can be very difficult to find. Hauling the boat every year and storing it on the hard also takes a toll in general wear and tear.

Maintaining two lives costs money. But part-time cruisers have a regular income, which gives them a degree of financial security that sabbatical cruisers lack. That financial security can extend the cruising time horizon.

Those who choose this option say they find the transitions go more smoothly if they simplify both of their lives. A smaller boat with less equipment is easier to commission and requires less work in the off-season. A condominium or apartment ashore eliminates yard work and maintenance. Despite the trade-offs, part-time cruising offers many of the benefits of full-time cruising without the sacrifice of cash flow, community, career, or home. As communications technology and workplace flexibility free more people from desks and offices, part-time cruising will become an increasingly attractive option.

Working Aboard

Technology and communications have also made it possible to take your career with you. Less than a decade ago when we finished our first circumnavigation, it was barely possible to maintain a professional relationship with the sailing magazines when you were actually out cruising. But with satellite communications aboard and Internet cafés ashore, computer programmers, accountants, and freelance writers can now work by phone, fax, and e-mail, with no one the wiser as to whether or not your home office floats. We know stockbrokers and portfolio managers, software designers and novelists, who have successfully moved their businesses onto their boats. The part-timers alternate working life and cruising life; those that bring their work with them try to blend the two together. Though still small as a total percentage of voyaging crews, the number of people in this category has been rapidly increasing over the last few years.

Like the part-time and retirement options, cash flow continues for those who take their work along with them. This removes the time restrictions imposed by a sabbatical and increases financial security. But managing a business from a boat takes a great deal of discipline, even more so than working from your own home. A boat is a small place with many distractions. Not only must you force yourself to sit down and do the work necessary, but your partners must be willing to spend a certain amount of time sitting in one place and letting you get on with it.

Evans and I have supported ourselves by writing for the seven years we've been cruising aboard our second boat, *Hawk*. We have fixed deadlines and ongoing commitments including a monthly column. We schedule our writing carefully, knowing we will not be able to produce anything when we are on passage or working on the boat on the hard. We have learned that you cannot plan on being able to spend 5 or 6 hours a day every day at your desk when you're cruising. You have to be able to work efficiently when the opportunity presents itself, and you have to be realistic about what you can accomplish in a given period of time.

If you are going to try to work from your boat, you'll have to invest in the best and most advanced communications equipment, computers, and e-mail systems. A larger boat with an area where you can have some real privacy will increase the chances you'll work efficiently. You'll also need space for the tools of your profession. At least one-quarter of the storage space in our main saloon is devoted to computers, cameras, reference books, printers, files, and so on.

Taking your career with you will compromise your voyaging. For many, bringing along deadlines, commitments, phones, and e-mail would ruin voyaging completely. But for those with the discipline and the desire, having something to stimulate you intellectually can make voyaging a more fulfilling, enjoyable experience.

THREE VOYAGING CREWS

Over the course of a decade spent sailing the world on small boats, we have come to realize that there are as many ways to cruise as there are people out there doing it. Every type of boat equipped to every possible level of comfort carrying crews from every conceivable background has successfully completed major voyages. To help you find your way through the maze of decisions you will need to make before you set off on your own adventure, I want to introduce three fictitious crews: the Simplicitys, the Moderations, and the Highlifes.

Simon and Susan Simplicity left Sydney, Australia, two years ago aboard their 33-foot fiberglass cutter, *Simplicity*. They decided to go cruising two years before that, after Simon's brother lent them his 20-foot daysailer and they spent the summer sailing around Sydney harbor. At the time, they were both in their mid-20s and entering the last stages of their PhD programs in microbiology. They had been together for three years and shared interests in nature, outdoor sports, camping, and photography. They had spent earlier summers backpacking around Australia, hiking in remote areas, living out of a tent, and eating only what they could carry or find.

They decided to take three years to sail around the world before they began their careers and started a family. They sailed up the Great Barrier Reef and spent three months cruising Papua New Guinea and Indonesia before heading across the Indian Ocean. They visited the South Indian Ocean islands and continued on to South Africa. They sailed up the Atlantic, stopping for Carnaval in Brazil, before reaching the Caribbean. During their six months cruising there, they applied for postdocs in Canada and were accepted starting the following fall. They sailed offshore to New York City in May, took the mast down, and headed up the Hudson River and Erie Canal to the Great Lakes. They will spend two years in Montreal before completing their circumnavigation.

As newly minted PhDs, Simon and Susan had a bit more money before they set out than do people who've just earned a high school or undergraduate degree. But their finances were strictly limited, so they kept their boat as small and simple as possible. They are already full of ideas about how to spend the money they are earning from their postdocs to make their last year or so of cruising more comfortable than their first two years.

Michael and Molly Moderation, along with their two children, Mindy (9) and Max (10), have been voyaging for two years aboard their 40-foot catamaran, *Moderation*. Michael and Molly, both in their late 30s, are taking a four- to five-year sabbatical from their jobs. Before they left, they lived in London, where Michael worked in the creative side of a large advertising firm, and Molly was one of three partners in a small architecture firm. They had grown increasingly disillusioned with the demands of corporate life and the pressures of living in a big city. They hardly saw Mindy and Max during the week and felt they were losing touch with their children. They had almost no sailing experience when Michael suggested they buy a boat, pack up the kids, and sail away. At first, Molly was afraid she wouldn't be able to handle the boat and was concerned about having to educate the children. But after attending several seminars and meeting some voyaging families on a vacation in Malta, she realized what a great experience it would be for the family.

They developed a five-year plan to build up their savings so they could buy and fit out the boat, set aside a cruising kitty, and learn the skills they needed. It took them longer than they had expected to find the right boat, and they ended up having to work an extra six months when they went over their refit budget. When they did depart, they left without a definite itinerary in mind. They agreed to cruise the Mediterranean for the late summer and early fall and see how everyone took to their new life. After four months in the Med, they were all hooked. They crossed the Atlantic with the Atlantic Rally for Cruisers (ARC) and spent six months in the Caribbean before heading up the U.S. East Coast to avoid cyclone season. They returned south via Bermuda to the Caribbean, then cruised Venezuela, the Dutch Antilles, and the San Blas Islands before transiting the Panama Canal. They intend to explore the Pacific for two or three years before selling the boat in Australia or New Zealand and returning to England in time for Max to enter secondary school.

After saving for three years and mortgaging their house, they had the money to afford quite a few conveniences, some of which they viewed as essential for the safety and welfare of their children. But they have to be careful of their budget to make sure their cruising kitty lasts for as long as they hope to be out.

Hugh and Hilary Highlife left San Francisco four years ago aboard their 52-foot fiberglass ketch, *Highlife*. In the 1990s, they had helped found a high-tech company specializing in robotics in Silicon Valley. They had always kept a sailboat in Sausalito, the last one being a J/120 that they raced extensively in San Francisco Bay. Hilary had crewed on a Transpac race (from Los Angeles to Honolulu), and Hugh had been on the delivery back to San Francisco. They had both loved passagemaking and wanted to do more of it. By the time they reached their mid-50s, their three children had graduated from college, and they were ready to trade their corporate lives for the cruising dream.

Their business partners bought them out, leaving them with enough money to afford just about whatever boat they wanted. It took them a year to find their perfect boat, make a few changes, and sail it until they were as comfortable on it as they had been on their J/120. At that point, they said good-bye to their friends and family and sailed down the California coast to Mexico, where they spent two years. Then they rode the trade winds to the Marquesas and spent the next three months cruising through French Polynesia. They left the boat on the hard in the Society Islands for cyclone season. They traveled to Easter Island and then on to Chile before returning to the United States just in time for the birth of their first grandchild. After returning to the boat, they cruised the Cook Islands, Tonga, and Fiji before heading to New Zealand for cyclone season. Their children and some of their sailing friends have visited several times and crewed on a couple of passages. They have no definite plans for the future, only to keep voyaging as long as their health allows and they are enjoying themselves.

These three crews are amalgams of crews we have met and are representative of the range of cruisers out there. In the following chapters, I will share their choices in boats, comforts, conveniences, and safety equipment, as well as the choices Evans and I have made in these same areas. In this way, I hope to help you define your own ideal cruising life.

CHAPTER 2
Adequate Financing

THE MONEY YOU will need to go cruising falls into two categories: funds to buy and outfit a cruising boat, and the total expenditures necessary to pay for your life aboard. For a three- to five-year voyage, the first will often be substantially larger than the second. Both can vary by more than an order of magnitude from boat to boat. We have interviewed crews aboard boats that cost less than $30,000 to buy and outfit who spent less than $8,000 per year while cruising. We have also interviewed crews aboard boats that cost several million dollars who spent well over $100,000 per year.

Most people go cruising when they decide they have enough money to buy the boat and finance the cruising kitty. But given this range, how much will be enough for you? It's easy to get into a chicken-and-egg dilemma over the whole question of money. To know how much you can afford to spend on the boat, you need to have some idea of how much you'll spend while cruising. But the largest expense categories depend upon the size and type of boat you buy. This in turn will depend on how much you can save, which depends upon how long you keep working. There is no easy way to untangle this, and most of us find a solution not through a linear process but through some mysterious gestalt that takes into account all these different factors and magically arrives at a workable solution.

Every dollar that goes into the boat means a dollar less in the cruising kitty and a few minutes less of cruising time. Too many people spend what they "have to" to buy and outfit the boat and use whatever's left to go cruising. All too often that means they spent much more than they needed to on the boat, and they may be forced to cut their voyage short when funds run low. Given that many inexpensive boats safely complete major voyages every year, a better approach is to allocate money to the cruising kitty first and then decide how much boat you can afford.

Only you can figure out how much you can invest in your dream. But to shed some light on the process, this chapter starts by considering the standard alternatives for financing a voyage. It then looks in great detail at the voyaging budgets of the three couples I introduced in the Three Voyaging Crews section in Chapter 1 in order to help you come to a realistic estimate of what you will spend while cruising. The last section discusses how to go about determining how much you can afford to spend on the boat based on your anticipated cruising budget and shares the financing solutions for our three fictitious crews.

ALTERNATIVES FOR FINANCING THE DREAM

How do you finance buying and outfitting the boat and topping up your cruising kitty? What can you do to generate income after you set sail? The answers to these questions depend a great deal on your financial situation and your skills. But generally speaking, the way people finance their voyage is closely related to which of the categories outlined in the Timing Options section in Chapter 1 they fall into. This section will consider the standard financing solutions for each of these options.

If you want to cruise badly enough, you will find a way even if it means scaling back your expectations. But however you go about it, don't close the door on returning. Make sure you have an escape hatch financially in case voyaging does not work for you.

Precareer: Earn as You Go

Precareer voyagers are not likely to have any income or savings to offset their voyaging costs, except for an occasional check from family. Their first big challenge will be finding and outfitting a boat they can afford. We've seen some pretty innovative ways of accomplishing this. One boat we ran across was crewed by a group of young men from a small town on Cape Cod. The boys were teenagers when the boat washed ashore in a hurricane and was declared a total loss by the insurance company. They sold shares to the local townspeople and used the money to purchase the boat and refit it. They circumnavigated, and when they returned they sold the boat and paid back their shareholders, along with a reasonable return. The boat was named *Lazarus*.

Other young people borrow the money from their families or throw everything they've managed to save into a fixer-upper boat. They'll leave with lockers full of provisions and savings for about six months. They start looking for work as their food and money supplies dwindle. Most of the younger voyagers we knew worked four to six months for every year of cruising. A few anchored off a resort, got jobs, and worked for two to three years before heading off again for a long adventure.

Working in foreign countries has become much more difficult over the last few decades and will likely get even more complex in the decades to come. Twenty years ago, you could get temporary visas that allowed you to work in almost any country. These days, countries vigorously protect their jobs for their own citizens. Tourist visas expressly prohibit working. Work permits are granted only if you have specific skills, which those traveling before starting careers are unlikely to possess. Many voyagers work "under the table." Without the tax bite, they can save quickly. If caught, however, they are asked to leave the country—in some cases, after paying back taxes.

Yet there are jobs available legally in many parts of the world, and voyagers pursue a variety of temporary occupations to fill the cruising kitty. Most job opportunities are available to anyone, not just the precareer cruiser. If you can be happy while being underemployed and if you're flexible, you will be able to find work as you go. The employment opportunities that follow are listed from most to least common and from most to least lucrative.

Working for Resorts and Charter Companies

When cruising, most voyagers prefer quiet anchorages away from the bustling tourist centers. But when the time comes to earn money, head for the tourist resorts. You can find work in the resort itself: running the waterfront, teaching sailing or sailboarding, waiting tables, tending bar, or selling in a boutique. With luck you may work your way into a position managing a shop, a restaurant, or the resort's recreational program. As the number of top-quality resorts increases in island groups around the world, there is more demand for people to fill these types of positions. One friend of ours ran day sails on a catamaran for a nudist resort—in the buff, of course.

Many people consider chartering their boat as a way to earn additional income. Although you may find a seasonal opportunity to take a dozen people each day from a local hotel out to a reef for lunch and a snorkel, taking guests on board for a week at a time cannot be undertaken on a casual basis. In most places, the charter market has become intensely competitive and highly regulated. Most successful chartering businesses take years to build up and are dependent upon good connections with the travel agents and charter brokers who find clients. Local regulations governing chartering vary considerably. In most countries, charter captains must be licensed, and violators face stiff fines. In some places, you will be required to pay a fee to pick up or drop off charter guests, and if you do so more than a few times a season, you may need to buy a trade license. Some countries, including France and the United States, require that captains of vessels operating entirely in their waters be citizens. Unless you plan to spend considerable time in one place and are committed to building a business, don't count on chartering your boat as a way to earn money as you go.

But that doesn't mean there isn't work to be had in the charter industry. Without doubt, charter companies are the largest employers of cruisers worldwide. Large charter bases are usually located near resort areas. There cruisers can find work repairing fiberglass, painting boats, maintaining engines, fixing refrigeration, and installing electronics. But if you have people skills, you'll find it a lot more lucrative to work as crew on the boats.

A couple working as skipper and first mate on a crewed charter boat can earn a real living and may end up with a long-term career. Putting in a couple of years as skipper and first mate on a 40- or 50-foot boat in the Caribbean or the Med opens up opportunities on 60-foot charter boats and can eventually lead to running a superyacht. To be successful, you need to be able to deal with the complete lack of privacy and the pressure of 24-hour turnarounds between charters.

If you're interested in crewing casually on a charter boat, get certified in the courses necessary to meet the 1995 Standards of Training Certification and Watchkeeping for Seafarers (STCW). If you want to be a cook, bartending and cooking classes will help you develop the skills you'll need to turn out consistent *Cordon Bleu* meals—one of the primary ways charter boats compete with one another. If you hope to run a boat as captain, invest the time and money into getting official credentials such as the U.S. Coast Guard's Six-Pack license (for carrying up to six passengers) and 100-ton license, or the Royal Yachting Association's (RYA) Commercial Yachtmaster. The Maritime and Coastguard Agency (MCA) sets standards for crew competence in the United Kingdom that have been accepted almost worldwide. If you dream of eventually making a career on the superyachts, invest in the MCA-accredited courses available through superyacht schools (see the Superyacht Schools section in the resources for this chapter in Appendix 1).

Many of these positions are in the tropics—the Caribbean or the Pacific islands. Unless you limit your stay to a few months, you will find yourself in these areas during hurricane season. Friends of ours sat through Hurricanes Luis and Marilyn aboard their 30-foot boat in 1995 so they wouldn't lose their lucrative jobs on St. Martin. If you find yourself in this position, they recommend you put your boat on the hard in a hurricane pit.

Deliveries

If you are an accomplished sailor who can adapt quickly to a strange boat and sail safely in the worst weather, deliveries offer a way to earn a decent daily wage and expand your skills. Delivery work can be found after large, one-way races such as the Bermuda Race or Transpac and before or after large rallies such as the ARC or the Baja-Haha. Deliveries can also be found at the major decision points for cruisers along the trade wind routes—New Zealand and Australia, the Caribbean, and the Med.

Most deliveries pay by the mile or by the day. Delivery skippers generally receive between $1.50 and $2 per mile (or $150 to $200 per day), plus boat expenses and airfare back to their point of origination. Although professional delivery crew also receive $75 to $100 per day, nonprofessional crew usually get airfare only, so taking your partner with you may reduce the financial attraction. If you take on a delivery, you will need to ensure your boat's safety while you're gone. Factor that into your costs.

Earning a couple hundred dollars a day for sailing may sound wonderful, but deliveries can be difficult and sometimes dangerous. Delivery skippers are hired for the upwind slogs, not the downwind sleigh rides. You may be asked to deliver a boat during hurricane season or find yourself in a winter gale. The quality of the boat and equipment can run the gamut from spectacular to spectacularly bad. Take a good look at the condition of the boat and safety gear before you agree to do a delivery. Make sure to get all your responsibilities in writing, including how much you can spend on making the boat seaworthy before you leave.

Offer Services to Other Cruisers

While it is possible to find work in the marine industry almost the world over, you will have to deal with work permits, taxes, and other hassles that make it less than worthwhile unless you plan to spend a year or more in one area. But it is possible to create a mobile career by selling these types of services to other cruisers in whatever anchorage you happen to be in.

When it comes to earning money by offering services to other cruisers, remember that most voyagers are just like you: they have built up their skills so they can limit the amount of money spent on repairs. To find a marketable service, consider what you would be willing to pay for in Tonga or Mauritius. The list won't be very long.

To be successful, you need to make it clear that there is a fee for your expertise. One of the unwritten rules of the cruising community is that we all help each other as insurance against the day when we will need help. The expectation that you will provide services for free can create misunderstandings and ill will unless you deal with it at the outset.

You will also need to have skills beyond those of the average cruiser. The most successful venture appears to be sail repair and canvas work. Most cruisers will not pay someone else to fix popped stitches or a ripped seam. But they will pay to have a sail recut, to have the sun protection replaced on their genoa, or to have a new dodger made. To be successful, you must carry a sewing machine, spare sail material, and spare canvas. The condition of your own sails and canvas needs to reflect your level of skill.

Skilled technicians may be able to make money as diesel mechanics, refrigeration experts, or electronics gurus. This works best in small- to medium-sized yachting centers where spares are available and competition is limited.

Sometimes the simplest skills prove valuable in a faraway place. In Tonga, one woman made pocket money doing professional haircuts. Most of us trimmed our partner's hair with rusty scissors, so a salon-quality haircut on a sand beach under a palm tree was a luxury. Another woman with an old-fashioned, hand-crank washing machine aboard did laundry for reasonable prices. A cruiser with a store of rye flour offered fresh-baked rye bread to order several mornings a week.

Teaching

Teaching, particularly teaching English, is another possibility. Where English is the national language, you may need to take a TEFL (Teaching English as a Foreign Language) or an ESL (English as a Second Language) course to become certified. In less-developed countries, your ability to speak the language qualifies you for informal tutoring and sometimes for more formal situations. If you have some proficiency in an area where there is a local need, you may find other teaching opportunities. One of our friends was offered a position teaching shop at the high school in Vava'u, Tonga.

Serendipity plays a large role in finding teaching opportunities, unless you have specialized training. For informal tutoring, post a sign on the bulletin board at the local yachtie hangout or pay for a small notice in the local paper to advertise your services.

Trading

When you purchase local crafts, the idea of buying a hundred instead of a dozen and selling them along the way may cross your mind. Every voyager has been tempted. Some profit handsomely, and others rue the day they ever had the thought.

To be successful, you must understand the value of what you are buying, know where you can sell the goods, and try to avoid handicrafts that might get confiscated at your next port. If you do not know the goods' quality and value, you may end up with a boatload that you cannot unload. But if you have spent a few months learning about the individual styles and quality levels of baskets made in South Africa, for example, and you have seen which baskets sell in the tourist shops, then you may want to buy some from local artisans and take them to your next port.

You are still not home free. Most countries have laws against importing items made from plant or animal material, including woodcarvings, coral, shells, tapa cloth, and baskets. By knowing the laws and adhering to them or by concentrating on items such as pottery, jewelry, and semiprecious stones, you should be able to avoid having your trade goods confiscated.

Technically, you still must apply for a license to bring the goods into another country, in which case you will be faced with import taxes and duties. To avoid this, most voyagers quietly sell their treasures to friends and fellow cruisers. When the scheme works, you can supplement your cruising kitty for several months. For example, friends of ours stuffed their forepeak with brightly colored hammocks they bought in Brazil for $5 each and then sold them in the Caribbean for $50 to $100 each. Other friends purchased the highest-quality black pearls they could find when they cruised the Tuamotus and earned ten times what they paid when they eventually sold them all.

Sabbatical: Save Enough to Finance Several Years

Most people who take a sabbatical have lucrative jobs, some savings, and some assets, usually including a house. A compensation package for redundancy or early retirement may also figure into their financing plans. They will buy and outfit the boat while they're still gainfully employed, probably liquidating some assets to do so. They will save as much as they can before they leave and will have a target for their cruising kitty that they will meet before they go.

If you fall into this category, try to outfit the boat completely while you still have a good income coming in. But don't get trapped ashore saving for one more year or one more contingency. In the end, you have to take the money you have, the boat you have, the gear you have, and go. You will never have as much money as you would like. However, you need to reach the point where a lack of financial resources will not interfere with your enjoyment of voyaging.

Most people taking the sabbatical option can be away only for a prescribed period of time. They will have to return before the kids enter secondary school or their résumés get stale. They do not plan to work along the way, and most of them don't. But a few choose to work, either at the money-earning options outlined in the Precareer section above or by arranging to use their skills ahead of time.

Professionals have the easiest time finding positions and getting temporary work permits. We know a teacher of disabled children who arranged a job in New Zealand for the cyclone season before leaving the United States. She and her husband were able to enjoy the Pacific without financial worries.

Doctors can always set up shop informally, especially if they carry a well-stocked medical kit. Some doctors choose not to announce their vocation to limit the amount of free medical advice solicited during cocktails in the cockpit. Others establish office hours once or twice a week and remain off duty at other times. Depending on their certification, doctors can often get shore-based work as well. Some British friends of ours who are both doctors have organized to practice for a year in New Zealand.

Many countries seek professionals with skills in computer technology and financial markets. Work permits can be obtained most easily if a local company sponsors your application. If this interests you, research the options before you leave. Investigate what areas of expertise are sought after in the countries where you intend to spend some time, and contact some local companies to see if you can meet with them when you arrive. We know people who've found work in stockbroking, consulting, financial analysis, and computing in a half-dozen different countries.

Early Retirement: Stretching the Retirement Income

The financing equation for most retirees is far simpler than for other cruisers. Retirees have built up assets over the course of their working lives. They often own their home free and clear. Financing the boat and equipment comes down to deciding which assets they will liquidate. Monthly income from investments combined with private or government pension plans meet or exceed most retirees' cruising expenses. Many also have rental income from real estate. Given their income, few retirees need to work along the way. But many choose to, often as volunteers in local communities.

Part-Time Voyaging or Working Aboard: Continuing Your Career

Like retirees, part-time voyagers and those who bring their work along with them don't give up their income stream. They need to buy and outfit the boat, and they may choose to set aside some funds for an emergency. But they don't need to worry about building up savings in the cruising kitty for a predetermined number of years. To finance the boat and its equipment, most will liquidate savings or other assets.

Part-time voyagers will not try to work during the short time each year they get to spend on the boat. That's what the other half of their life is all about. But those who work aboard may well supplement whatever income they have through some of the employment opportunities already discussed.

We know a small number of people who have taken different kinds of work with them, including computer programming, stockbroking, investing, and writing novels. With the exception of computer programming, where we know three people who have successfully managed to work from aboard, the rest are all one of a kind in their respective fields. Marine writers and photographers form the only moderately large group of people we have met who cover most of their expenses for a period of several years from their boats.

The number of liveaboard sailor-writers has increased from one or two in the 1980s to a dozen or so today. Internet and satellite communications have made it possible to stay in touch with editors and deliver stories on demand.

For those who hope to make a living this way, consider the economics first. When you're breaking in, U.S. magazines pay between \$400 and \$600 for feature articles; UK magazines pay between £250 and £350. Photographs can double this, and a single cover photograph or table of contents two-page spread can bring in as much as an article. To get those kinds of photographs, you'll need a high-quality digital SLR (single-lens reflex) camera with a telephoto lens. If you are considering writing a book for the marine market, be realistic about the economics. A marine book is considered a bestseller when it sells 10,000 copies over three years. At a 10 percent royalty rate on the net price, you will have an annual income of around \$5,000 for three years versus the year or so invested in writing.

To make a starving-artist living at marine writing takes hard work, discipline, and focus. But any cruiser who writes well can earn some extra money occasionally by investing a little bit of effort. To break in with the marine magazines, download the submission guidelines from the Internet and pay attention to what they say. Focus on how-to articles, provide good illustrations, and produce a professional-looking manuscript.

We know a few other artists who have managed to finance their cruising with their art. One friend of ours is an oil painter who specializes in marine paintings. He has the talent to capture the feel of a boat on the open ocean, something most boatowners find irresistible. He set up his cruising boat with painting in mind and financed his voyage with commissions from cruisers and mega-yacht owners. Another cruising artist in Antigua specialized in small watercolors. He painted local scenes and sold them to the tourist shops and boutiques. A few singer-songwriters such as Eileen Quinn (see the Crew Resources section in the resources for Chapter 1 in Appendix 1) have also managed to make a living singing about the cruising life. If you're passionate about what you do and have some talent, then you'll probably be able to find some way to make it pay while you're out cruising.

HOW MUCH DOES VOYAGING REALLY COST?

To help you determine how much money you will need for whatever voyage you are planning, this section will examine how much the three crews you were introduced to in the Three Voyaging Crews section in Chapter 1 spend. The budgets for *Simplicity*, *Moderation*, and *Highlife* have been constructed from the detailed financial records of more than a dozen crews who generously shared the information with us for this chapter. These people cruised aboard boats ranging from small and simple to large and complex, and their budgets were grouped and averaged to come up with the figures that follow.

Throughout this chapter, numbers refer to U.S. dollars, not adjusted for inflation. Inflation has been low enough in most of the major currencies over the last decade that it has not significantly affected cruising costs. Exchange rates, on the other hand, while stable through much of the 1990s, became more volatile after 2001 and were complicated by the introduction of the Euro. This has affected the relative purchasing power of different national currencies. Rather than attempt to capture the changes in exchange rates between all the major currencies, I have stuck to U.S. dollars as the currency whose value is most likely to be understood by people from the widest range of nationalities.

The three crews described in Chapter 1 cruise aboard very different boats. These will be discussed in detail in the next chapter, but the following summaries give a good idea of boat size and complexity:

- ***Simplicity.*** This 30-year-old, 33-foot cutter carries good ground tackle, one suit of sails, a hard dinghy, a self-steering vane, a GPS, and little else. Susan and Simon recently finished PhD programs and plan a few years of adventure before settling into their careers. Their resources, to put it kindly, are limited. They make every dollar count and think twice and even three times about every expenditure.
- ***Moderation.*** This 13-year-old, 40-foot catamaran crewed by a family of four carries all the modern equipment for sailing, navigation, and steering, along with a basic range of comforts including refrigeration and a watermaker. Her crew have far more resources than the owners of *Simplicity*, but unless they live within what seems to them a strict budget, their cruising kitty will be empty before they finish their voyage.
- ***Highlife.*** This 8-year-old, 52-foot ketch crewed by a couple is fully equipped with the most up-to-date sail handling, communication, navigation, and safety equipment. In addition, she carries almost all the luxuries available: a watermaker, generator, freezer, refrigerator, air conditioner/heater, washer/dryer, trash compactor, microwave, TV/DVD with plasma screen, satellite telephone, and more. The couple's retirement income comfortably meets their onboard living expenses, and they have additional money available for discretionary spending.

None of these crews or their boats will exactly replicate your situation. But by comparing their budgets, you will be able to construct a realistic estimate of your cruising expenditures that reflects your own cruising preferences. Their expenses can be divided into three broad categories: living, boat, and discretionary. Table 2-1 summarizes the average amount each of these three crews has spent annually in each of these categories.

Living expenses include all the recurring expenses necessary for the day-to-day functioning of boat and crew and comprise anywhere from one-half to three-quarters of the budgets of most cruisers. The simpler the boat and the lower the budget, the higher the percentage of money allocated to living expenses. Boat expenses include boat insurance, boat maintenance, and capital expenditures and vary widely depending on boat complexity, size, and whether or not the boat is insured. Despite the range in total dollars spent, the percentage allocated to this category is surprisingly consistent—between one-quarter and one-third of the total budget. Discretionary expenses cover those costs some crews choose to incur and others choose to forgo, such as health insurance and travel home. Being truly discretionary, these increase as the overall budget increases.

As with most of the voyagers who shared their finances with us, the crews aboard *Moderation* and *Highlife* regularly exceed their budgets, covering the difference from savings accounts kept separate from the cruising kitty. The *Simplicity* crew doesn't have that option; when their money runs out, they stop spending.

It's hard to spend less than *Simplicity*'s crew without beginning to cut corners on boat maintenance or nutrition. *Highlife*'s cruising expenses include many luxuries not found in most shoreside budgets: travel to exotic places, restaurant meals several times a week, and regular adventures such as whitewater rafting and horseback riding. Most cruisers live very comfortably on a lot less, though a few cruisers do manage to spend more than the Highlifes. Adding one paid crewmember to the *Highlife* budget would take it over $100,000 per year.

TABLE 2-1. SUMMARY OF AVERAGE ANNUAL EXPENSES BY TYPE (U.S. DOLLARS)

Annual Expenses	*Simplicity*	%	*Moderation*	%	*Highlife*	%
Living expenses	$5,581	72	$12,414	53	$28,854	45
Boat expenses	$2,023	26	$5,972	25	$21,889	35
Discretionary expenses	$150	2	$5,052	22	$12,711	20
Total Expenses	**$7,754**	**100**	**$23,438**	**100**	**$63,454**	**100**
Target Annual Budget	**$8,000**		**$20,000**		**$60,000**	

TABLE 2-2. AVERAGE ANNUAL LIVING EXPENSES BY CATEGORY (U.S. DOLLARS)						
Annual Living Expenses	***Simplicity***	**%**	***Moderation***	**%**	***Highlife***	**%**
Provisions	$3,055	55	$4,851	39	$9,776	34
Entertainment	$697	12	$2,587	21	$8,450	29
Marina/mooring	$316	6	$1,475	12	$3,752	13
Communications	$419	8	$996	8	$2,481	9
Fuel	$344	6	$660	5	$1,562	5
Officials/fees	$180	3	$687	6	$614	2
Other	$570	10	$1,158	9	$2,219	8
Total Living Expenses	**$5,581**	**100**	**$12,414**	**100**	**$28,854**	**100**

The following sections discuss each of these categories in detail. By understanding how each crew's budget goes together, you will be able to come up with a good approximation of what you will spend cruising.

Living Expenses

Table 2-2 details the specific types of expenses included in this category along with the expenditures in each area by each of our three crews.

Provisions and entertainment account for around two-thirds of living expenses for all three boats, the one almost universal percentage among all the crews who shared their budgets. Around $4,000 in living expenses is the absolute minimum we have heard of to keep body, soul, and boat together, with the vast majority of that spent on food. Like the Moderations, most crews get along reasonably well on around $12,000 per year, though they have to make some trade-offs to stay within their budgets.

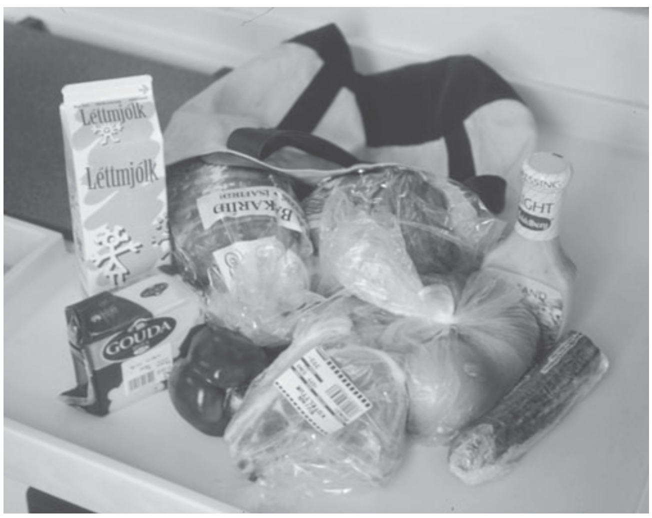
Provisions

Anything purchased to be eaten aboard plus paper goods, cleaning supplies, and toiletries fall into the category of provisions. All three of our crews eat whatever fresh, local produce is available and fill up their boats with other items wherever it is cheapest. But the crew on *Highlife* still spends more than three times what *Simplicity*'s crew does on provisions. If the Highlifes run short of something in Tahiti, one of the most expensive places in the world for food, they go ahead and buy it. *Highlife* also carries convenience and luxury goods such as frozen blueberries, gourmet coffee, and prepackaged mixes along with fresh and frozen meats. *Simplicity*'s crew would buy only market produce and government-subsidized foodstuffs such as flour and dried milk while in French Polynesia. Most of their protein comes from fish they catch themselves.

To keep food costs low, the Simplicitys and Moderations eat what the locals eat and avoid imported luxuries. Local fish, meat, produce, and dairy products are usually inexpensive. The cost of everything else in this category varies widely, and in remote places prices can easily be double or triple normal (Figure 2-1).

Mainland ports in developed countries are less expensive than island ports. In the islands, major ports where you clear customs are the least expensive and offer the

Figure 2-1
Thirty dollars doesn't go far in Iceland.



most variety. The Provisioning Basics section in Chapter 14 details what you can expect to buy where and lists the best places to provision around the world. The SSCA's *Commodores' Bulletins* and scuttlebutt from other cruisers provide current information on inexpensive provisioning ports. Following are other suggestions for minimizing provisioning costs:

- **Buy in quantity.** When you find something you need at a good price, stock up. For foodstuffs, buy in quantity, but don't buy in bulk. If there are only two people aboard, lots of small packages will minimize spoilage. The quality of paper goods, cleaning supplies, dried goods, and canned items varies around the world, so make sure it's what you want before laying in a big supply.
- **Eat inexpensive meals ashore.** In a few places, it can actually be cheaper to eat ashore than to make something on the boat. In Fiji we could buy huge plates of rice smothered in curry for under $2, and on Christmas Island we got heaping plates of lo mein for about $1.50. Even in Tahiti, a cheap dinner can be purchased from the vendors who sell out of their trucks near the waterfront. In general, large Indian, Indonesian, or Chinese communities mean inexpensive meals ashore.
- **Stock alcohol wisely.** Alcohol costs varied the most widely from boat to boat and from place to place. With the exception of rum in the Caribbean, alcohol is very expensive on most islands—two to three times mainland prices for questionable quality. Taxes and duties make up much of the price differential. To keep costs down, you can purchase duty-free alcohol as you check out of many countries.

Entertainment

Any off-boat activity falls in the category of entertainment, including cook's night out, a Fijian feast, an island tour, or a safari in South Africa. Entertainment is the most discretionary expense of the living expenses, so the money allocated to it tends to increase with the size of the budget.

Even the crew aboard *Simplicity* spends some money seeing the places they have worked so hard to reach, though they do it in the least expensive way possible. They eat ashore only when it's cheaper than eating on the boat, and they sightsee from a rental bicycle, a local bus, or their own two feet when they hike and camp inland. With four people and a limited budget, Michael and Molly Moderation view entertainment as discretionary, the thing they'll spend money on only if they're sure they have a bit extra. They don't "waste" money on eating out; rather, they take trains, buses, or rent a car to travel inland. The crew aboard *Highlife* eats dinner ashore once or twice a week. When they reach a new area, they rent a car to explore the surrounding countryside and visit nearby tourist attractions. On several occasions, they have put the boat on the hard and spent several months traveling.

Marina/Mooring

Paying for a slip or a mooring buoy instead of anchoring for free has become increasingly difficult to avoid in many parts of the world. Marinas have sprung up in even the most remote corners of the globe, often in small, protected harbors that once served as anchorages. In areas designated as marine reserves, anchoring has been forbidden to protect the reef and sea grass systems on the ocean's floor. Other areas, such as the Florida coast, have become anchoring unfriendly. Private buoys and, in the high latitudes, fish and mussel farms fill many prime anchorages. Also, in a few places such as large cities in Brazil and Venezuela, the security of the boat depends upon being in a gated, guarded marina.

Simplicity has still managed to anchor out almost all the time, with the exception of South Africa, where good anchorages don't exist. But it takes a certain amount of planning to avoid areas where security might be a problem and to take on fuel, water, and provisions without spending time in marinas. The crew on *Moderation* found it hard to avoid marinas in certain parts of the Med, and they always leave the boat in a secure marina when they go traveling. *Highlife*'s crew leaves the boat on the hard when they travel extensively or fly back to the States, which is less expensive than leaving her in a slip. But the Highlifes also spend time in marinas after making landfall to get the boat back in order and whenever visitors join or leave them to make it easier to get luggage on and off the boat.

Marinas are most expensive in Europe and the United States, where costs can easily exceed $2 per foot per day. On our circumnavigation aboard *Silk*, prices in Europe and the United States were eight to ten times higher than anywhere else in the world. But the gap is narrowing. Aboard *Hawk*, we paid roughly $1 per meter per day for long-term stays during the winter months in Chile, western Australia, and New Zealand.

Communications

Few things have changed as much for the long-distance voyager in the last decade as communications. Since the mid-1990s, the ways to communicate have proliferated as the costs have plummeted. Staying in touch on a weekly basis now costs almost nothing at all, but if your goal is to remain connected from the boat by phone and e-mail at all times, you can still spend a great deal of money.

This revolution in communications has many components, but the following have contributed the most to being able to stay in touch from half a world away:

- **SSB/ham e-mail.** Most crews now do e-mail from on board over SSB (single sideband) or ham radios. After you purchase the equipment, e-mail over the ham nets costs nothing at all, and text-only e-mail over the SSB using SailMail costs a couple hundred dollars per year.
- **Internet cafés.** For attachments, photographs, and longer e-mails, cruisers use Internet cafés ashore. The best cafés offer high-speed links and cheap prices on the order of $3 to $5 per hour. We have used Internet cafés in Ushuaia, Argentina, 70 miles north of Cape Horn, and in Akureyri, Iceland, just south of the Arctic Circle. International phone calls can also be made at properly equipped Internet cafés for a few cents per minute.
- **Calling cards.** Phone cards or calling cards can be purchased in most countries for making international phone calls at ridiculously cheap prices—usually less than 5 cents per minute. We've paid less than 2 cents per minute to call the United States from Australia and Chile.
- **Cell phones.** Cell phones can now be purchased in most countries for $100 or less and operated for around 10 cents per minute. In most of the world, it isn't even necessary to keep buying phones. In Europe, Australia, New Zealand, and other countries that use GSM (Global System for Mobile Communications) phones, all you need to do is purchase a new SIM (subscriber identity module) card for the country you've just entered for between $20 and $40.

Our three crews have each established a different balance between cost and connectivity in their communications. The Simplicitys do e-mail on average once a week through Internet cafés ashore but may go a month or more without contacting their families. They buy phone cards to call home once every six weeks or so unless they get an e-mail asking them to get in touch. They rely more on snail mail than the other two crews, regularly sending postcards and letters to family and friends.

Highlife is equipped with a high-frequency (HF) radio and a Pactor modem, and her crew uses SailMail over the SSB bands to send and receive short e-mails daily. They do e-mail ashore a couple of times a week to make sure they don't miss out on pictures of the grandchildren or long, newsy messages from friends and family. In most places, they buy a SIM card for their cell phone, and they use phone cards or Internet cafés to call their families once a week. For offshore, they carry a satellite phone capable of letting them make calls from anywhere in the world and downloading weather over a very slow link from the Internet. They would use this if they ever needed medical advice or emergency assistance while on passage.

The crew aboard *Moderation* also relies on their HF radio, but Molly has a ham license that they can use to do e-mail free from the boat. They also use Internet cafés ashore on a weekly basis. They spend a great deal more time in Internet cafés on tasks associated with Max and Mindy's schooling, often as much as 3 to 5 hours per week when they find good broadband Internet. The frequent e-mails and their website keep them in close contact with family, but they still call the grandparents once a month using inexpensive phone cards.

Fuel

Anything purchased at a fuel dock—diesel, gasoline, oil, transmission fluid, and water—gets included here. On most boats, diesel fuel accounts for 90 percent of the expenditures in this category. During the course of our two voyages, we have paid an average of $2 per gallon worldwide (50 cents per liter). But fuel costs are rising everywhere and have always been two to three times higher in remote islands unless subsidized.

Simplicity's crew uses the diesel engine only for getting into and out of anchorages where they can't sail. They don't use it for charging batteries but rely on solar panels. If there's no wind on a passage, they sit and wait. Her crew also catches most of the water they drink. They don't carry gasoline, as they have no outboard.

The Moderations run their engine an average of 1½ hours a day for charging and refrigeration. They try to be frugal with engine use otherwise, but they do occasionally motor or motorsail in light or contrary winds. They have two outboards for their two dinghies, but they still use less than a gallon of gasoline per week on average.

Highlife requires diesel for the generator as well as the engine, and one or the other runs an average of 2 to 3 hours per day. The Highlifes motorsail whenever their boat speed drops below 4 knots on passage. They also use diesel for heating, and they ran their diesel heater at night for several weeks after arriving in New Zealand in the spring. In addition, their 15-horsepower outboard engine for the dinghy consumes several gallons of gasoline per week.

Officials/Fees

This category includes harbor dues, clearance fees, visa fees, and transit fees for the Panama and Suez canals. Panama Canal fees have tripled since we transited aboard *Silk* in 1993. The transit fee for boats less than 50 feet in length is now $600, and other fees can bring the total cost to $1,000. As the number of boats increases, so do the fees for local services such as obtaining visas and cruis-

AVOIDING BUDGET BUSTERS

Cruisers tend to spend slightly more than they budgeted, so the more you save, the more you'll spend. But it doesn't have to be this way. Budget-conscious cruisers prove you can get away with spending almost nothing by shore standards. If you don't have the luxury of a high-paying job or assets you can cash in to go cruising, you can still go and have most of the same experiences as those spending ten times as much.

The following suggestions will help you avoid breaking the bank. Rigorously applied, they'll keep you out cruising longer.

- **Stay away from the "bright lights and big city."** The easiest way to avoid blowing the budget is to spend as much of your time as possible in remote areas where there is little to buy. These also happen to be the places where you are most likely to encounter pristine environments, plentiful wildlife, and local people who will be friendly, open, and interested in sharing their lives with you.
- **Manage the spending cycle.** When you're voyaging, spending tends to be cyclical. You'll spend nothing at all for weeks on passage or cruising remote islands. Then you'll reach a place with chandleries and supermarkets and spend an entire month's budget in a few days. To keep from losing track and overspending, we calculate a per-day spending average from our annual budget and accumulate that into a reserve on our ZSDs (zero spending days). If we don't exceed our reserve when we get back to civilization, we stay within our budget. Keeping detailed records of all expenditures will also help you figure out if you're getting off track and identify in which areas you are going over your budget.
- **Create an emergency fund.** In addition to the cruising kitty, most crews allocate a certain amount of money to handle emergencies. We know some voyagers who did not and who were forced to end their voyage due to an engine that seized up or a first mate who needed surgery. But if you consider every possible calamity and try to factor it into your budget, you'll never go cruising. If you don't manage to save enough for a separate emergency fund, put 10 percent of your cruising kitty into a separate account and manage on a little less in your daily budget.
- **Take as many spare parts as you can.** Shipping parts to remote destinations with rapacious customs officials tops the list of budget busters for many crews. Shipping costs often exceed the cost of the part, and customs and import duties can double the price again. To avoid this, bring along as many spare parts as possible. Go through the lists in the Essential Tools and Spares section in Chapter 13, and take along as much as you can stow.
- **Make sure you really need it.** Each time we wish we had a major piece of equipment on board (for example, an additional sail or dive gear), we put it on a wish list. If the item appears three times on the list, then we consider buying it. This simple rule prevents us from making impulse purchases and ending up with items we rarely use and have to stow aboard.
- **Let crewmembers indulge their special whims.** It makes it easier to stick to a strict budget if each crewmember, including kids, has a small amount of money for which they are not accountable to anyone. This money should be totally outside the cruising kitty, for each person to spend as he or she pleases.
- **Rebuild your consumer defenses.** For the first few days after reaching a place with chandleries, restaurants, and supermarkets, you'll spend less if you don't carry a lot of money. Go ahead and get a couple hundred dollars from the ATM, but tuck most of it away in an envelope aboard the boat until you're no longer tempted to buy eight jars of gourmet jam or fancy garden hose attachments.

ing permits, disposing of garbage or oil, visiting marine parks, anchoring in historic harbors, and so on.

Although *Simplicity*'s crew does everything possible to avoid these fees, they still end up spending a couple hundred dollars a year on various costs related to clearing in and out and obtaining visas. The Moderations transited the Panama Canal this year, and the $750 they paid in fees increased their average costs to the highest among our three crews. Except for that, *Highlife*'s crew would have the highest costs in this category because many fees, such as clearance costs and harbor dues, are linked to boat size.

Other

This category includes miscellaneous items such as clothing, laundry, haircuts, batteries, nonprescription medications, books, magazines, charts (paper, not electronic), cruising guides, nonboat hardware and household items, and anything else that doesn't fit into one of the other categories. The exact composition varies a great deal from crew to crew, as do total expenditures.

For tropical cruising, clothing costs substantially less than when living ashore. Living aboard is hard on clothes, but you can get away with not wearing much at all for long periods of time. If you leave with a full set of clothes for a three-year tropical cruise, you won't need to purchase much en route for each crewmember beyond a couple pairs of shorts, an occasional T-shirt, a swimsuit, a pair of good walking shoes, and several hats.

If you buy a complete set of new, original charts and all the available cruising guides for each area you cruise, you will spend thousands of dollars each year. That's not to mention electronic charting, which can cost thousands of dollars more, and which is considered in the Charting Options section in Chapter 8. Few crews can afford to spend that much, so most people make do with some combination of new, photocopied, traded, and borrowed charts, along with one or two guides for each cruising ground.

Most of what the Simplicitys spend each year in this category goes toward obtaining adequate charts and guides for their next cruising area. They also spend some money each year on clothing and batteries, but they cut each other's hair, do laundry in buckets, and trade books and magazines with other cruisers.

Moderation's crew spends about a quarter of the money in this category on charts and guides each year. With two growing children aboard, they spend more on clothes, haircuts, and laundry than average. They trade books with other cruisers and frequent used bookstores, but they are willing to buy new books if they will help teach the children about the area's history, geography, and wildlife.

The Highlifes spend the most on charts and guides, about a third of the total in this category. But they also buy magazines on a weekly basis and don't hesitate to buy the new bestsellers. They each get haircuts about once a month. Although they have a washer and dryer aboard, they use a laundromat or go to a professional dry cleaner to clean blankets and bedding after a passage.

Boat Expenses

Three types of expenses fall into this category: boat insurance, ongoing maintenance, and capital expenditures. Maintenance costs maintain the boat's original value and normal level of upkeep; capital expenditures increase the value of the boat by improving it in some fundamental way. When the boat is sold, the depreciated value of the capital expenditures should be recovered. Thus, the cost of replacing a broken compressor on a refrigerator would fall under maintenance, but installing a refrigeration system on a boat that previously had none would be a capital expenditure.

How much you spend on the boat while you're voyaging depends upon a number of factors including the boat's size and complexity, the material from which it is made, its level of upkeep, whether or not it is insured, whether or not you are constantly upgrading systems, how much of the work you do yourself, how much passagemaking you do, and whether you cruise in a warm climate or a cool one. The smallest, simplest boats still require around $1,000 per year to keep them sailing safely. At the other extreme, brokers selling boats over 50 feet say you will need to budget an amount equal to annual depreciation—on average about 10 percent of the cost of the boat per year over the course of a ten-year voyage—to maintain the boat's resale value. While many cruisers with complicated boats between 50 and 60 feet long scoff at that when the boat is brand-new or newly refit, most of them come around to this point of view in the fifth or sixth year, after a major overhaul.

As shown in Table 2-1, our three crews spend between a quarter and a third of their total budgets on boat-related expenses. Table 2-3 shows how each crew allocates their spending between insurance and maintenance. None of them have had any capital costs on their voyages so far. That's because they all outfitted their boats perfectly before they left. In the real world, it takes most of us two or three years to get the boat right, so some of the refitting and outfitting costs detailed in Part II of this book would spill over into the first few years of cruising as capital costs (see the Capital Costs: Two Case Studies sidebar below).

Boat Insurance

Insuring a boat for full offshore and foreign coverage usually costs between 1.5 and 2 percent of hull value, depending on the specific coverages and the deductible. Even for this price, many insurance companies won't cover liability in U.S. waters or damage from tropical storms. Anyone who insures a boat valued at over $200,000 will find that insurance is a significant part of the total budget—up to 10 or 15 percent—which explains why many

TABLE 2-3. AVERAGE ANNUAL BOAT EXPENSES BY CATEGORY (U.S. DOLLARS)						
	Simplicity	**%**	***Moderation***	**%**	***Highlife***	**%**
Boat insurance	$368	18	$1,473	25	$9,000	41
Boat maintenance	$1,655	82	$4,499	75	$12,889	59
Total Expenses	**$2,023**	**100**	**$5,972**	**100**	**$21,889**	**100**

cruisers choose not to carry boat insurance. But this is one expense that's becoming harder to avoid.

During our circumnavigation aboard *Silk*, the vast majority of voyagers we met did not insure their boats. Today more and more countries are requiring some sort of insurance, from third-party liability insurance to full hull insurance, before granting visas or cruising permits. In Australia and New Zealand, we needed full hull insurance to get one-year visas in order to show we would not end up financially destitute if we lost the boat. Proof of financial assets sufficient to repatriate you to your home country may suffice in some places. Many marinas around the world now require proof of liability insurance before they will give you a slip. In Australia and New Zealand, all the marinas we stayed in required liability insurance for long-term stays. As a result, most cruisers are now insured for at least part of their voyage.

How often and to what extent voyagers are insured depends in large part upon the value of their boat. Those who insure only when forced to do so by regulations have generally spent less than $50,000 on their boats and have done most of the work aboard themselves. Those who carry insurance for their entire voyage have generally spent $200,000 or more. For most such people, the boat represents a major asset, and replacing it would be impossible without insurance. Among cruisers who invest between $50,000 and $200,000 in their boats, the decision to insure varies from boat to boat and reflects personal considerations.

Wanting insurance and getting insurance are not the same thing. The boat insurance business is cyclical. After a spate of tropical storms or some weakness in the financial markets, it can be much harder than usual to get boat insurance for long-distance voyaging. When this is the case, insurance companies tend to be reluctant to insure boats that have shorthanded crews (fewer than three people aboard) or that are less than 40 feet long. Most insurance companies refuse to insure single-handers, wooden or ferro-cement boats, or boats under 30 feet for offshore passages at any time. Formal qualifications like a RYA Yachtmaster certification or a professional license can reduce insurance premiums by up to 10 percent.

Like many long-term voyagers with moderately expensive boats, we've been insured when we could get insurance at an affordable price or when we had to have it for administrative reasons. We've been uninsured about half the time. On passage it makes little difference to us whether we're insured or not, but if we're sailing in challenging coastal waters, our stress level goes down and our enjoyment goes up when we're insured.

Our three crews have each taken a different approach to the insurance question. *Highlife* is fully insured by Lloyd's of London with a low deductible and excellent coverage for items like the dinghy and outboard, the most common things to be stolen from cruising boats. At almost 2 percent of hull value and 14 percent of their total budget, boat insurance is the Highlifes' third largest expense.

The Moderations cannot afford to lose their boat, as it represents far too much of their net worth. But the premiums for full offshore coverage were beyond their means when they set out, especially given how little experience they had. They started off with a good policy for third-party and liability coverage and relied on that during their cruising in the Med. They weren't insured across the Atlantic, but when they got to the Caribbean they were able to get a policy from an American insurer that covered them coastally throughout the Caribbean islands and along the East Coast of the United States. By the time they reached the Panama Canal, they'd done enough sailing that they qualified for one of the experienced liveaboard programs, so they will be fully insured as they cross the Pacific. Going forward, insurance will cost them over $2,000 per year and will be the fourth largest item in their annual budget, representing some 10 percent of the total.

Simplicity's crew cannot afford insurance except where it's required. They had to have liability insurance in Australia in order to stay in marinas, and that cost a couple hundred dollars. Since then they've been uninsured.

CAPITAL COSTS: TWO CASE STUDIES

Capital costs consist of expenditures to upgrade or fundamentally change a boat. How much you spend after you start cruising will depend on how much of a refit you did before you left and whether or not you enjoy upgrading the boat over time.

Many couples spend years fitting out a coastal boat for offshore cruising, but we left on our first circumnavigation within four months of purchasing *Silk*. Although we would not advise others to do the same, the result is that the numbers in Table 2-4 include all expenditures to convert *Silk* from a coastal cruiser to an offshore voyager.

In the first year, about two-thirds of the $24,000 reflects capital investments in major equipment such as a windlass, a hard dinghy, an upgraded electrical system, a wind vane, an autopilot, an EPIRB (emergency position-indicating radio beacon), and a GPS. About one-sixth represents costs associated with fixing early teething problems after our first passage. The final sixth includes a range of smaller items such as our medical kit, galley equipment, bedding, and storage containers.

Had we known more about offshore sailing, we could have done the work ourselves and done it better. Almost half of the initial $24,000 was poorly spent, either on inappropriate items or shoddy work.

After our second year and 17,000 nautical miles, we took advantage of the high-quality, low-cost boat work available at that time in New Zealand to do a major refit. We invested in a brand-new set of full-battened sails and a new cruising chute; the only sails we did not replace were the staysail and the Yankee sail. The sails cost half what they would have in the United States. We installed a feathering prop and a below-deck autopilot. After sailing halfway around the world, we had finished fitting out the boat, and *Silk* was well suited to our idea of offshore voyaging.

In the third year, we added an SSB radio. If we had continued voyaging on *Silk*, our capital costs would have stayed at or below our third-year level. By this time, however, maintenance costs had already started to rise as we began to replace existing equipment (see Table 2-4).

When we fitted out *Hawk*, we did just about everything differently. We had the experience to know exactly what we wanted, and we installed most of the interior and the equipment ourselves. The bulk of our capital costs occurred during the four years we were building the boat and not in our first years of cruising. But one of Evans's greatest pleasures is to continue to improve and upgrade the boat, to try out new equipment, and test new ideas. So in the seven years we've been cruising on *Hawk*, we have continued to spend money on the boat. Instead of major capital expenditures, though, these have taken the form of many small refinements and modifications that have averaged around $5,000 a year.

When we left aboard *Hawk*, she was almost new. Our maintenance costs in the first year were only $2,000, but this increased to $10,000 by the third year of our voyage, and to $20,000 by the fifth year. As of this writing, we have just completed a major refit that cost roughly $50,000, bringing our average maintenance expenditures to just under $20,000 per year. While still less than the 10 percent annual depreciation number, we are starting to get close to that. Although we have spent more than others might have on sails and sail handling, *Hawk* is a very simple boat mechanically, and we have avoided many costs other crews on boats of *Hawk*'s size would have incurred. In seven years averaging 8,000 miles per year, we have replaced our working sails twice. We have also rebuilt our hatches and ports, replaced our batteries and some components of our instrument system, and upgraded several structural elements including the companionway and the mast.

TABLE 2-4. CAPITAL AND MAINTENANCE COSTS ABOARD *SILK* (U.S. DOLLARS)

	1992	1993	1994	Total	Average
Capital costs	$24,000	$17,000	$4,000	$45,000	$15,000
Maintenance costs	$2,250	$2,411	$3,392	$8,053	$2,684

Boat Maintenance

Any investment to maintain the boat's condition or to repair, fix, or replace worn fittings or equipment falls under maintenance. This includes everything from varnish for teak to a replacement sail inventory. The total cost depends a great deal on the size and complexity of the boat, the level to which it is maintained, and the number of miles sailed every year. These costs can be ignored on a boat doing an Atlantic circle or spending a year in the Caribbean, but they will become a significant part of the budget for a long-term voyager. The Simplicitys, Moderations, and Highlifes have been out for two to four years, so their maintenance expenses are still relatively low. If they continue voyaging for another three years, their average maintenance costs would most likely double over those shown in Table 2-3.

Most cruisers haul their boat every year or every other year and do several weeks of intensive work. In addition, most of us do a major three- to six-month refit on the boat every four or five years. By the first of these, the crew will have gained enough experience that they'll have a number of changes they want to make to the boat. Typically, this first refit will include things like redesigning bits of the interior, fixing leaking hatches and ports, and reconfiguring and upgrading the electrical system. It might also involve upgrading major equipment such as a refrigerator, rebuilding an engine, or replacing most of the sail inventory. Most people will install some new equipment like a watermaker or a new sail handling system. Some of these costs might fall under maintenance, but those that enhance the value of the boat can be considered capital costs.

To minimize maintenance costs, simplicity is the key. But even the simplest boat requires some investment each year. The Simplicitys take pride in keeping their boat in excellent sailing condition, and doing so is critical to their passage times since they don't use their engine. This is probably the only category where they spend more than they absolutely have to. They haul the boat every year because they've learned how much a clean bottom improves their light-air sailing performance. They look for the least expensive place to haul and do all the work themselves, but they still find it hard to get away with spending less than $500. They also seem to have one major expense each year. They bought a new spinnaker in South Africa when they blew out the one that came with the boat in the Indian Ocean, and they rebuilt their 30-year-old engine when they got to New York, before heading up the Hudson River and the Erie Canal.

The Moderations do as much of the work on the boat themselves as they possibly can. About the only task for which they call in professionals is to deal with malfunctioning electronics. They haul the boat as needed, averaging about once every eighteen months. They can beach their catamaran to scrub the bottom, and they have done that on occasion to extend the life of their bottom paint.

Highlife's complex systems require constant maintenance, a steady supply of spare parts, and, all too often, expensive marine professionals. The Highlifes haul the boat whenever they leave it to travel, and they organize most of the work around that time, doing about a quarter of it themselves and hiring out the rest. They view money spent on the boat as critical for maintaining its value, so they don't cut corners.

Discretionary and One-Off Expenses

Most cruisers make some basic lifestyle decisions that entail additional expenditures beyond the living and boat expenses enumerated above. We did not incur most of these expenses on *Silk* but have incurred almost all of them on *Hawk*. We have found that they tend to be typical of people who are living aboard indefinitely with some sort of income, as opposed to taking a three- or four-year sabbatical and living off of savings (see The Cost of Two Cruises sidebar below).

Some of these expenditures are truly discretionary—for example, the purchase of souvenirs and gifts. Other expenditures, such as health insurance or travel home, would be considered essential by some and discretionary by others. Still other expenditures cannot be avoided but also cannot be predicted, such as health-care costs for a sudden illness. Finally, some costs fall into this category simply because they need be paid only once a year—for example, the expense of a storage unit or the cost of homeschooling course materials.

Discretionary and one-off expenses therefore vary a great deal from year to year and from boat to boat. Some of these costs you will be able to budget for; others you won't even be able to predict. But being aware of typical discretionary and one-off expenditures will help you determine if you're likely to spend anything beyond the expenses already discussed.

Table 2-5 summarizes the types of costs in this category incurred by our three crews. At one extreme, the crew of *Simplicity* spends $100 or so a year on souvenirs and gifts for friends and family. At the other, the Highlifes' discretionary spending exceeds the Simplicitys' entire annual budget.

Health Insurance and Medical Costs

This category includes both the cost of health insurance for those who choose to carry it and any medical costs not covered by insurance. As voyagers get older, medical costs start to become part of the annual budget. Most cruisers over about 45 years of age spend something on

TABLE 2-5. DETAIL OF DISCRETIONARY EXPENSES BY CATEGORY (U.S. DOLLARS)

Discretionary Expenses	***Simplicity***	**%**	***Moderation***	**%**	***Highlife***	**%**
Health insurance/care	$0	0	$2,180	43	$4,623	36
Travel home	$0	0	$1,237	24	$6,100	48
Souvenirs/gifts	$150	100	$435	9	$1,268	10
Homeschooling fees	$0	0	$1,200	24	$0	0
Storage unit	$0	0	$0	0	$720	6
Total Discretionary Expenses	**$150**	**100**	**$5,052**	**100**	**$12,711**	**100**

medical expenses each year. The over-55s who have shared their finances with us report spending an average of $1,000 annually on doctor's visits, preventive tests, prescription medications, dental work, and so on.

The decision to buy health insurance is as difficult and complex as for boat insurance, and the answer is every bit as individual. Less than a decade ago, all but a handful of cruisers chose to forgo the expense of health insurance. Minor ailments dealt with at local clinics cost next to nothing. For more major health problems, socialized medicine paid a large part of the bill, even for foreign visitors. Today, medical systems stretched to their limits to meet the needs of citizens are not freely available to outsiders. In many places, noncitizens must pay the full cost to receive health care. Even where that's not the case, private health insurance (or a lot of money) often gives access to treatment options and professionals not available through the government health-care system. Those from countries with nationalized health systems may find that reciprocal agreements do not cover the full cost of procedures.

One key to this decision centers on whether or not you will have any interactions with the U.S. health-care system, the costliest in the world. For American citizens who want to be able to receive treatment in the United States or for non-Americans traveling there, the issue of how to cover the costs of a serious medical situation has to be taken into consideration. In our experience, U.S. medical costs run from two to ten times those for similar procedures in the countries where we have become familiar with the medical system: Belgium, Sweden, Ireland, St. Martin (Caribbean), French Polynesia, New Zealand, South Africa, Chile, and Australia. The more expensive and complex the procedure, the greater the cost disparity seems to be, assuming the same treatment is available.

In the last decade, a variety of excellent health insurance plans have been designed to meet the requirements of expatriates, and these are also well tailored to the needs of cruising sailors (see the International Health Insurance section in the resources for this chapter in Appendix 1). To qualify, those who apply must not reside in the United States for more than six months of any coverage year. The plans fall into three categories based on amount and comprehensiveness of coverage, as shown in Table 2-6.

Characterized by high deductibles, relatively low policy limits, and many exclusions, catastrophic coverage offers protection from the worst financial consequences of a life-threatening accident or illness. Limited plans provide higher lifetime maximums and extend coverage to include many non-life-threatening situations. Comprehensive plans offer the most extensive benefits both in terms of dollar amounts and coverage and offer treatment options anywhere in the world, including the United States and Canada. Insurance costs vary with an individual's age and health history, but assuming you can get insured at all, you do get what you pay for. Table 2-6 shows the minimum you can expect to pay as a healthy 45- to 49-year-old. To insure a healthy 60-year-old under one of the comprehensive plans can cost on the order of $4,000 per year.

Travel insurance policies offer another solution for those traveling abroad. These policies are intended to cover a trip of limited duration, and they assume you will return to your home country for treatment of any chronic illness. They are widely available through travel agencies and on the Internet, and the cost can be quite reasonable. Policies can sometimes be extended for up to a year, but those wanting more than six months of coverage will almost always find a better deal through one of the health insurance plans meant for expatriates described in Table 2-6. Travel policies do offer a low-cost solution for non-Americans traveling in the United States who would otherwise rely on their national health insurance and reciprocity with other countries.

When budgeting for health insurance, factor in annual increases on the order of 20 percent. Once they've signed you up, most international insurance companies raise their rates annually even if you haven't moved into a new age bracket. Also, even if you are insured, don't assume you won't have to pay your health-care costs up front. Almost everyone we know who has been treated outside their country of residence had to front the money—often tens of thousands of dollars—before they could leave the hospital. The insurance company reimbursed them weeks or months later.

Each of our three crews has made different decisions about health coverage, and their decisions reflect their different ages, health situations, nationalities, budgets, and risk tolerances. *Simplicity*'s crew is young and in excellent health. As Australians, they would be covered in their home country and in the other countries in the Commonwealth if they had a life-threatening illness. They can't afford health insurance in any event, and until they reached U.S. waters they didn't worry about it. The university will cover them during their postdocs in Montreal. After hearing the horror stories of people denied treatment in the States because they were uninsured, they've

TABLE 2-6. COMPARISON OF TYPICAL PROVISIONS OF INTERNATIONAL HEALTH INSURANCE PLANS

	Catastrophic	Limited	Comprehensive
Base policy limits[1]	\$250,000–\$1 million life	\$500,000 annual or \$5 million life	\$1–\$1.5 million annual
Deductibles available	\$250–\$5,000	\$500–\$10,000	\$250–\$10,000
Residency requirement	6 months of each year outside the U.S.	6 months of each year outside the U.S.	Must not be residing in U.S. at time of application
U.S. coverage	None	In PPO[2]	Unrestricted
Coinsurance after deductible	Ex-U.S.: None to 50% of next \$10,000 U.S./Canada: No coverage	Ex-U.S.: None to 20% of next \$10,000 U.S./Canada: None to 50% of next \$10,000	Ex-U.S.: None U.S./Canada: 20% of next \$5,000
Waiting period	Up to 180 days	None to 180 days	None
Precertification penalty[3]	50%	40%–50%	None
Preexisting conditions	No coverage to \$25,000 life	Covered if not excluded	Covered if not excluded
Evacuation	Not covered	\$50,000 maximum	\$25,000 maximum
Maternity benefit	Limited coverage after 24 months	Varies	Fully covered after 10 months
Organ transplant	Not covered	\$1 million lifetime or URC[4]	\$300,000–\$350,000 per transplant
Children < 10 free	None or one	Two	Two
Costs start at[5]	\$500 per person per year	\$1,000 per person per year	\$1,500 per person per year

[1]Some plans offer policy limits by year; others offer a lifetime maximum.
[2]Preferred Provider Organization—a limited network of health facilities the insured can use under the policy.
[3]Most plans require notification and precertification of expenses before admission to the hospital or treatment. In emergency situations, notification must occur within 48 hours. Failure to precertify causes a reduction in benefits.
[4]Usual, reasonable, and customary charges for the procedure and the geographical region.
[5]For a healthy 45- to 49-year-old with no preexisting conditions and a \$5,000 deductible.

already decided to pay the $700 it will cost to insure them both under a travel policy for three months when they sail back down the U.S. East Coast.

As British citizens, the Moderations have adequate coverage in the UK and reciprocal coverage in EU countries, Australia, and New Zealand. They didn't really think much about insurance before they left. But they have incurred some health-care costs. Michael suffered from kidney stones while they were in St. Martin, and he had an ultrasound to make sure there was no blockage. Mindy got an ear infection from snorkeling and needed antibiotics. These costs were pretty minimal and would not have exceeded the deductible on any policy they might have carried. Before they set off up the East Coast of the United States, they decided they had to have insurance. They joined Trans-Ocean, the German cruising club, and signed up for their insurance coverage (for other organizations that provide health insurance coverage, see the International Health Insurance section in the resources for this chapter in Appendix 1). This increased their average discretionary costs by $2,000 per year.

The Highlifes never even considered setting sail without insurance. In addition to being American citizens, they are older and starting to deal with various health issues. They knew they would be traveling back to the States regularly, for up to three months at a time, and they didn't want to be uninsured for those periods. When they sold out to their business partners, they negotiated free health coverage under the company policy until age 65, when they become eligible for Medicare. This is a comprehensive policy that covers them whenever they are in the States. Hugh has already had a hip replacement under this insurance.

But in Mexico they discovered that, good as their insurer was in the States, it had no idea how to deal with the Mexican health-care system. The company couldn't process claims in Spanish or even determine what treatments had been provided. Getting care outside the provider network reduced the benefits by more than half. After hassling with the insurer for three months, they decided to purchase one of the limited international health plans from a company with a reputation for excellent international claims resolution and customer response. This covers them anywhere in the world, and their experience with the company was hassle free when Hilary broke her wrist after falling from a bicycle in Bora-Bora. The plan costs about $3,500 per year for the two of them with a $2,500 deductible.

In the last year, they have also incurred close to $1,000 in health-care costs not covered by either policy. About a third of that went for prescription medications, and the other two-thirds went for regular health checks including a mammogram for Hilary and a blood workup for Hugh. When they reach 65 years of age, they'll be eligible for Medicare in the States, and the premiums on the international policy will more than double. At that point, they'll probably buy a catastrophic policy to cover them in case of an accident or sudden illness outside the States, and they'll plan to return to the States to have any chronic illness treated.

Other Discretionary and One-Off Expenses

The rest of the expenses in this category are harder to generalize and reflect crew choices. The easiest way to discuss them is to see what our three crews have spent.

Simplicity's crew cannot afford to travel back to Australia, but friends and family have met up with them in South Africa and the Caribbean. Their only discretionary spending is on gifts and souvenirs, unique items they will never have the chance to purchase again. In South Africa, they bought dozens of hand-woven, gaily colored baskets as Christmas presents and sent them back to their family in Australia. In Brazil, they bought hammocks.

The Moderations had not intended to travel back to the UK during their voyage, but at the end of their second year of cruising Molly's father was involved in a car crash in London. Molly flew back to England for six weeks to help her mother cope with the situation. Other than that unexpected expense and the health insurance and medical costs they've incurred, they have stayed within their budget on discretionary items. They allowed money in their budget to send gifts, souvenirs, postcards, and other trinkets to stay in touch with the rest of their family and close friends. In addition, they've paid a total of $1,200 per year for Max and Mindy's schooling. They did not sell their house in London when they left, but rented it furnished to one of Molly's colleagues from work. They were able to store their personal items in the basement, so they have no storage costs.

Highlife's crew has traveled to the States each year to spend Christmas with their children. From Mexico, the cost was quite reasonable, but they've had to pay about $2,500 per person to fly back from the South Pacific. Once in the States, they've rented a car and spent some time in hotels; these costs are included in the Travel Home figure shown in Table 2-5. They love local handicrafts and take it as a personal challenge to learn about each kind of art and then search out the greatest master and buy pieces for a fraction of what they would cost in the States. They sold their house when they left California as it was much too large after their children moved out. They purchased a piece of land in New Mexico where they plan to build a house whenever they are done with cruising. In the meantime, all their furniture and possessions are stored in a storage unit near their daughter so she can check on things if necessary. That costs them over $700 per year.

THE COST OF TWO CRUISES

Evans and I circumnavigated aboard our Shannon 37 ketch, *Silk*, between 1992 and 1995. We have now been cruising aboard our 47-foot Van de Stadt Samoa, *Hawk*, full-time for seven years. On both voyages, we have tracked all our expenses and divided them into the categories used throughout this chapter: living expenses, boat expenses, and discretionary/one-off expenses. In addition, we have a category for business expenses, the costs associated with the writing and speaking we do to earn enough money to keep cruising.

As Table 2-7 shows, our living expenses have averaged $13,520 per year or just over $1,100 per month aboard *Hawk*, slightly more than the average for the three years we circumnavigated aboard *Silk*. The low cost of food in South America explains the lower food expenses aboard *Hawk*. The higher fuel costs aboard *Hawk* reflect the higher fuel usage per hour of her larger engine and the fact that we use diesel for heat in the high latitudes. We have also spent two or three winter months in marinas each year aboard *Hawk*, while we stayed in the tropics and anchored more than 90 percent of the time for our time aboard *Silk*.

Boat expenses averaged about $5,000 per year aboard *Silk*; aboard *Hawk*, we're spending about three times that. This difference reflects the greater cost of maintaining a 47-foot boat versus a 37-foot one, the longer time we've spent living on our second boat, and the fact that we've carried boat insurance more often on *Hawk* than on *Silk*. As discussed in the Capital Costs sidebar above, we also spent about $17,000 per year on capital improvements on *Silk*, and about $5,000 per year on *Hawk*. We recovered most of these costs when we sold *Silk*. Whether or not we recover our investments in *Hawk* remains to be seen.

With respect to discretionary expenses, the costs on *Silk* fall out as roughly one-third each for souvenirs/gifts, health insurance, and travel home. I had a catastrophic insurance policy for the last eighteen months aboard *Silk*, and I flew home twice to see my family. Evans incurred neither of these expenses. The amount shown for *Hawk* is roughly equally divided between health coverage, medical costs, travel home, and souvenirs. We've each flown home every other year on average, and we have both had limited international health insurance coverage for the last two years.

Not including business expenses or capital costs, we've spent over $35,000 per year aboard *Hawk*. This is almost double the $18,000 we averaged aboard *Silk* but reflects the larger, more complicated boat and our long-term liveaboard lifestyle on *Hawk* versus the short-term sabbatical approach of our first circumnavigation. While barely sufficient to cover living and discretionary expenses, having an income during our voyage aboard *Hawk* has also encouraged us to spend more than we would have otherwise, particularly in the entertainment and discretionary categories.

TABLE 2-7. COMPARISON OF AVERAGE ANNUAL EXPENSES ABOARD *HAWK* AND *SILK* (U.S. DOLLARS)

	Hawk[1]	**%**	***Silk***	**%**
	1999–2005		1992–1995	
Provisions	$4,946	37	$5,455	46
Entertainment	$2,037	15	$1,605	14
Marina/mooring	$1,237	9	$485	4
Communications	$1,853	14	$1,705	15
Fuel	$1,091	8	$635	5
Officials/fees	$465	3	$430	4
Other	$1,891	14	$1,425	12
Total Living Expenses	$13,520	100	$11,740	100
Total Living Expenses	**$13,520**	**38**	**$11,740**	**64**
Total Boat Expenses	**$15,607**	**44**	**$5,105**	**28**
Total Discretionary Expenses	**$6,149**	**18**	**$1,402**	**8**
Total Nonbusiness Expenses	**$35,276**	**100**	**$18,247**	**100**
Capital Costs	**~$5,000**		**~$17,000**	

[1]Does not include $50,000 refit completed in 2006.

HOW MUCH BOAT CAN YOU AFFORD?

Those of us with limited resources can very easily end up buying more boat than we need and putting on more gear than we can afford, only to find ourselves with a lot less money than we had planned on for cruising. To avoid this, don't spend what you "have to"; spend what you have left. Determine how much money you have to work with and how much of that you'll need for cruising. What's left is what you can afford to spend buying and outfitting the boat. If you rigorously stick to the boat budget you set, you should avoid having to cut your cruise short when funds run low.

Start by estimating how much money you can accumulate before you set off cruising. Unless you already have a clear timeline in mind, set an arbitrary departure date three to five years hence and see what happens. Add together what you have already saved, what you will get from selling assets, and what you can realistically expect to save between now and then.

Next, use the information in this chapter to come up with an estimate of your total annual cruising budget. Deduct the annual value of any retirement payments or other income that will continue after you go cruising. Multiply the result by the number of years you hope to be out, and add any emergency fund you think you need. That total makes up your cruising kitty, the amount above and beyond the cost of the boat and fitting it out that you'll need to save before you can leave. If you subtract this number from the total you came up with in the last paragraph—the amount you can accumulate before your departure date—then you're left with what you can afford to spend on the boat.

For example, assume you will take early retirement in five years. You and your crewmembers have saved $50,000 and are setting aside an additional $2,000 per month. Using a very conservative assumption that interest and inflation cancel each other out, you will have saved $180,000 by the time you retire. You will net $100,000 from selling your house, cars, and other assets, so your total pool of funds will be a minimum of $280,000. You estimate that you will spend a total of $2,000 a month or $24,000 per year while cruising. Your Social Security and pension will cover that monthly budget, but that income won't start until three years after you retire. You will need just over $70,000 to cover that three-year gap. In addition, you want a $20,000 emergency fund. That leaves you with about $185,000 to spend on the boat.

But that doesn't mean you can afford to go out and buy a boat for $185,000. Commissioning a brand-new production boat can take anywhere from 15 to 40 percent of the purchase price; you can easily put 60 to 100 percent of the purchase price into a 20-year-old used boat to get it ready to go to sea. Exactly how you allocate that $185,000 between purchase price and refit/commissioning costs will depend upon how old a boat you buy. You could spend $60,000 on a 20-year old boat, strip it to a bare hull, and refit it over several years; or you could spend $160,000 on a less than 5-year-old boat, add some equipment, and head offshore in a few months. The Refit Costs: Some Rough Figures sidebar below will give you a general idea of how much it can cost to refit a 20- to 30-year-old, 40-foot boat. Most of these costs would be reduced by one-third to one-half for a 35- to 39-foot boat.

Once you have a rough idea of how much boat you can afford, get a feel for what your money will buy. The easiest way to do that is to get on the Internet and search some of the databases listing used boats for sale (see the Boat Brokerage Websites section in the resources for this chapter in Appendix 1). Search the database using the boat budget you came up with less 15 percent (the minimum you will need for commissioning) and specifying whatever attributes you have in mind at this point—size, material, age, and so on—to get a list of boats currently on the market in your price range. If you're not being realistic about what you can afford, you'll find out quickly enough.

We know people who've managed to buy and fit out a good boat in the 40-foot range for less than $100,000, but they're few and far between. Table 2-8 summarizes average prices for a random sample of 290 name-brand, offshore-production monohulls advertised in European and U.S. sailing magazines in the same month. We have seen sister ships of all the boats included in the sample out cruising. Bear in mind that these are averages, and within each of the age/size ranges shown there are boats that cost half the average and boats that cost twice the average.

This table confirms our experience: most people spend between $100,000 and $200,000 to buy a good, used, 40-foot boat. That increases to $250,000 to $350,000 for a used 50-foot boat. On average, going up one size bracket or one age bracket in the table increases the price by 50 percent. In a given size/age bracket, catamarans cost even more. In a similar sample of 81 cruising cats, purchase prices averaged 25 percent higher than the numbers shown in Table 2-8 (see Table 3-2).

If your aspirations are seriously out of step with your budget, you have four options: scale back your cruising budget, work for another couple of years, buy an older boat, or buy a smaller boat. Avoid the first one at all costs, as that all too easily leads to being overboated and underbudgeted. As Table 2-8 suggests and the budget numbers throughout this chapter illustrate, going to a boat 5 feet smaller than your "ideal" will have a major financial impact. For most people, this is the easiest way to fit a boat to their budget. But if you have the time, the skills, and

TABLE 2-8. AVERAGE PRICES[1] FOR A RANDOM SAMPLE OF 290 NAME-BRAND OFFSHORE MONOHULLS BY AGE AND SIZE (U.S. DOLLARS)						
Age	**25–29 Feet**	**30–34 Feet**	**35–39 Feet**	**40–44 Feet**	**45–50 Feet**	**50–54 Feet**
> 20 years	$25,000	$40,000	$65,000	$115,000	$140,000	$200,000
10–20 years	$40,000	$70,000	$110,000	$190,000	$270,000	$335,000
< 10 years	N/A[2]	$100,000	$135,000	$265,000	$375,000	$380,000

[1]Average price is 90% of asking price.
[2]Too few boats available in size/age range to calculate a meaningful average.

the inclination, buying an older fixer-upper and doing the work yourself will get you a bigger boat for less money.

Each of the three voyaging couples introduced in Chapter 1 wanted a safe, seaworthy boat with a proven record offshore that was within their budget. They help illustrate how people with very different budgets determine what they can spend on a boat, and how they go about financing their dream.

Simon and Susan Simplicity finished their PhDs with a minimum of debt, thanks to Australia's generous funding of university education. But full-time studies had kept them from earning much, either. So when they decided to go cruising, their assets consisted of $4,000 they'd managed to save and $9,000 in two cars, a stereo system, surfboards, and camping gear.

While they were working on their dissertations, they didn't have time to earn money. But once they graduated, they each found one-year postdoc positions that paid reasonably well, and they started saving every penny they could. They were able to save $1,500 per month for a year.

In the meantime, they were looking at boats and budgeting. They believed they could get by on $8,000 per year for all their expenses. If they planned on finding work in two years, they would need $16,000 for their cruising kitty. Based on what they were saving, and assuming they sold all their assets, they would have a total of just over $30,000 by the end of the year. That left less than $15,000 to buy and outfit a boat.

They started looking for something around 30 feet in length that was seaworthy for less than $10,000, but it didn't take long for them to get discouraged. They would either have to work for another two years or start looking at even smaller boats.

Susan's parents intervened. They offered to lend Susan and Simon up to $15,000 to buy the boat, but only if they could come up with whatever else would be required to fit it out and fund their voyage (Table 2-9).

After discussing every item in the budget and talking about where their priorities lay, Michael and Molly Moderation decided they needed about $20,000 per year to cruise comfortably with the kids. Molly also wanted to set aside $20,000 for an emergency fund, so to finance five years of cruising they would need $120,000 in their cruising kitty. They agreed that they would not touch their retirement savings to pay for their voyage, and they planned to use whatever was left in the emergency fund to bridge the gap while they were looking for jobs when they returned.

They had $50,000 in nonretirement savings and owned a nice house Molly had redesigned and they had renovated in a gentrifying area of London. The house had just begun to appreciate in value, so it made no sense to sell it. But by refinancing the mortgage and selling their cars and some other assets right before they left, they could raise an additional $150,000. They started sav-

TABLE 2-9. FINANCING *SIMPLICITY* (U.S. DOLLARS)		
Sources/Uses of Funds	**Amount**	**Comments**
Existing savings	$4,000	
Sale of assets	$9,000	Surfboards, cars, stereo, etc.
Additional savings	$18,000	$1,500/month for 1 year
Total Assets	**$31,000**	
Less cruising kitty	($16,000)	$8,000/year for2 years
Budget for Boat	**$15,000**	
Plus loan from parents	$15,000	To be repaid with interest
Total Budget for Boat	**$30,000**	

TABLE 2-10. FINANCING *MODERATION* (U.S. DOLLARS)

Sources/Uses of Funds	Amount	Comments
Existing savings	$50,000	
Sale of assets	$25,000	Cars, etc.
Refinancing mortgage	$125,000	In 5 years, just before leaving
Additional savings	$120,000	$2,000/month for 5 years
Total Assets	**$320,000**	
Less cruising kitty	($100,000)	$20,000/year for 5 years
Less emergency fund	($20,000)	Job hunting fund as well
Budget for Boat	**$200,000**	

TABLE 2-11. FINANCING *HIGHLIFE* (U.S. DOLLARS)

Sources/Uses of Funds	Amount	Comments
Sale of house	$200,000	Invested rest of money in land
Sale of assets	$100,000	J/120, cars, household items
From savings	$200,000	Part of proceeds from sale of company
Budget for Boat	**$500,000**	

ing and found they were putting aside $2,000 per month. Given their five-year time frame, they would be able to save an additional $120,000 before they left, for a total of $320,000. That meant they could afford to spend about $200,000 on buying and fitting out the boat (Table 2-10).

Hugh and Hilary Highlife had adequate retirement income from their pension and Social Security to comfortably cover the $5,000 they budgeted to spend monthly while cruising. But they still needed to decide how much of their assets they were willing to put into a boat.

They started by rearranging their assets. They had wanted to sell their house for some time because it was too large now that the children had left. They put their house on the market and put half of what they got for its sale into a large piece of land in a growing area in New Mexico. They plan to build a house there with the money from selling the boat when they have finished cruising. The rest of the money from the sale of the house they put toward the boat. They knew they would be able to get an additional $100,000 from selling their J/120, their cars, and some other household items. They were comfortable spending up to $200,000 of what they got when they sold their company, which gave them a budget of $500,000 (Table 2-11).

As different as these financing solutions are, they share one feature: all three crews are debt free while cruising. Though two of the crews used some form of debt in their financing mix, they're not making payments on that debt out of their cruising budget. Most cruisers choose to leave debt free and find it keeps life simpler and lessens the possibility of having to end the voyage unexpectedly.

REFIT COSTS: SOME ROUGH FIGURES

The following list will give you a rough idea of what it can cost to upgrade the basic structure and systems on a 20- to 30-year-old, 40-foot boat to a level appropriate for offshore sailing and living aboard. The labor-hour estimates are for professional labor experienced at the specific task with no complications in the project.

- Replace spars and standing rigging: $15,000 plus 40 labor-hours
- Rebuild bow platform, add electric windlass: $3,000 plus 40 labor-hours
- Replace hatches/ports: $500–$1,000 plus 8 labor-hours per opening
- Replace engine, transmission, prop shaft, propeller: $15,000 plus 80–100 labor-hours
- Rewire entire boat, replace all lights, replace electrical boxes and all fuses: $2,500 plus 80–100 labor-hours
- Replace all hoses, plumbing fittings, seacocks, and through-hulls: $2,500 plus 80–100 labor-hours
- Replace toilet and sanitation hoses, install holding tank: $1,000 plus 20 labor-hours
- Install propane stove, propane tanks, and propane locker: $2,000 plus 20 labor-hours

- Replace all cushions throughout boat: $500 plus 40 labor-hours

Depending on exactly what needs to be done, reinforcing the structure and upgrading the basic systems on such a boat can easily cost $50,000 and take six months or more if the owners do everything themselves and work on the project full-time. If a boatyard does the work, the total cost will increase to $75,000 or more.

After that, a variety of equipment will need to be purchased, from sails to refrigeration. The total cost will depend upon how much equipment the crew chooses to bring along. But the following list gives an order-of-magnitude idea of costs for typical purchases for a 40-foot boat:

- Replace working sails: $8,000–$15,000
- Buy new self-tailing primary winches: $3,500–$5,000
- Upgrade ground tackle: $800–$1,200
- Buy new inflatable dinghy and outboard: $3,000–$5,000
- Buy new offshore life raft: $2,000–$6,000
- Install SSB: $2,500 plus 10 labor-hours
- Install radar: $1,500 plus 10 labor-hours
- Install watermaker: $4,000–$10,000 plus 20 labor-hours
- Install refrigeration: $3,000–$5,000 plus 20 labor-hours
- Install generator: $5,000–$10,000 plus 40 labor-hours
- Install new batteries, cables, boxes: $2,000 plus 20 labor-hours

To fully equip a 40-foot, 20- to 30-year-old boat, then, could easily cost another $40,000 to $60,000, in the same range as the cost of upgrading the basic structure and systems. If only the essential equipment is purchased—sails, ground tackle, batteries—then the total cost of refitting and equipping the boat will be on the order of $60,000 to $75,000 if the owners do all the work themselves and more than $100,000 if they hire a yard to do the work. The few people we know who ended up with a basic 40- to 45-foot offshore boat for less than $100,000 found a bargain hull for $15,000 to $30,000 and did all the work themselves.

CHAPTER 3
A Bluewater-Capable Yacht

MARINE BOOKS AND magazines devote thousands of pages and millions of words to describing the "perfect" offshore yacht. Yet very few of us can afford the new boats reviewed in the pages of the marine magazines. Those of us with finite resources and a desire to do more than dream have all had to compromise to find a capable, seaworthy boat that fits our budget. As much as most cruisers love their boats, we've never met a crew who claimed their boat was perfect.

When it comes to boats, the opinions of experienced bluewater voyagers are often difficult to reconcile and are sometimes even completely contradictory. Should you buy a 30-foot, heavy-displacement, full-keel design like Lin and Larry Pardey's *Taleisin;* a 78-foot, light-displacement, fin-keel design like Linda and Steve Dashew's *Beowulf;* or one of the thousands of designs in between? Or should you consider one of the many production cruising multihulls now on the market? Where do you start when figuring out what boat will be right for you?

At the end of Chapter 2 you took the first and most important step by determining how much boat you can afford to spend. Most people's boat budget will narrow the universe of available boats down to a mere galaxy.

You will be able to limit the options even further when you decide what type and size of boat best suits your needs and what age of boat best fits your budget. From there, it's a matter of legwork and perseverance. You'll need to evaluate individual boats against the requirements for a competent offshore voyager until you find the right boat for you—one you can afford that not only meets your requirements for comfort and safety but also touches your heart and captures your imagination.

NARROWING THE FIELD

Go to a place like Papeete in Tahiti or Las Palmas in the Canaries at the height of the cruising season, and you will find every conceivable combination of design, hull material, keel configuration, rig, age, and size. Older, smaller, less expensive boats allow people without much money to live their dreams and keep company with those who can afford the newest, biggest, and most modern bluewater voyagers.

How do you go about finding a boat that will suit your style of offshore voyaging from among so many options? Four questions will help you focus your search:

1. What type of boat do you want?
2. Where do you intend to cruise?
3. What size boat will suit you?
4. What age boat will suit your budget?

By the time you get through reading this section, an image of the boat that suits your needs should be emerging in your mind.

What Type of Boat Do You Want?

Even a cursory look at the variety of "expert" opinions out there makes it clear that reasonable people can come to very different conclusions when picking a boat for cruising. One key to finding a boat *you* will be happy with, one you will trust and enjoy living aboard, is understanding how your needs match up against the strengths and weaknesses of the various types of cruising boats.

Offshore monohull design has produced four major cruising boat types as shown in Table 3-1 (for conver-

TABLE 3-1. DIFFERENT MONOHULL DESIGN TYPES

	Traditional Voyagers	Performance Cruisers	Racer/Cruisers	Cruising Sleds
	 full keel	 modified fin keel	 fin keel, spade rudder, round sections	 fin keel, spade rudder, flat sections
Examples	Bermuda 40, Bowman 36, Westsail 32, Mason 43, Nicholson 40, Trintella 45	Valiant 40, Swan 46, Oyster 43, Island Packet 38, Baltic 38, Norseman 447	X-402, Swan 45, J/160, Beneteau 50	Hunter HC50, Santa Cruz 52
Ratios:				
Displacement to length ratio (DLR)[1]	> 300	200–300	100–200	< 100
Sail area to wetted surface area ratio (SA/WSA)[1]	2.3–2.5	2.3–2.6	2.6–2.9	> 3.0
Sail area to displacement ratio (SA/D)[1]	15–17	17–19	23–26	> 25
Length to beam ratio (L/B)[1]	2.8–3	3–3.2	3.3–4.0	> 4
Ballast ratio[2]	33%–35%	36%–39%	38%–42%	> 43%
Motion comfort ratio	35–45	25–35	20–25	< 25
Rated speed to theoretical hull speed[1]	67%–72%	70%–74%	73%–78%	75%–80%
Profile of an "average" boat:				
Length overall (LOA) (ft.)	40	40	44	54
IMS displacement (lb.)	24,300	21,650	20,425	26,300
Length at waterline (LWL) (ft.)	31	33.5	38.4	48
Beam (ft.)	11.6	12.5	13	13.7
Draft (ft.)	5.5	6.4	7.7	9.8
Wetted surface area (sq. ft.)	350	350	380	533
Working sail area (sq. ft.)	850	858	1,100	1,800
Estimate of average miles per day on passage	120–125	130–135	140–145	175–180

[1]Calculated using data from USSA's *Performance Characteristics Profile of the North American IMS Fleet* (2004 edition) for comparability; see Appendix 3 for more information.
[2]Manufacturer's ballast/displacement in IMS (International Measurement System) trim (see Appendix 3).
(Fritz Seegers illustrations)

sions to metric measurements see Appendix 2; for formulas and an explanation of what the ratios measure see Appendix 3). Each new type has incorporated proven innovations in design and materials from offshore racing yachts into offshore cruising boats. These types are not discrete—they lie along a continuum, and many boats straddle the borders between them. But they differ markedly along all the major design parameters and make very different trade-offs between comfort and speed.

Over the last half century, production yachts designed for offshore sailing and bluewater cruising have become lighter, more powerful, and more manageable. Boats at the cutting edge have always pushed the limits of durability and comfort, and sometimes of safety. Each stage of yacht design includes seaworthy, livable vessels that can make excellent long-term, bluewater voyagers as well as boats that lack the stability or durability to live up to the sea's exacting standards.

Figure 3-1.
Lin and Larry Pardey's *Taleisin* has circled the globe and doubled the Horn.

Traditional Voyagers

Early offshore cruising boats were made from wood and incorporated the knowledge gained over generations to create strong, safe, seaworthy boats. The lines were taken from small vessels meant to brave the meanest of seas, such as coastal trading and fishing boats, whaleboats, and Scandinavian double-enders originally designed as pilot boats and rescue craft. Spars were constructed from wood; sails were made from canvas; line was made from hemp. These materials limited design innovation. The traditional voyager that resulted had been taken to the highest level of design possible given the strengths and weaknesses of the materials available.

When fiberglass began to replace wood as the material of choice for boatbuilding in the late 1950s and early 1960s, many boatbuilders took proven wooden designs and built them in the new material. Thus, most of the earliest traditional voyagers have long full keels, often with transom-hung rudders; most are relatively shallow for their length, and many are double-enders. Examples include the Bristol Channel Cutters, the Colin Archer designs, and the Westsail 32. These are the types of boats that sailing authors Lin and Larry Pardey advocate for offshore cruising (Figure 3-1). A few production boatbuilders—such as Cape George and Sam L. Morse, builder of the Bristol Channel Cutter—produce such boats.

Other builders—such as Pacific Seacraft, Cabo Rico, and Malö—build modified fin-keel boats with skeg-hung rudders whose ratios put them in the traditional voyager category. Sailing author Nigel Calder prefers these boats, which combine some elements of modern design with the strength and comfort of traditional voyagers.

As Table 3-1 shows, traditional voyagers can be characterized as slow but safe and comfortable. By modern standards, they displace a lot and don't carry much sail area for their displacement. They will rarely reach hull speed and will exceed it only if caught running downwind under full sail by a 40-knot squall. The large keel area and heavy displacement damp motion in a seaway, allowing the crew to move around safely and sleep comfortably.

Traditional voyagers take care of their crews and are comfortable even in a blow. They are easy to heave-to and to control when running off in anything but extreme breaking seas, and they can manage just about any conditions as long as they have sea room. But their shallow keels and low ballast ratios make for disappointing performance to windward. They are sluggish under power, difficult to maneuver in a marina, and all but impossible to back up in a straight line. They'll get even inexperienced crews safely to port, but they may take a few days longer to do it than more modern designs.

Performance Cruisers

In 1973, Bob Perry drew the lines for the Valiant 40, which married a skeg-hung rudder and a modified fin keel to the balsa-cored fiberglass decks and larger rig becoming prevalent in the offshore racing fleets. With a DLR around 250 and a SA/D ratio around 17, the Valiant 40 had more in common with the racy and highly successful Cal 40 than the offshore cruising boats of the time. The term "performance cruiser" was coined to describe this groundbreaking example of an entirely new genre of bluewater cruising boats (Figure 3-2).

Figure 3-2.
Scott and Kitty Kuhner's Valiant 40, *Tamure*, has sailed more than 100,000 nautical miles, completing a circumnavigation and competing in numerous demanding offshore races. (Billy Black photo)

Over the last three decades, dozens of production boats have been built incorporating many of the elements of the Valiant design philosophy. A number of these are still being manufactured today and are considered by many to represent the perfect marriage between performance and comfort. These include the current range of Hallberg-Rassys, all but the newest Swan and Oyster designs, Calibers, Passports, Shannons, Tayanas, Taswells, and, of course, the Valiants, to name just a few. Some older designs with modern underbodies originally intended for coastal cruising or offshore racing—such as the Ericson, Cal, Tartan, and IOR One Ton designs—have also joined the ranks of offshore voyagers.

When we began our first circumnavigation in 1992, most new charter and coastal boats carried fin keels and spade rudders, but these had been incorporated into only a few offshore production cruising boats. By the time we left on our second voyage in 1999, more than a quarter of the production boats being built for offshore cruising had fin keels and spade rudders. Today it's hard to find a newly introduced bluewater design with a full skeg or relatively long keel. In practice, this means that new boats maneuver much more easily under power, but it also means the occasional rudder failure as new materials such as carbon fiber are adapted to this high-load application.

The vast majority of cruising boats sailing the world's oceans fall within the performance cruiser category. They run the gamut from the Island Packets with their cutaway full keels to middle-aged Swans with their fin keels and spade rudders. Over the course of three decades, new materials such as foam cores, S glass, and more recently Kevlar and carbon fiber have been incorporated into the newest generation of hulls. Lessons have had to be learned about the shortcomings and limitations of the new materials, and some production designs suffered from osmotic blistering, core failures, and delamination. Over time, boatbuilders have learned how to address these issues to create lighter, stronger boats.

A number of well-known sailing writers have made voyages in boats whose ratios put them into the performance cruiser category, including Liza Copeland, John Neal and Amanda Swan-Neal, Webb Chiles, and John Gore-Grimes. Both of our boats have been performance cruisers, though at opposite ends of the spectrum. Our Shannon 37, *Silk*, fell near the border with traditional voyagers, while our Van de Stadt 47, *Hawk*, lies near the border with racer/cruisers. Their quite distinct sailing characteristics help clarify the differences between the various categories (see the Two Boats, Two Voyages sidebar at the end of this chapter).

As Table 3-1 shows, although the performance cruisers are still heavy enough to carry cruising loads without sacrificing performance, they are large enough, light enough, and have enough sail area to average an extra 10 to 15 miles per day on long passages. Their moderate keel areas and displacements keep motion comfortable even in large seas, while more efficient ballasting provides greater stability (and therefore sail-carrying ability) than many traditional designs. Depending on keel configuration, these boats range from easy to all but impossible to heave-to, but their greater stability means they need to heave-to infrequently if at all in trade wind conditions. Most run off very well, although those capable of surfing may require some active management (such as trailing a drogue) to remain in control. Performance cruisers sail much better to windward than traditional voyagers and are reasonably agile under power.

The performance cruisers also have more interior volume than traditional voyagers and are almost as comfortable and as hard to get into trouble with. In the most extreme conditions, however, they are slightly less forgiving and demand slightly more from their crews.

Racer/Cruisers

New, lighter, stronger materials—including carbon fiber for hulls and spars, Kevlar for hulls and line, and Spectra for line and sails—have been developed for use on sailboats. In some cases they failed initially, but eventually they proved their usefulness aboard round-the-world racing boats. These materials, along with aspects of high-performance boat design, have slowly been adapted to offshore cruising boats.

When the materials became light and strong enough to build a durable, offshore-capable boat with a DLR of less than 200, the bluewater racer/cruiser was born. Many of these, such as the J/40 and J/120, were intended for racing first and foremost; others, like many of the Beneteaus and Jeanneaus, were designed for the burgeoning charter market. As these designs have grown dated, boats like the Beneteau First 40.7 and the larger Js have found their way into the offshore cruising fleet. Others, such as the J/160 and Farr Pilot House designs, were introduced as high-performance offshore cruising boats capable of sailing 200-mile days (Figure 3-3).

Figure 3-3.
Jim and Sue Corenman completed a circumnavigation on their Carl Schumacher–designed, custom Concordia 50, *Heart of Gold*. (Jim Corenman photo)

Like the boats at the performance end of the performance cruiser spectrum, racer/cruisers all have fin keels and spade rudders. But their keels and rudders tend to be deeper, and their hulls have flatter sections, have finer entries, and carry their beam farther aft. Keel and rudder foils have improved in both hydrodynamic efficiency and balance. Ballast is often concentrated in a bulb endplate attached to the bottom of the keel, which increases the righting moment created by a given weight of ballast. Their lighter displacements allow them to carry less sail area than a similarly sized traditional or performance cruiser design, easing sail handling for a shorthanded crew. In IMS trim, these boats sail faster on every point of sail, point higher, and surf far more easily than performance cruisers.

However, the current racer/cruisers have some drawbacks as long-distance offshore voyagers when compared with their heavier counterparts. Their flatter, fatter hull shapes surf well and create spacious accommodations, but their shallow bilges offer little in the way of stowage and don't keep bilge water confined to the sump. To maintain their performance edge, these boats need to be kept reasonably light, which means they can't carry the same payload as heavier boats (see the Why Weight-Carrying Ability Matters sidebar in Chapter 10). While modern sail handling techniques have made large sail plans manageable for a shorthanded crew, cruiser/racers can be unforgiving if caught with too much sail up in a 40-knot squall. As a result, they take some skill and forethought to manage. The speeds these boats are capable of reaching can lead to pounding in big seas. Many crews we've met on racer/cruisers slow the boats down in stronger winds to improve the motion, which reduces their performance advantage.

Running downwind in heavy weather and large waves, these boats will surf at exhilarating speeds even under bare poles. Although most remain under control if hand steered, some will not look after themselves under self-steering unless slowed down. The forces generated when a boat falls off a wave at 15 or 18 knots instead of 6 or 7 put huge shock loads on sails, rig, rudder, and hull; as a result these boats need to be significantly stronger than heavier boats, in large part because they can sail faster. At the same time, some extra material here and there to add strength makes little difference in a heavy boat, but a light boat has to be engineered and built exceptionally well to stand up to more than a few years of offshore cruising.

The difficulties of building strong, lightweight production boats have led to a number of problems, including broken rigs and rudders, bulkheads separating from hulls, keels cracking, keel bolts breaking, and hulls flexing and sagging. Boats marketed as offshore cruisers from their inception are more likely to stand up to the rigors of long-distance bluewater cruising than those originally designed and built for racing and chartering.

As Table 3-1 shows, racer/cruisers deliver, on average, 10 to 15 miles more each day than performance cruisers and 20-plus miles more than traditional voyagers. To realize that potential, however, a boat must be kept light, which normally means not taking along many gadgets and goodies. It also means not carrying as much in the way of stores, fuel, or water, which translates into less self-sufficiency and a more limited cruising range. And although passages may be faster, they're likely to be more uncomfortable in boisterous conditions. The boat will need to be actively managed instead of left to her own devices running before strong winds and big seas.

On the other hand, even when slowed down, these boats can easily and comfortably average 6 knots over the course of a long offshore passage, more than respectable for any cruising boat. Racer/cruisers sail extremely well on any point of sail, so they will be able to sail themselves out of just about any situation. They are agile and efficient under power and easy to maneuver in a marina. These boats need an experienced crew to keep them out of trouble, but they'll often be the first boats into port, and their crews will be relaxing on deck drinking margaritas when the rest of the fleet makes its way in.

Cruising Sleds

In the last decade, materials and building techniques have improved to the point that the fastest monohulls in the world now have DLRs of less than 100 and SA/D ratios well over 30. Sometimes called ultralight-displacement boats (ULDBs), these include maxi racers such as *Skandia*, the 2004 winner of the Sydney-to-Hobart race, and the Open 60s used in the Vendée Globe nonstop, round-the-world race. It was only a matter of time before someone translated this thinking to production cruising boats, and today there are a few examples of what have been dubbed "cruising sleds," most notably the Santa Cruz 52 (Figure 3-4).

All the attributes of racer/cruisers apply even more so to cruising sleds. The boats can be very fast, and they do manage 200-mile days, but they must be kept very light. Hal Roth completed two BOC races in his Santa Cruz 50, *American Flag*, which proves that at least some of these boats can withstand Southern Ocean–style punishment. However, production cruising sleds are too new to have a proven cruising track record, so their long-term durability remains to be demonstrated.

Figure 3-4.
Janet and Ken Slagle have cruised aboard their Santa Cruz 52, *Aquila*, for seven years and 30,000 miles.

Many design innovations are occurring in this category as naval architects try to adapt aspects of the maxi, Vendée Globe, and Volvo race boats to cruising boats. Designers have been experimenting with ways to reduce keel depth, and the current approach uses hydraulically lifting keels. These are complex and take up a lot of space in the interior, but several newer cruising boat designs have incorporated them. Other innovations from racing boats, such as water ballast to make a boat sail flatter and faster and twin rudders to prevent rudder stalling and cavitation, have made their way into some of these cruising designs.

Whether racer/cruisers and cruising sleds ever come to dominate offshore cruising as performance cruisers have done in the last two decades will depend upon how durable and comfortable they prove to be. No matter what the majority decides, there will always be people willing to sacrifice comfort and cruising luxuries for sailing performance, just as there will always be people willing to sacrifice sailing performance for comfort and manageability.

Cruising Multihulls

Monohulls still make up the vast majority of the offshore cruising fleet, but multihulls, particularly catamarans, represent a small but growing percentage. In 2003, 9 percent of the boats participating in the Atlantic Rally for Cruisers (ARC) were multihulls, and that percentage is likely to continue to increase.

Most of the performance ratios used to evaluate monohulls cannot be applied to multihulls, nor do multihulls sort themselves into convenient groupings that can then be compared. But multihulls sail and cruise differently from monohulls. To decide if a multihull makes sense for you, you'll need to weigh the advantages against the disadvantages, just as when trying to choose among different types of monohulls.

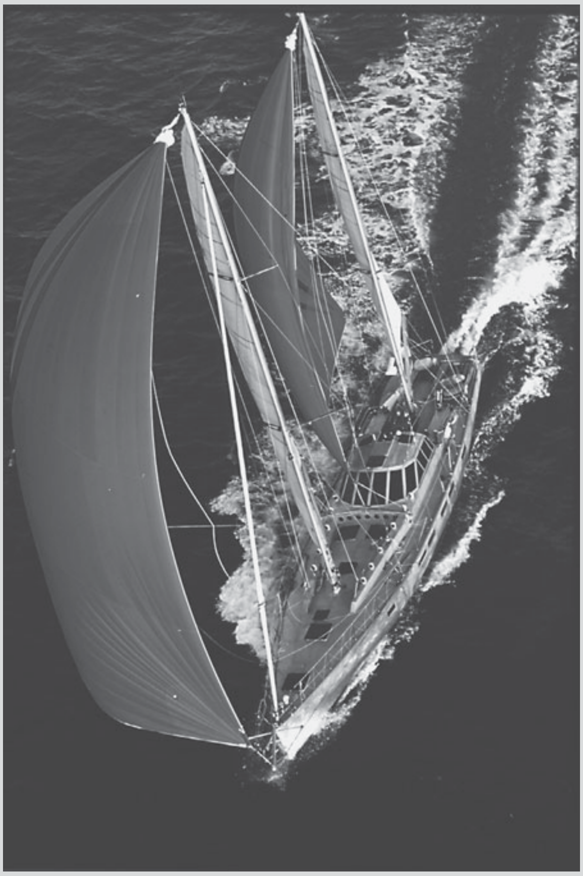
We have met dozens of crews cruising in catamarans, many of whom had cruised for a long period of time and experienced a wide variety of conditions. We have never met anyone living aboard and cruising a trimaran. Even 50-foot trimarans are too limited in space and weight-carrying ability to function as comfortable, long-term homes. The following comments, therefore, focus on modern cruising catamarans and come from interviews with a half-dozen experienced crews.

When most sailors think of catamarans they think of speed, but speed is not one of the first advantages cited by most experienced catamaran cruisers. Other things—such as space, shoal draft, and sailing flat—usually get mentioned first. When the discussion turns to speed and sailing performance, many of the comments mirror what we hear from those aboard racer/cruisers or cruising sleds.

STEVE DASHEW'S HYBRID DESIGNS

For three decades, Steve Dashew has been creating bluewater voyagers that mix traits from the various categories in Table 3-1. His goal is to create an easily handled, easily driven, comfortable, potentially fast boat that can still carry all the equipment cruisers want to carry and go all the places cruisers want to go. His designs include the Deerfoot and Sundeer lines and his own cruising boats, *Intermezzo II* and *Beowulf* (Figure 3-5).

Figure 3-5.
Beowulf blasts along under full sail. (Dashew Offshore photo)



These boats resemble cruising sleds in having DLRs under 100 and L/B ratios over 4. But they also have motion comfort ratios in the 30s, ballast ratios around 35 percent, SA/D ratios around 15, and drafts around 6 feet, numbers that fall somewhere between performance cruisers and traditional voyagers. Dashew's design philosophy produces large boats—from around 60 to over 80 feet—that rely on waterline length to absorb a large enough displacement to give them a good motion and carry a payload. He distributes sail area among many smaller sails to keep the boat manageable for a couple. Like racer/cruisers and cruising sleds, these boats need to be built exceptionally strong for their weight if they are to prove durable.

Dashew's boats can now be found in remote and not-so-remote anchorages the world over. Sailing writers Colleen Ryan and Bryan Savage cruised for several years aboard their Sundeer 64, *Theta Volantis*. Dashew's designs prove that comfortable, fast, light-displacement boats are possible, but only by trading off these factors against size and complexity. Both matter. A 60- or 70-foot boat with complicated systems has a dramatically higher initial purchase price and significantly higher running costs than a 45-footer.

If kept light, multihulls surf much more easily than any monohull. But in practice, very few of those we know aboard cruising catamarans under 45 feet in length manage to keep them light. Weight in the bows can be a particular problem, as the bows will bury going downwind, limiting the cat's ability to surf. On average, over long passages, an overweight cruising cat won't outperform a monohull with a similar waterline length, and we've met many cruisers who have been disappointed with their cat's performance in the real world.

On the other hand, like Dashew's hybrids (see sidebar above), bigger cats with enough waterline to absorb some payload do manage to sail significantly faster than monohulls with similar waterline lengths. Steve and Dorothy Darden on *Adagio*, a 52-foot Morrelli & Melvin–designed catamaran, have averaged between 190 and 200 miles per day on a half-dozen passages, including the slantwise run from New Zealand to Alaska across all the weather zones of the Pacific (Figure 3-6). The fastest cruising cat we've encountered was a 55-footer designed in Australia. The first 12 feet of each bow consisted of sealed, watertight buoyancy compartments. This reduced interior space but kept the boat light and the bows from burying in waves. The family of four still had more room aboard than most cruisers have on a 60-foot monohull, and they averaged 190 to 200 miles per day without any effort at all.

Figure 3-6.
Steve and Dorothy Darden's 52-foot Morrelli & Melvin–designed catamaran, *Adagio*, averaged 190 to 200 miles per day while crossing the Pacific the "wrong way."

But large cruising cats, like racer/cruisers and cruising sleds, are often not sailed to their full potential. Under certain conditions, most catamarans will suffer *wing slams*, waves that come up under the bottom of the boat and crash into the bridgedeck or into one of the hulls. The two conditions that cause this, either alone or in combination, are sailing at high speeds, when the bow waves interfere with one another, and sailing in confused seas. If this "thunder down under" gets too violent, the crew will often slow the cat down. Extra bridgedeck clearance helps reduce slamming, but at the expense of increased windage. Multihulls have the advantage over similar-sized monohulls only when sailing off the wind in light to moderate air, when their speed helps bring the apparent wind forward, and their limited underbody profile minimizes drag.

So although speed may play a part in the choice of a catamaran, in all but the biggest cats it often turns out to be less important in practice than in theory. Most multihull cruisers we've interviewed rate space as the number one advantage of catamarans over monohulls. When cruising with children or guests, the separate hulls offer a degree of privacy virtually unobtainable in a monohull less than 60 feet long. Mechanical and electrical equipment can be completely isolated from living areas, eliminating noise, vibration, and unpleasant odors. Most catamarans 40 feet and over have plenty of room for a dedicated workshop or a dedicated office, and often for both.

Shoal draft probably ranks second among the considerations for picking a catamaran. Even relatively heavy cats in the 50- to 60-foot range will have a draft of only 4½ or 5 feet, a foot or more less than fixed-keel monohulls of similar size. If the hull is designed properly, a cat can be safely beached in order to paint the bottom or repair damage.

Several other advantages become clear only after you've spent some time aboard. The first time we entered *Adagio*'s main saloon, Steve Darden greeted us with, "Catamaran advantage number one—visibility." We were treated to a 360-degree view of the cliffs of 4,000-foot-high Mount Wellington towering over the city of Hobart in Tasmania. In addition to its aesthetic advantages, 360-degree visibility from a dry watchkeeping station increases safety on passage.

Many experienced sailors value the redundancy a catamaran provides. Dual rudders, dual autopilots, dual engines, and dual tankage offer an added margin of safety when things go wrong. The twin engines make a catamaran significantly more maneuverable than a monohull without a bow thruster. They also provide redundancy in power generation. Having two engines makes catamarans excellent "powerboats," especially if the engine rooms are isolated from the living quarters. Of course, all that redundancy also translates into higher costs and more maintenance—nothing comes for free!

Sailing flat comes as a revelation to anyone who has always sailed on a slant. You can leave the dock without stowing the tomatoes sitting on the counter or the computer sitting on the nav station. You can head off on passage without putting up lee cloths, and you can move around the boat without always having to have a hand firmly on a handhold. When other boats are rolling gunwale to gunwale in an anchorage, a catamaran will do little more than sway a bit from side to side.

Catamarans do have their disadvantages, but like the advantages, these are not as obvious as they might appear. The motion, which most people see as an advantage, can be a problem for some. When the U.S. Navy was testing hull forms for use on troop ships, the multihulls proved more fatiguing than comparable monohulls. Anybody who has sailed a monohull knows that the body learns to anticipate what will happen next and compensate for it. But the two hulls on a multihull often move to two different waves, with no discernible pattern. When conditions really deteriorate, some crewmembers may feel "like a golf ball teed off in a bathroom" as one experienced offshore multihull sailor put it.

If you're like most sailors, you know how you react to the motion from strong winds and big waves on a monohull but have never experienced such conditions on a multihull. If you're considering purchasing a multihull and have never sailed one, charter a catamaran with your crew for a few weeks and make sure to take it out in some moderate waves to see how everybody responds.

Many people are put off by the fact that, with a catamaran, what goes down doesn't necessarily come back up. Monohulls depend upon weight in the keel for stability; catamarans depend on their beam and overall size to stay upright. If a well-designed monohull capsizes, its keel will help bring it back upright. But when a catamaran capsizes, it won't right itself. On the other hand, monohulls sink, which properly designed catamarans shouldn't do. In the end, a well-built multihull over 40 feet in length is about as likely to capsize as a well-built monohull is likely to sink. Both events are rare. In our decade of offshore voyaging, we know firsthand of one case of a monohull sinking and none of multihulls capsizing.

One serious disadvantage of a multihull can be finding a place to "park." In some cruising areas, few marinas have slips large enough to accommodate the beam of a catamaran over 40 feet in length. Where space is available, marinas may charge for two slips or by the square meter, doubling marina costs. On the plus side, a cat can easily carry a large dinghy with outboard motor on davits, making anchoring and dinghying in to town more convenient than on many monohulls. Still, finding places to take on fuel and water can be problematic in parts of the North Atlantic, South Africa, Japan, and South America where marinas were built to cater to 35-foot monohulls.

Like racer/cruisers and cruising sleds, cats need to be built strong enough to withstand the forces they generate. When a monohull heels, it dissipates much of the force of the wind in the sails. Multihulls don't heel, so their rigging and sails must be significantly stronger than on a similar-sized monohull.

As with racer/cruisers and cruising sleds, building a strong, light, durable boat is much more difficult and expensive than building a strong, heavy one. Cruising cat design is still in its early stages compared with monohull design. Catamarans now 15 to 20 years old were built very early in the design evolution, when many structural issues had yet to be resolved. Rudder loads can be quite high on a catamaran, and this is a common area of failure in older cats. This is where duality makes a big difference—a cat that has lost one rudder can still be steered with little difficulty until the rudder can be fixed.

Ten years ago, new catamarans could easily be double the price of a new monohull of similar overall length. Very few of the catamarans available are more than 15 years old, which means there aren't many inexpensive ones around. Prices are slowly coming more in line with monohulls and are now almost comparable in the 40- to 50-foot range for 10- to 20-year-old cats. Given that a 40-foot catamaran has at least as much space as a 45- to 50-foot monohull, it can be argued that these catamarans cost less than comparable monohulls. Table 3-2 summarizes average prices for 81 offshore catamarans listed in national sailing magazines in the same month.

Most of these catamarans have worked the charter trade; these will have many hours of use on mechanical equipment and may have suffered groundings. After five years in charter, many cats will have 3,000 hours or more on their engines. Engines, transmission, refrigeration, and charging systems may all need to be replaced. Bottom repairs will be the most difficult to spot, since they are often covered well with fiberglass and bottom paint. Yet there are more good-quality catamarans available now than ever before, and prices should continue to come down as more cats leave charter fleets and find homes with voyaging crews.

TABLE 3-2. AVERAGE PRICES[1] FOR A RANDOM SAMPLE OF 81 NAME-BRAND OFFSHORE CATAMARANS BY AGE AND SIZE (U.S. DOLLARS)

Age	35–39 Feet	40–44 Feet	45–50 Feet	50–54 Feet
> 20 years	$100,000	N/A[2]	N/A	N/A
10–20 years	$150,000	$185,000	$265,000	$420,000
< 10 years	$190,000	$290,000	$410,000	$550,000

[1]Average price is 90% of asking price.
[2]Too few boats available in size/age range to calculate a meaningful average.

As with the different types of monohulls, catamarans suit the needs of a specific set of sailors. If your plans call for a large crew (four or more), a catamaran will be the least expensive way to get a boat with comfortable accommodation for everyone. If you plan to sail in areas with light winds, shallow waters, and good anchorages, a catamaran will offer significant advantages over most monohulls. But you'll need to make sure to buy a strong, structurally sound catamaran, and you may need to reinforce key structural areas like the rudders and the rigging (see the Revitalize the Rig section in Chapter 4).

Where Do You Intend to Cruise?

Different cruising grounds offer different rewards and present different challenges. A boat well suited to high-latitude cruising may not perform as well in the tropics. Knowing where you intend to go helps define which attributes matter most when you're evaluating boats.

For a tropical voyage with the prevailing trade winds, a boat needs to sail well downwind. It should be stable and easy to steer when running dead downwind and have a variety of downwind sail combinations for everything from light to gale-force winds. If the crew is to stay cool in tropical heat and humidity, the boat needs to be well ventilated, and at least part of the cockpit needs to be protected from the sun. Shoal draft (less than 5 feet) is a big advantage in a handful of cruising areas like the

Bahamas and the east coast of Australia. In general, in the tropics a draft over 7 feet makes it difficult to read water depths in coral lagoons and to explore poorly charted areas without risking running aground.

A boat meant for voyaging in the high latitudes needs to be able to sail to windward in 25 or 30 knots of wind and the accompanying seas. You should be able to close it up like a submarine in such conditions to keep things dry down below. It also needs to motor efficiently into big waves to reach a protected anchorage in the calm spells that precede most serious blows. That means having a large prop, low gearing on the transmission, and sufficient horsepower (hp), preferably 1.5 to 2 hp per foot of boat length. Good insulation will prevent condensation below, and a protected watchkeeping station will keep the crew out of the cold, rain, and sleet. Most high-latitude sailors prefer rugged metal construction with collision bulkheads forward and aft to minimize damage from a hard grounding on rocks or a close encounter with ice.

Shoal draft and a short rig will make transiting the Intracoastal Waterway (ICW) on the East Coast of the United States or the many canal systems in Europe much easier. Bridges limit mast height to 63 feet in many parts of the ICW, and a draft of less than 6 feet will mean going aground on fewer mudbanks. For most of the European canals, a maximum draft of 5 feet 10 inches and beam of 16 feet 4 inches is permitted. If the mast will be stowed on the deck of the boat, a mast height that doesn't exceed the length of the boat by more than 10 or 15 feet is preferable. A ketch rig with a centerboard that reduces draft to less than 5 feet would work well in either the ICW or the canals. A multihull would make a good ICW/Bahamas boat.

What Size Boat Will Suit You?

An overly large boat can ruin a voyage. For each 10-foot increase in boat length, the hours spent on maintenance double and boat-related costs triple. Unless you can afford full-time crew, cruising a monohull over 55 feet or a catamaran over 50 feet will likely force you to pick up extra crew for passagemaking. In many places, a large boat will limit the choice of marinas and make it harder to get fuel and water. The larger the boat, the more likely it is to sit for long periods of time once it has arrived somewhere. Very few people take a boat over 55 feet out for a day sail. All of that means more work and less pleasure.

But an overly small boat can cause just as many problems. A boat under 30 feet will be uncomfortable and wet in anything but idyllic conditions. Limited space makes it difficult to have friends aboard for more than a day or so, or to take along the personal items and the comforts and conveniences the crew might want. The lack of stowage space can result in a monotonous diet, and the boat won't be able to carry much in the way of water, tools, or spares. Self-sufficiency and cruising range will be more limited than on a larger boat. The lack of privacy can turn minor annoyances into irreconcilable differences.

Everything aboard a cruising boat is a trade-off, and size is no exception. During our circumnavigation aboard 37-foot *Silk*, she was about average in size for an offshore cruising boat. At that time, the conventional wisdom was to buy the biggest boat you could afford, and almost everyone we met wanted a bigger boat. Those we know who went cruising a second time all went up 10 feet in length, from an average of 33 feet to an average of 43 feet (see the Second Boats sidebar below). We wanted a boat around 42 feet, but we couldn't find one that met our requirements and included a well-integrated hard dodger. At 47 feet, *Hawk* is just a bit above the average among today's offshore boats. Now most of the long-term cruisers we meet do not want a boat larger than the one they are on. Instead of the biggest boat you can afford, I would say that you should buy the smallest boat on which you can live comfortably.

Our experiences in moving from *Silk* to *Hawk* help clarify the trade-offs between different sizes. By going up 10 feet in boat size, we have gained stability, speed, and space, but the benefits of these gains, while real, have not always been exactly what we expected.

- **Stability.** As discussed in the next section, size does matter when it comes to stability, but smaller boats can be perfectly safe as long as their limits are respected. In conditions where *Hawk* will happily keep sailing, we would have hove-to on *Silk*. We might not have been making miles toward our destination, but we would still have been perfectly safe. *Hawk*'s stability and her ability to sail well to windward keep us sailing in a lot of conditions where she's far happier than we are. But we have depended upon that stability to keep us upright several times in our seven years of high-latitude cruising, particularly on the 9,000-nautical-mile Southern Ocean passage eastabout from Cape Horn to Fremantle, Australia.
- **Speed.** We've averaged 148 nautical miles per day on *Hawk* compared with 117 on *Silk*, with part of that increase coming from *Hawk*'s stability; that is, her ability to keep going in heavy weather instead of heaving-to. Yet what does that speed really buy us? On a 1,500-nautical-mile passage it means we spend ten days at sea instead of thirteen. That may sound like a lot, but after the first week, once we get into the rhythm of a passage, a few days doesn't make any real difference to us. We still cannot outrun fast-moving low-pressure systems.

Our increased hull speed benefits us most where we least expected it, by extending our coastal cruising range during daylight hours. We can now sail some 30 percent farther between ports during the day, which has greatly reduced the need to sail at night in reef-, rock-, or iceberg-infested waters.

- **Space.** Most of *Hawk*'s 10 feet of extra length have been devoted to watertight compartments in the bow and stern and a large sail locker forward. As a result, we don't have much more usable interior length than we did on *Silk*, but we do have much more space. *Hawk*'s 3 feet of extra beam translate into a tremendous amount of interior volume (see Table 3-3). The majority of that space is devoted to stowage: twice as much water and fuel tankage as *Silk* carried, three times as much clothing storage, twice as many large compartments dedicated to food, four times as many bookshelves, and five times as many toolboxes. This in turn translates into much greater self-sufficiency. Our extended cruising range has allowed us to spend up to three months in remote, uninhabited areas like the Chilean channels.

We knew there would be downsides to a larger boat, though for our high-latitude, liveaboard agenda, we didn't think they would begin to outweigh the benefits, and indeed they have not. None of what follows should have surprised us, but as with the advantages we envisioned, the reality hasn't always matched the theory.

- **Cost.** Costs to buy, fit out, and maintain a boat roughly triple with every 10-foot increase in size, as shown in Table 3-3. We averaged about $5,000 per year in boat-related expenses for *Silk*, but we've averaged over $15,000 per year for *Hawk*. Both numbers are pretty typical for moderately complex boats of their respective sizes insured at least part of the time. The initial expenditure to buy and outfit the boat also tends to triple with a 10-foot increase in boat length.
- **Seamanship.** Though *Hawk* is much more stable than *Silk* and therefore much "safer" in extreme conditions, *Silk* was much more forgiving. If we misjudged a squall and didn't get the chute off in time, we could wrestle the sock down over it and manhandle it to the deck. If we wrapped the jib during a jibe, we could unwrap it by hand in light air and with a winch in windy conditions. But brute force gets us nowhere aboard *Hawk*. She requires much greater forethought, because the forces she generates quickly become unmanageable and dangerous. *Silk* offered the perfect learning environment while we made every mistake in the book; *Hawk* demands all the skills we've acquired to sail safely and efficiently.
- **Fitness.** Before we started sailing *Hawk*, I'd been of the "bigger boat, bigger winches, no problem" school. But we quickly discovered that bigger winches won't wrestle a larger, weightier anchor out of a locker; won't flake and tie down an oversized, ill-mannered mainsail; and won't claw down and secure a furling sail if the furler breaks. Only after we moved up to *Hawk* did I start to notice the direct correlation between the waterline length of racing boats and the size of the crews' necks and biceps—and those boats have *big* winches!
- **Reliance on mechanical aids.** No matter how fit we are, we still have to rely on mechanical aids to handle the forces generated by *Hawk*'s sails and anchors. Some sort of mechanical device needs to be between those forces and us at all times: a self-tailing winch, rope clutch, furler, or windlass. We need additional leverage from some sort of mechanical advantage to adjust our checkstays, vangs, and most of our halyards. We find ourselves constantly walking a fine line between controlling the forces on *Hawk* and becoming dependent on mechanical aids. Adding in-mast or in-boom furling would greatly facilitate handling our mainsail but would leave us with few options if it broke.
- **Scale.** On a bigger boat, everything is bigger. When coiling lines, your hands need to be larger to hold the loops. You need to be taller to reach the top of the boom to put sail ties over the sail or to attach the halyard to the headboard of the mainsail. You need to be stronger to wrestle an anchor off the bow or out of a locker. A bigger boat may mean that smaller crewmembers can't manage simple things like putting the sail cover on by themselves.

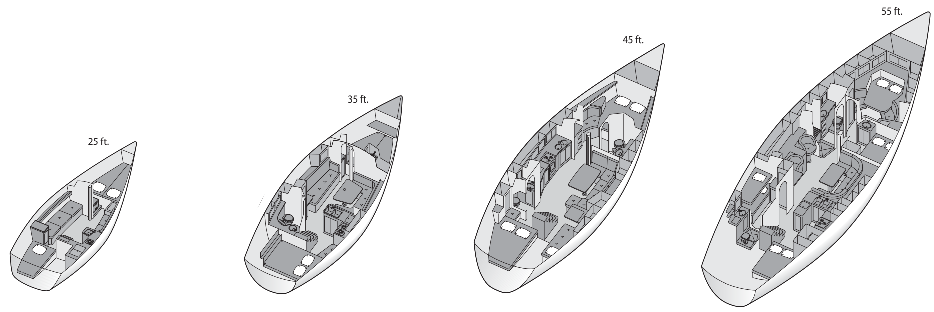
In considering the pros and cons of moving up 10 feet, we've come to four conclusions:

First, it would have been a mistake for us to have started out on *Hawk*. Given our almost total lack of offshore sailing experience, we needed a boat that would help us get out of trouble, not one that would help us get into it.

Second, somewhere around 40 feet seems to be the optimal length for a "first" offshore boat. This is large enough to stow the basics and some luxuries, such as spare light-air sails and extra fuel and water; to carry a generator and a watermaker without making major compromises in other areas; and to offer guests some measure of privacy without using the main saloon as a sleeping area.

Third, it will be fairly obvious if you really *need* a boat larger than that. If you have children, intend to have visi-

TABLE 3-3. PRODUCTION OFFSHORE BOAT SIZE AND COST COMPARISON



Boat length	25.0 ft.	35.0 ft.	45.0 ft.	55.0 ft.
LWL at 0.8 LOA	20.0 ft.	28.0 ft.	36.0 ft.	44.0 ft.
Beam	8.5 ft.	11.5 ft.	14.0 ft.	15.5 ft.
Displacement[1]	5,400 lb.	12,000 lb.	24,000 lb.	42,000 lb.
Length–beam ratio	2.94	3.04	3.21	3.55
Displacement–length ratio	301	244	230	220
Cabin area[2]	120 sq. ft.	240 sq. ft.	360 sq. ft.	480 sq. ft.
Stowage volume[3]	120 cu. ft.	360 cu. ft.	720 cu. ft.	1,200 cu. ft.
Berths (singles, doubles)	3, 1	2, 2	2, 2	2, 3
Heads, separate shower	1, 0	1, 0	2, 0	2, 1
Tankage (fuel, water)	20, 40 gal.	40, 80 gal.	150, 100 gal.	200, 200 gal.
Engine size[4]	14 hp	30 hp	60 hp	105 hp
House battery bank	100 Ah[5]	200 Ah	400 Ah	800 Ah
Sail area–displacement ratio	17.15	18.31	19.23	19.86
Sail area (main and 130% genoa)	330 sq. ft.	600 sq. ft.	1,000 sq. ft.	1,500 sq. ft.
Mainsail area	132 sq. ft.	240 sq. ft.	400 sq. ft.	600 sq. ft.
Genoa area	198 sq. ft.	360 sq. ft.	600 sq. ft.	900 sq. ft.
Primary winch rating	16	40	53	66

Acquisition price for boat without additional equipment:				
Price (15-year-old used boat)[6]	$25,000	$90,000	$230,000	$365,000
Minimum refit costs[7]	$3,750	$13,500	$34,500	$54,750
Sail costs (main and genoa)	$2,000	$5,000	$8,000	$12,000
	$30,750	$108,500	$272,500	$431,750
Estimated annual boat expenses:				
Insurance	$308	$1,085	$2,725	$4,318
Annual maintenance[8]	$1,538	$5,425	$13,625	$21,588
	$1,845	$6,510	$16,350	$25,905

[1]Averages of published values for production cruising boats.
[2]Cabin area varies in proportion to length × beam.
[3]Space available for stowage and optional systems; actual values depend upon hull shape and can be significantly lower than shown.
[4]Sized at 2.5 hp per 1,000 lb. displacement.
[5]Ah = amp-hours.
[6]Average prices for quality offshore production boats; calculated based on data for Table 2-8.
[7]Costs to upgrade basic boat structure for offshore (see Chapter 4), estimated at 15% of purchase price.
[8]Average annual expenditure for voyage of 5 years calculated at 5% of boat value per year.
Source: Illustration courtesy *SAIL* magazine and Kim Downing.

THE "AVERAGE" BLUEWATER VOYAGER

Despite the diversity of today's cruising fleet, analyzing large groups of offshore cruising boats does yield an "average" bluewater voyager. Table 3-4 summarizes the characteristics of four diverse collections of offshore boats.

The circumnavigator sample consists of the 55 boats we encountered during the course of our two voyages that completed circumnavigations. Eight finished their round-the-world trips prior to 1990; these tended to be much smaller custom-built boats, thus skewing the sample. For a more up-to-date and larger selection, I drew the second set of boats, the SSCA sample, from the Seven Seas Cruising Association *Commodores' Bulletins*. The 336 boats belong to the crews who submitted letters to the bulletins over a two-year period.

Because cruising sailors tend to be conservative by nature and constrained financially, it takes many years for innovations to work their way into the cruising fleet. Neither the circumnavigator nor SSCA sample generates many insights into current trends in offshore boats. Competitors in the Atlantic Rally for Cruisers (ARC) tend to be both newer and more performance oriented, but these are still by and large cruising boats. The Bermuda Race includes a range of vessels that run the gamut from pure cruising to pure racing; this sample offers some perspective on where the cruising fleet may be heading in the next decade.

What can we learn from these samples?

1. **Diversity of offshore cruising boats.** No single brand dominates any of these samples. The circumnavigators range from a 19-foot fiberglass converted lifeboat to a 60-foot wooden schooner and include 24 custom boats and 31 different production boat designs. The SSCA boats

TABLE 3-4. STATISTICS FROM FOUR GROUPS OF OFFSHORE BOATS

Data Source	Group of 55 Circumnavigators	SSCA *Commodores' Bulletins* from 12/2001–12/2003	Participants in 2003 ARC	Participants in 2004 Bermuda Race
Sample size	55	336	191	134
Percentage of boats:				
< 40 feet	34	35	17	10
40–49 feet	53	52	63	61
> 50 feet	13	13	20	29
Average length (feet)	40	42	47[1]	48[1]
Percentage of:				
Fiberglass production boats	56	89	93	84
Custom boats	44	11	7	16
Catamarans	2	2	9	—[2]
Top 5 brands	Valiant	Tayana, Morgan, Island Packet, Hans Christian, Amel	Beneteau, Hallberg-Rassy, Swan, Oyster, Jeanneau	Swan, J/Boat, Farr, Nelson/Marek, Beneteau

[1]Minimum length requirements: 30 feet for the ARC; 35 feet for the Bermuda Race.
[2]Catamarans are not allowed to compete in the Bermuda Race.

range from a Cal 25 to an 84-foot aluminum Palmer Johnson ketch and include a staggering 143 different boat brands. The 191 ARC participants in 2003 included 63 different boat models. The most common brands across all three samples were Tayana, Amel, Swan, Oyster, Bavaria, Hallberg-Rassy, and Beneteau.

2. **Fiberglass sloops and cutters have become the norm.** In terms of hull material, fiberglass dominated every sample at over 90 percent of the boats represented—except among the circumnavigators, where the percentage dropped to 60. Just as fiberglass has become the dominant hull material, sloops and cutters dominate the sailing rigs. More than 85 percent of the boats in every sample were sloop- or cutter-rigged.
3. **The offshore cruising fleet is gradually moving toward more modern types.** With the exception of a single racer/cruiser and a single catamaran, about two-thirds of the boats in the circumnavigator sample would be considered traditional voyagers, with the other third falling into the performance cruiser category. We have yet to meet anyone who has completed a circumnavigation on a cruising sled. This sample includes the oldest boats, many of which completed their circumnavigations prior to 1990. Performance cruisers increase to more than half of the more up-to-date SSCA and ARC samples, which also include a handful of racer/cruisers and Dashew hybrids. The SSCA sample includes 7 catamarans, while 12 catamarans, or 9 percent of the total, competed in the 2003 ARC. Not surprisingly, performance cruisers and racer/cruisers dominate the Bermuda Race entrants; more than half a dozen cruising sleds and all-out maxi racers also competed. These samples illustrate the gradual shift toward more modern hull types throughout the offshore fleet.
4. **Average length is now between 40 and 50 feet.** Boats between 40 and 50 feet make up half to two-thirds of every sample. Average lengths were 40 feet among the circumnavigators and 42 feet among the SSCA boats. The ARC and Bermuda Race entrants averaged 47 and 48 feet respectively, though minimum length requirements bias both samples toward larger boats. Even after removing the fully crewed, 60-plus-foot maxi race boats from these two samples to compensate, both groups still averaged 46 feet in length. These data suggest that average offshore cruising boat length has been increasing, which confirms our own observations. What can we conclude from these analyses?

   Based on these samples, if there were an "average" voyaging boat, it would be a production fiberglass performance cruiser between 40 and 50 feet long with a cutter or sloop rig and a modified fin keel and skeg-hung rudder or a fin keel and strong spade rudder.

That average length has increased by 10 feet in the decade we have been out cruising. Among the circumnavigators, those boats that completed their voyages before 1990 averaged 32 feet in length, and none was over 50 feet. Those that finished in 1990 or later averaged 41 feet in length and included 7 boats over 50 feet. There are still a lot more boats under 40 feet voyaging than there are boats over 50 feet, as can be seen in the circumnavigator and SSCA numbers, but the ARC and Bermuda Race data confirm our sense that somewhere around 45 feet will become the average for the offshore cruising fleet in the near future.

Will this trend toward larger boats continue?

We may be approaching the optimum average length for a shorthanded offshore voyager. After moving up steadily through the 1990s, the average length of the boats in the ARC increased only 1 foot between 1999 and 2003. Average length increased by 1 foot when comparing the circumnavigators finishing their voyages between 1990 and 1995 and those completing their voyages after that.

What do these data suggest about future trends in offshore yacht design? Although performance cruisers dominate today's fleet, the "average" boat will continue to move toward the performance end of the spectrum as more catamarans, racer/cruisers, and cruising sleds join the offshore cruising fleet.

tors or crew aboard more than a third of the time, plan on "expedition sailing" to remote places for extended periods, or want to pursue some activity, like scuba diving, that requires a great deal of space, a larger boat may well make sense—but only if you're certain you can afford it.

Fourth, boat size needs to be limited by the fitness and strength of the regular crew. If a furler breaks, the crew must be able to drop a jib in gale conditions and gather it on deck. If the electric windlass fails, the crew still has to be able to retrieve a storm anchor. Otherwise, overall safety actually decreases in a larger boat. Most experienced couples who don't want to depend upon crew feel comfortable with a maximum length somewhere around 50 feet.

What Age Boat Will Suit Your Budget?

Prices start around $300,000 to buy and fit out a new 40- to 44-foot fiberglass production monohull designed and built for offshore sailing. That increases to $400,000 for an offshore-capable catamaran in the same size range. A custom boat costs even more. Most new semicustom or custom boats end up costing double what a similar-sized production boat would have cost, and unless a name designer and boatyard are involved, that difference won't be recovered when the boat is sold.

If these numbers shock you, don't despair. Most cruisers who have to live within a budget end up buying a used boat and refitting it partially or completely. Assuming you have settled on a boat type and size range that suits your needs and is realistic given your budget, then the boat budget you calculated in Chapter 2 will determine how old a boat you buy as well as how much of that budget goes into the boat and how much goes into the refit.

The dozen crews we know who spent less than $100,000 buying and fitting out their cruising boat fall into three categories. A very few built the boats themselves; most of them built steel or cold-molded boats around 40 feet long. A larger group bought a 25-plus-year-old, 35- to 45-foot boat, stripped it to a bare hull, and refitted it themselves. In either of these cases, if any sort of monetary value were put on the time the owners invested, the cost of the boat would at least double. The half-dozen cruisers we know who spent less than $50,000 all bought a 20-year-old or

TABLE 3-5. COMPARISON OF TRADE-OFFS IN BUYING BOATS OF DIFFERENT AGES

	Nearly New (<10 years)	Middle-Aged (10–20 years old)	Senior (20+ years old)
Percent of purchase price invested in refit	10–20	30–50	50–100+
Percent of labor supplied by owner	20	40	90
Average time spent refitting boat (months)	3–6	6–12	13–24
Pros	• All-but-new boat • Up-to-date equipment • Takes the least time	• Much less expensive than "nearly new" • Takes much less time than "senior"	• Lowest investment of money • Invest only in the equipment you want • Can upgrade basic boat
Cons	• Paying for equipment you may not want • Won't be able to change basic boat • Will have to fix someone else's mistakes	• Equipment may be dated • Won't be able to change basic boat • Will have to fix someone else's mistakes	• Takes the most time and effort
Sample budget:			
Purchase price for 40- to 44-foot boat[1]	$265,000	$190,000	$115,000
Estimated refit costs[2]	$40,000	$75,000	$85,000
Total Boat Budget	$305,000	$265,000	$200,000

[1]From Table 2–8.
[2]Based on midpoint of ranges shown above; does not include owner's labor.

older boat under 35 feet long and did only what was absolutely essential to get out cruising.

Most people lack the mechanical skills to build or outfit a boat themselves. Their time is far better spent earning money at their jobs and using that money to pay others to do the refit. These people may still come up with a bargain relative to the market value of the boat, but they'll either have to be very patient or very lucky. Bargain boats range from almost new boats exhibited at a series of boat shows to "total loss" hulls purchased from an insurance company after a hurricane (see the "Bargain" Boats section in the resources for this chapter in Appendix 1). Most cruisers end up paying for what they get, and they get a boat of an age that fits their budget. Table 3-5 illustrates the trade-offs.

It's easy to underestimate how much you will need to spend refitting and equipping the boat once you've purchased it. The Refit Costs: Some Rough Figures sidebar in Chapter 2 gives some ballpark estimates for refitting and equipping a 40-foot, 20- to 30-year-old boat. Part II details the refits for *Simplicity*, *Moderation*, and *Highlife* to illustrate the costs of equipping and refitting boats in these three age groups.

If you don't want to go with a "senior" boat, but your budget won't stretch to a "middle-aged" one, then you should probably take another look at size. If you can find a way to make do with a boat 5 feet shorter, you will be able to afford one that isn't quite so dated.

Whatever approach you take, the economic equation won't be complete unless you factor in the eventual resale value of the boat. Boats are not investments: they don't appreciate in value. But some cruising boats hold most of their value through a three- to five-year voyage, while others will decline by well more than half their purchase price in that period. If the boat will represent a large fraction of your total assets, the money you get out of it when you stop cruising has to be a key consideration in your purchase decision. Cruising almost never means a step up the economic ladder, but it shouldn't push you back down several rungs either.

Resale value is another reason so few cruisers leave aboard a new boat. Just as cars lose a significant portion of their value the minute they drive off the dealer's lot, boats depreciate substantially as soon as they leave a builder's yard. That value is lost forever no matter how well the boat is taken care of over the course of its life.

Resale value can be maximized in one of two ways. A "nearly new" brand-name boat designed by a name designer and built by a reputable builder that is still in business will cost significantly more to purchase but will hold its value better than any other type of boat. Alternatively, a fully depreciated, 20-year-old or older boat with a brand name respected in the cruising community will cost much less to buy initially and will depreciate little while you're out. But if resale value is your primary concern, don't make the mistake of investing too much in refitting such a boat, for these boats tend to have an upper price limit beyond which the market will not go.

EVALUATING INDIVIDUAL BOATS

As should be clear from the last section, boats of almost every conceivable type, keel configuration, rig, hull material, and length make successful voyages. While these characteristics can help define the boat that best suits you, they don't matter much in determining the general success or failure of a specific boat for offshore sailing and liveaboard cruising. The things that really do matter are less straightforward and harder to quantify than the depth of the keel or the number of masts. They include the boat's stability, its durability, its design and layout, and its sailing ability.

Screening Criteria: Stability and Durability

In an ideal world, you would do nothing over the course of the next year but look at boats in order to figure out what you really want. You would spend several days going over every detail of each candidate's construction and then take each one on a passage and evaluate its sailing performance and layout in everything from calms to gales. But in the real world, you'll be lucky if you thoroughly inspect a dozen boats sitting on the hard and get out sailing for a couple of hours on the boat you end up buying. That means making sure the few boats you do examine and the one or two boats you sail are the right boats. A set of screening criteria can help identify boats of interest and eliminate others.

The attributes discussed in the Narrowing the Field section above will all become screening criteria. The values shown in Table 3-1 for the various ratios can be used to identify boats of a specific type. Appendix 3 explains how to calculate these values. Your budget and the age range of the boats you have decided to consider will also be used to screen out boats, as will any special requirements related to where you intend to cruise or how you intend to use the boat.

This section attempts to come to grips with something far less tangible than size or age but at least as important: seaworthiness. This concept includes *stability* (the ability to stay upright when the sea would have it otherwise) and *durability* (the ability to take the constant punishment the sea delivers). Though both are difficult to evaluate, I give you some objective measurements for each to use as a further screen in your boat selection.

Taken together, the screening criteria should help you narrow your search to a couple dozen specific boat brands that meet all your requirements. If you have access to the Internet, you can reach this list without leaving your desk chair. Many brokerage sites, like those listed in the Boat Brokerage Websites section in the resources for Chapter 2 in Appendix 1, provide most of the information you need to work through your screening criteria, including walk-through photo tours that let you evaluate a boat's layout against your needs.

But most people prefer to get a feel for boats in person. They start their search by opening the net wide and learning everything they can about as many different boats as possible. They go to boat shows and stand in line for hours to see a variety of interiors and to listen to the questions experienced voyagers ask salespeople. They order brochures for dozens of new boats and spend hours comparing ratios and specifications. They read all the boat reviews in all the sailing magazines and surf the Internet looking for owner's groups, sailing bulletin boards, and searchable databases of brokerage listings. They compile exhaustive lists of everything the boat must have, then scratch out the entries and start again after talking to another expert or reading another book. If all this sounds familiar, then you're already well launched into your search.

Make as much use as possible of the wealth of information within the cruising community. Most sailors love to talk about their boats and are flattered to be asked. If you see a boat with scuffed topsides and a battered dinghy, ask the people aboard where they've been, and the conversation will almost certainly take off from there. You won't fully appreciate the willingness of cruisers to help those who'd like to join their ranks until you experience it for yourself. And you'll remember it when you get out on your own boat and someone stops by and shyly asks how it has performed for you.

Even if you've already decided you want a name-brand fiberglass performance cruiser built for offshore sailing between 40 and 43 feet long and less than 15 years old with shoal draft and a two-cabin layout, you still have a vast array of cruising boats to choose from. At first, it can seem impossible to sort out opinion from fact, entrenched dogma from valuable experience. But the more boats you see—and the more you actually manage to sail—the clearer the picture of your ideal boat will become. Eventually you'll be ready to look seriously at a short list of boats.

Stability

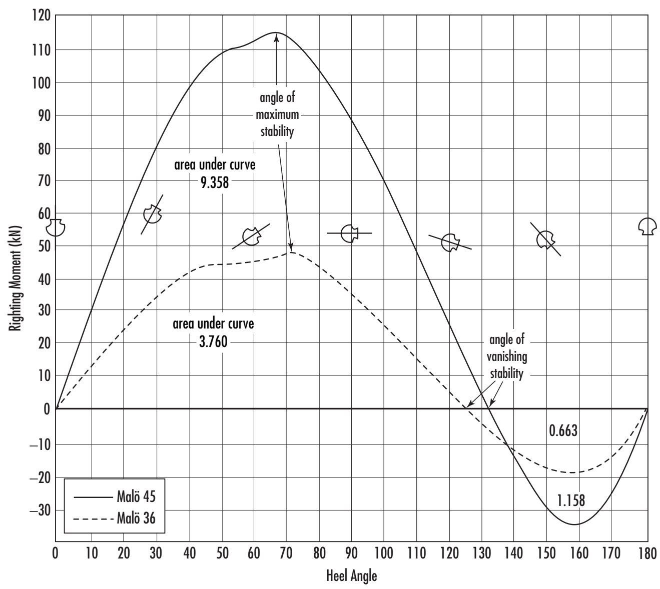
Stability—a boat's ability to stay upright despite a sudden squall or large seas combined with its willingness to come back upright if knocked down—is the ultimate measure of seaworthiness. Almost as much has been written about stability as about boats in general, and even less of it is helpful in picking one boat over another.

An incredible variety of boats have successfully completed long voyages; many of these craft would barely be considered seaworthy by most cruisers today. In our travels, we have met sailors who have crossed oceans in open boats, some little more than dugout canoes; in 20-foot catamarans affording only a bit more shelter than a beachcat or Hobie Cat; in converted lifeboats less than 20 feet long; and in a huge variety of small, homemade boats under 25 feet long, some of which weighed little more than a couple of tons. A few minutes spent considering any of these boats keeps me from getting dogmatic about that elusive quality called "seaworthiness." They remind me that just about any boat can successfully sail offshore, as long as its crew respects its limits and sails it wisely.

That's not to negate the seriousness of the question of picking a boat to which you will entrust your life. As poorly understood as it is, stability represents one of the only measures of how well a boat will stand up to extreme conditions. Coastal sailors encounter stability issues when they don't put enough weight on the rail during a heavy-weather race or when they broach while carrying a chute. Inshore, such events are exciting; offshore, they are terrifying and potentially life-threatening.

An offshore boat needs to stay upright. If it is rolled by an exceptionally large wave, a monohull needs to come back upright within less than 2 minutes, the length of time most of us can hold our breath. In theory, a boat's stability is determined by her size, hull shape, center of gravity, buoyancy, and a host of other factors. In practice, many dynamic factors affect stability, including the shape and speed of the waves and the inertia created by the mast and keel in a roll.

Figure 3-7.
Stability curves for a Malö 36 and a Malö 45.



Designers use various measures to describe a boat's stability. The righting moment or stability curve shows how much additional force is necessary to heel the boat through each degree of a 180-degree roll (Figures 3-7 and 3-8). The amount of force required to make it heel the first degree is called its *initial stability*. Each additional degree of heel requires more force, so the curve slopes steeply upward for the first 50 or 60 degrees of heel.

The curve levels off where the greatest force is required to roll the boat one more degree. This is called the boat's *angle of maximum stability*—just under 70 degrees for the Malö 45. After that, it takes less and less force to make the boat heel another degree. As the boat continues rolling, it reaches a point where it will continue over rather than come back upright, even if no more force is applied. This occurs where the curve crosses the X-axis and is called the *limit of positive stability* (LPS) or the *angle of vanishing stability* (AVS), about 132 degrees for the Malö 45.

Note how much difference size makes in Figure 3-7 and Table 3-6. On average, the absolute force required to heel a boat 1 degree and keep heeling it through each additional degree doubles with each 5-foot increase in length for boats with similar DLRs. The same is true for catamarans, which explains why cruising boats of any type over 50 feet so rarely get capsized or knocked down beyond the horizontal. Also note how much more force it takes to capsize a modern catamaran versus a modern monohull of the same overall length (Figure 3-8). Catamarans are inherently much more stable than monohulls—whether right side up or upside down.

The governing bodies of offshore racing agree that a 40-foot monohull should have an LPS of at least 120 degrees, meaning that it can withstand a knockdown 30 degrees beyond the horizontal without capsizing. This number is considered the minimum because, if inverted, such a boat will right itself in under 2 minutes, before any crew trapped under the boat can drown. For offshore sailing, smaller boats require a higher limit because their lighter displacement means the absolute magnitude of the forces necessary to capsize them are lower (Figure 3-7, Table 3-6). The minimum recommended LPS for traditional designs under 40 feet can be approximated by 160 degrees minus the waterline length of the boat in feet.

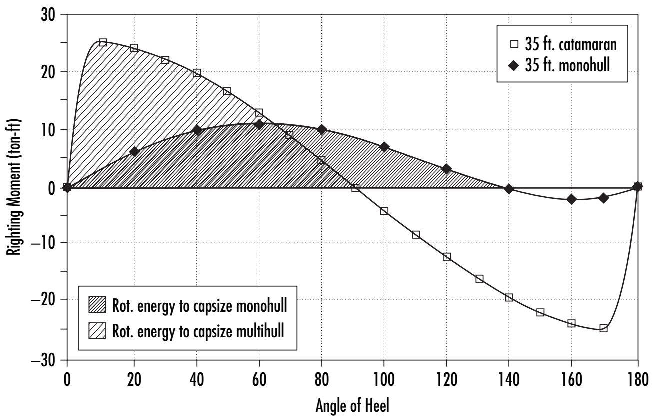


Figure 3-8.
Stability curve for a 35-foot multihull versus a 35-foot monohull.

TABLE 3-6. COMPARISON OF STABILITY MEASURES[1] FOR DIFFERENT-SIZED BOATS WITH SIMILAR DLRs

Boat	DLR	Initial Stability	Stability Ratio
Contessa 35	238	881 ft. lb.	4.2
Valiant 40	253	1,382 ft. lb.	3.0
Stevens 47	250	2,831 ft. lb.	2.6

[1]From USSA's *Performance Characteristics Profile of the North American IMS Fleet* (2004 edition); averages for all measured boats of that type.

Once a boat is completely upside down, at 180 degrees in Figure 3-7, it is again stable. What matters at that point is how much force is required to bring it back upright. A catamaran is at least as stable upside down as right side up; while it takes more to capsize it initially, once capsized it's going to stay that way (Figure 3-8). A cruising monohull is designed to be unstable upside down; a small amount of force will get it to return to its proper orientation. In righting itself from 180 degrees, it needs only to reach its LPS before the forces will carry it back around. In a good design, the weight of the keel acts like a pendulum when the boat's inverted. If a wave rolls the boat just a little bit, the keel helps carry the boat through the LPS and back upright.

The *stability ratio* measures how easily the boat will come back upright once it has reached an inverted position. It is calculated by dividing the area of positive stability (the area under the curve and above the X-axis) by the area of negative stability (the area over the curve and below the X-axis). The higher the number, the faster the boat will return upright once rolled to 180 degrees.

On well-designed monohulls, the area under the curve is much larger than the area over the curve (Figure 3-7). Monohull stability ratios range from just over 1 to as high as 10 and vary a great deal even among boats of similar DLRs (Table 3-6). In Figure 3-7, the ratio for the Malö 36 comes out to 5.7 (3.76 ÷ 0.663); for the Malö 45, it's over 8 (9.358 ÷ 1.158). An offshore boat should have a ratio over 2.

Stability curves contain a wealth of information and would be exceptionally useful in evaluating offshore boats if they were readily available and if the way the measurements and calculations were performed could be standardized. Since no one actually rolls their boats through 180 degrees to measure the forces required (except participants in some single-handed offshore races), the curve comes from a few objective measurements and a lot of theoretical calculations. Very few manufacturers put together stability curves for their boats, and when they do the calculation methodologies vary widely, making them almost impossible to compare.

There have been moves to create a uniform standard for generating stability curves, and in Europe the International Standards Organization (ISO) has been working on a sophisticated stability index they've dubbed STIX. The process is highly political. It will be many years before the industry comes to agreement and comparable curves become available for all new production boats. Even then, reliable, standardized data will continue to be difficult to obtain for used boats.

Given this lack of data, how do you go about determining whether a boat you're interested in has sufficient stability to be trusted offshore?

The easiest way is to find out how sister ships have actually performed. The manufacturer, owner's groups, Internet cruising websites, and boat show seminars all offer opportunities to meet and "chat" with people who have cruised aboard the make and model of boat you are considering. A dozen or so sister ships that have successfully circumnavigated or completed long voyages do not certify that model as Southern Ocean–capable, but they almost certainly indicate the vessel has sufficient stability for offshore sailing. If you're considering a multihull, this will be about the best information you can get in conjunction with any stability curves the manufacturer has created, but if you're considering a monohull there are other ways to assess stability.

The second easiest way to determine monohull stability is to calculate the boat's *capsize screening value* (CSV). This ratio was created following the disastrous 1979 Fastnet Race, when a Force 10 gale went through a fleet of 303 boats, sinking 5, rolling 18, and killing fifteen sailors. In the race's aftermath, the United States Yacht Racing Union (now the U.S. Sailing Association—USSA) and the Society of Naval Architects and Marine Engineers developed the capsize screening value to quantify the "risk of being unduly easily capsized and the risk of sticking in the inverted position for an extended period of time." The CSV is calculated by dividing the cube root of the boat's displacement volume (in cubic feet) into its maximum beam: $CSV = MB \div (D \div 64)^{0.33}$. The lower the value, the less likely it is that the boat will be prone to capsize, with 2 considered a maximum value for an offshore boat.

This formula offers a quick and easy way to get some feel for a boat's stability; however, the ratio does not take into account the distribution of weight in a boat, and it penalizes beam quite heavily. It will give two boats of the same beam and displacement the same rating even if, in one boat, the weight is above the waterline, and in another boat, half the weight is in a bulb at the bottom of a 10-foot keel. As a result, the CSV should not be considered a definitive measure, especially with respect to more modern, beamier hull types like racer/cruisers and cruising sleds.

Beyond this, the only source of consistent, useful stability data for used boats is fleet data from rating agencies such as the U.S. Sailing Association and the Royal Ocean Racing Club (RORC). If the boat you are considering or a sister ship has ever been measured for racing by one of these organizations, you can purchase a rating certificate that will include basic stability information.

To examine the stability characteristics of a wide variety of boats in order to narrow your choices, purchase USSA's *Sailmakers' Listing of IMS Yachts* (see the Performance Information section in the resources for this chapter in Appendix 1; the RORC used to offer similar data for their fleets but unfortunately no longer does so). While the calculation methodologies can always be debated, fleet statistics offer comparable data for evaluating many boats on consistent though static measurements. As USSA itself cautions, "No account is made for any of the dynamic factors which accompany capsizes."

Based on all these data, we should be able to identify specific design features that increase stability. But characteristics that increase stability are complex and not always consistent. A deep hull increases the angle of maximum stability but decreases the amount of force the boat can withstand at that angle. A wide beam increases initial stability but makes the boat less likely to right itself after a capsize. Lowering the center of gravity by putting much of the ballast at the bottom of the keel would seem an obvious way to increase stability, yet some researchers claim that this can create a flywheel effect that carries the boat past its limit of positive stability and contributes to capsize. Potential long-distance cruisers end up with few clear rules to follow when selecting a boat.

Only size seems to correlate consistently with stability, as the earlier righting moment curves demonstrated. This is not surprising given that the kinetic energy to capsize a boat will vary as the fourth power of boat length. That means that a 60-foot sailboat can absorb sixteen times as much kinetic energy from a wave crest without capsizing as a 30-foot boat. The exact relationship between size and stability has been demonstrated for monohulls using tank testing, the results of which are discussed in the Breaking Waves and Rogue Waves section in Chapter 22.

But small boats can meet minimum stability requirements given adequate displacement. Table 3-7 shows the stability characteristics of two groups of boats, the first around 35 feet long and the second around 50 feet long. Boats in bold do not meet some or all the recommended stability criteria for offshore sailing. As this table illustrates, traditional boats (with DLRs over 300) around 35 feet long are more likely to meet the criteria than those with lower DLRs. Fifty-foot boats can rely on length to give them adequate stability even with DLRs less than 100. Very few cruising boats with waterlines of 50 feet or more fail to meet the minimal requirements shown in Table 3-7. Stability is probably the single biggest reason why the ULDBs now starting to infiltrate the cruising ranks tend to be at least 50 feet long.

Thus, length and displacement seem to be the only two design factors that correlate unequivocally with stability, and it is possible to make up for a lack of one with the other. Heavy, small boats and light, large boats can both be stable enough to weather extreme conditions offshore.

Many boats that do not meet the stability criteria shown in Table 3-7 have successfully completed long voyages. On an average trade wind circumnavigation timed to avoid both tropical cyclones and winter gales, only a handful of people will be unlucky enough to test their boat's limits. This is not true in the high latitudes. Of the 18 boats we know that completed Southern Ocean passages, more than half were knocked down past the horizontal at least once during their voyage. Given the consequences of not staying upright, most cruisers will want to add these basic stability guidelines to their search

TABLE 3-7. COMPARISON OF STABILITY MEASURES FOR SIMILAR-SIZED BOATS

Boat	DLR[1]	Righting Moment at 1 Degree of Heel[1]	IMS Stability Index[2]	Stability Ratio[1]	CSV
Recommended value			> 120°	> 2	< 2
Around 35 feet:					
Crealock 34	344	707	128.5°	4.0	1.68
Tartan 34	332	641	120.9°	2.5	1.77
Bristol 355	326	792	126.7°	3.3	1.76
Catalina 34	**252**	**885**	**113.9°**	**2.1**	**1.95**
Contessa 35	238	881	127.5°	4.2	1.87
Hunter 34	**236**	**822**	**117.0°**	**2.4**	**1.97**
Baltic 35	**211**	**737**	**110.3°**	**1.8**	**2.07**
J/34	**210**	**588**	**106.7°**	**2.0**	**2.29**
Around 50 feet:					
Hood 50	320	2,197	131.7°	3.1	1.63
Beneteau 51	210	2,997	126.9°	3.2	1.86
J/160	130	3,355	124.9°	2.6	1.78
Santa Cruz 50	82	1,500	124.1°	2.6	1.84

[1]From USSA's *Performance Characteristics Profile of the North American IMS Fleet* (2004 edition); averages for all measured boats of that type.
[2]IMS limit of positive stability adjusted for the boat's size and beaminess relative to displacement.

criteria. For a high-latitude voyage, stability should be close to the top of the list.

Durability

An offshore boat needs to be rugged enough to stand up to the constant punishment of sailing 5,000 to 12,000 miles per year, year after year. Even boats with good track records designed and built for offshore sailing require constant maintenance and attention to keep them up to the task. Taking a production offshore boat voyaging, no matter how well built, is like taking a stock Jeep in the Paris-to-Dakar rally. Taking a coastal boat is like trying to do the rally in an economy car.

A well-built offshore boat should get you through a circumnavigation without needing serious structural work halfway around the globe. What you want to avoid are major failures that require you to remove half the interior or to sit on the hard for six months or more—bulkheads pulling away from the hull, compression around the mast step, a failed hull-to-deck joint, extensive delamination, large-scale osmotic blistering, and so on (see the Common Structural Problems in Older Boats sidebar opposite). These are the kinds of things that can easily ruin a voyage or end it altogether when the money runs out.

The best way to avoid these problems is to invest in a really good marine surveyor who can evaluate the boat's suitability for the voyage you plan to take. Even if you are buying a new boat, you should hire a surveyor to inspect it before it leaves the factory. We have seen brand-new boats in which a mast was off center by almost 4 inches, an improperly wired electrical system caused a fire within a few months of purchase, and missing structural stringers around a keel caused leaking through the keel bolts on the first offshore passage. Organizations that can help you find a qualified marine surveyor are listed in the Marine Surveyors section in the resources for this chapter in Appendix 1.

If you're buying a wood or metal boat, you'll need to hire a surveyor who specializes in these materials. For any boat, you'll want to check references and ask around to be sure you're getting someone competent. Your friendly neighborhood boatyard manager will probably have opinions on local surveyors. Ask surveyors about their past experience, areas of expertise, and what boat brands they are most familiar with. Also ask them for a sample of a past survey (with the owner's information blacked out) so you can evaluate their professionalism and thoroughness.

A good survey costs from $12 to $15 per foot in the United States. Most of us can only afford to survey the boat we really believe we're going to buy, which means we hope to have eliminated any boats with major problems before a surveyor ever sees them. Information from others having experience with the model of boat under consideration is the best way to do this.

As with stability, a half-dozen boats of a specific model that have completed long offshore voyages can be taken as necessary—but not sufficient—proof of the boat's durability. Here's where it really pays to get on the Internet and track down other owners. Just "eavesdropping" on an owner's group will offer a wealth of information on how many boats have actually done extensive offshore voyaging and the problems they encountered. It will also put you way ahead on figuring out what you'll need to do after you buy the boat by giving you firsthand knowledge of how other people have refitted the same model for offshore, what kind of work other owners have needed to do after two or three years of voyaging, and typical structural problems among older boats and how to fix them.

Major yachting magazines, including *Cruising World* and *Yachting Monthly*, offer services to put you in touch with owners willing to talk about their experiences. Contact the manufacturer as well—if a sister ship has completed a circumnavigation, the manufacturer will probably be using that fact in its advertising. See if the company will give you contact information for people who have done major voyages on the boat model you're considering. The Information on Specific Boat Brands section in the resources for this chapter in Appendix 1 offers some other ideas on where to start looking for more information.

When you find anyone who has cruised the boat for several years, ask the owners the following questions:

- How old was the boat when they bought it? What did they do to refit it before they left?
- Did they do a refit while cruising? What did they do?
- If they were to refit the boat for another long voyage now, what would they do?
- Did they have any problems with osmotic blistering? Delamination? Galvanic corrosion? Rust? Electrolysis? Leaking through the toe rail or hull-to-deck joint? Compression under the mast? Keel attachment? Rig failure?

Finally, before you start looking at individual boats, read Chapter 4, which examines the most common upgrades that need to be made to older boats and provides a basic checklist for evaluating the durability and structural integrity of any boat.

Bear in mind that no boat is ever trouble free; every boat has minor issues you will need to address during the refit. The goal is to find any major structural problems that would undermine durability. But also, you want to know about any specific weaknesses you'll have to deal with on that boat, to weigh those against the weaknesses of other boats you're considering, and, if you buy that

COMMON STRUCTURAL PROBLEMS IN OLDER BOATS

A good surveyor should uncover any of these structural problems common on many older boats. Most of them can be fixed for a price, but you'll want to take into account the cost of the repair when you're purchasing the boat.

- **Osmotic blistering.** Many older fiberglass boats develop blisters under the waterline where water has penetrated the fiberglass. The problem can range from a few large blisters to a "pox" of smaller blisters covering the entire hull. To fix blistering, the affected area has to be stripped back to dry fiberglass and new layers of fiberglass applied. A few large blisters will not be costly to repair, but a full peel job on the entire underbody can cost tens of thousands of dollars. It can take up to a year for the hull to dry out completely, so the project will need to be undertaken in a heated shed in colder climes. A badly blistered boat can be a bargain for someone with the time and money to fix it, but it will be a financial nightmare for anyone who did not realize what they were buying.
- **Core damage.** Most fiberglass boats built since the mid- to late 1970s use a sandwich of fiberglass on either side of a lightweight core for the decks and, in some cases, for the hull. Balsa was a common coring material in the early years; later, foam became popular. If water penetrates a balsa core, it will rot (Figure 3-9); if it penetrates a foam core, the foam will turn to mush. The result will be soft, spongy places in the hull or deck, often accompanied by a bump or blister in the fiberglass. Most core failures occur where a deck fitting passes through a cored area that has been improperly sealed, allowing water to penetrate the core. Almost all older cored boats will have a few small areas of core failure, generally around deck fittings. The damaged core needs to be removed and replaced with chopped fiber and epoxy resin. This is time consuming and will be costly if a yard does it for you. In the worst case, the core can become so saturated that entire areas of the hull and deck have to be replaced. Solid fiberglass boats, which include most boats built before the mid-1970s, will not have core problems. In the last decade or so, high-quality production boatbuilders have learned to replace the core with solid fiberglass where fittings pass through the decks. These boats should have problems only if a previous owner added a fitting through a cored area without properly sealing the core.
- **Bulkheads adrift.** The bonding attaching bulkheads to the hull on older boats will often have broken down, leaving the bulkhead floating free and not supporting the structure of the boat. These bulkheads will need to be rebonded to the hull. The bonding itself is not particularly complex or expensive, but removing the interior to get to the edges of the bulkhead turns this

Figure 3-9.
Weeping brown fluid indicates balsa core failure in the bows of a 30-year-old fiberglass boat.

(continued on next page)

into a major project. Be prepared to find structural problems or rot in bulkheads on boats over 20 years old. Small areas can probably be patched with new wood and fiberglass, but if the whole bulkhead is compromised, it will need to be replaced.

- **Leaking hull-to-deck joint.** Most sealants are designed for a working life of only ten to fifteen years, so many hull-to-deck joints begin to leak around that time. The least expensive way to fix this problem is to glass over the entire thing. If this is not possible, a leaking hull-to-deck joint could be quite costly to remedy.
- **Chainplate problems.** On most good offshore boats, the chainplates pass through the decks and are through-bolted to a solid piece of stainless steel, which is in turn bolted to a reinforced structural member called a *knee*. Any rot in the knees or any corrosion or cracking in the stainless steel at the knee or the chainplate can lead to a failure of the chainplate, which could bring down the mast. As with bulkheads, fixing the problem is a good deal easier than accessing the area in the first place. If a good part of the interior has to be removed to reach the knees, this could be a costly fix.

boat, to learn ways to reinforce and upgrade these areas before you head offshore.

Bluewater Survey

Once you narrow the field to specific boats, you will want to do your own inspection of the boat to see how it matches up to your expectations. The bluewater survey that follows pinpoints critical differences between a successful offshore voyager and a coastal cruiser. These details make for a safe, workable, comfortable cruising home; most apply to any monohull or multihull from less than 30 feet to more than 60 feet long. If your current boat meets the general requirements for stability and durability, see how it fares against the criteria below.

The survey that follows will not help you assess the construction quality of a boat or allow you to identify potential defects. That needs to be left to a qualified surveyor performing a professional structural and mechanical survey after you've decided to make an offer. But it will help you evaluate how the boat at hand will meet the demands of offshore voyaging and liveaboard cruising.

Whenever you look at a boat, ask for the owner's manual, all maintenance records, and the most recent survey available. The existence of an owner's manual and maintenance records suggests that the owner cares about the boat. The condition of the maintenance records and their content will give you a good feel for how well the boat has been cared for over the course of its life. If nothing else, it should tell you how many hours are on the engine and how well it has been serviced, at least by the current owner.

Although you cannot implicitly trust a survey that a buyer has in hand, its age and the comments in it can give you some useful information. If the survey is more than five years old, you should probably discount it completely except to see if the surveyor's recommendations, if any, were carried out by the owner. Any survey for offshore insurance purposes that is less than two years old will provide useful information.

Given a seaworthy, structurally sound hull capable of accommodating you and your proposed crew, almost everything else can be upgraded, changed, or fixed. But if the boat lacks most of the items in the bluewater survey that follows, the cost to make it offshore capable may prove prohibitive.

Sea-Safe Deck Layout

The boat's decks become your entire world at sea. They must offer a safe, comfortable environment even when chaos reigns just beyond. Each area needs to be well designed to meet its function: the cockpit must keep crewmembers secure and comfortable, the side decks must allow free movement forward and aft, and the bow platform must facilitate anchoring.

Secure cockpit. The cockpit gets used constantly, at sea and in port. In port you might like to have a comfortable cockpit that holds a small crowd. But at sea, you must have a small cockpit that drains quickly. With a boat between 35 and 40 feet, a properly sized cockpit seats up to seven people comfortably without using the coamings or coach roof as auxiliary seating.

A good offshore cockpit on a monohull has a bridgedeck or high sill to prevent a boarding wave from going below (Figure 3-10). The first or second hatchboard should come level with the top of the coamings to prevent downflooding into the interior, and you should be able to enter the cabin without removing those boards.

Figure 3-10.
The cockpit on this Cal 39 is properly sized for offshore work yet large enough for entertaining.

Cockpit drainage matters on every boat, but it matters most on smaller monohulls with poorly protected cockpits. Larger boats have enough buoyancy to support the weight of water their cockpits can hold, but smaller boats lose responsiveness and buoyancy if their cockpits are filled with water and may end up being rolled or flooded by a subsequent wave. Cockpit drains need to be large enough to empty the cockpit in 2 minutes or less after it has been filled to the level of the coamings by a large wave.

If there's a wheel, there should be at least 18 inches of standing room behind it and a way to brace your feet when the boat is heeled. On a catamaran, the helm should be positioned so the helmsman can see the bows and side of the boat for ease of docking. There should be a seat for the helmsman as well as comfortable watch positions under the dodger. On a monohull, the cockpit seats should be long enough to allow an adult to lie down on them and close enough together to brace your feet against one when sitting on the other. That means the seats should be about 6 feet long and a bit over 2 feet apart.

On most boats, the single biggest openings through the deck are for the cockpit lockers. Locker hatches should be watertight, reasonably sized, well secured, and fully protected by the coamings. Ideally, the lockers should not communicate directly with spaces below and should drain overboard. Otherwise, a lost locker hatch could lead to a sinking in heavy weather.

On a daytime watch in the tropics, your primary concern will be shade. Many voyagers' second offshore boat includes a well-ventilated hard dodger or pilothouse (see the Second Boats sidebar below). Short of a permanent structure, the cockpit must include some provision for rigging a canvas shade that can be securely stowed in storm conditions.

Safe decks. A safe deck is one that keeps crew from going overboard in any ordinary circumstances at sea. The single most important element in helping crew stay on deck is not lifelines, stanchions, handholds, or footholds—since none of these will help a crewmember who loses his or her footing—but nonskid. A good nonskid pattern molded into the deck of the boat is ideal. Other types of nonskid will need to be revitalized on older boats as discussed in the On Deck section in Chapter 4.

After good nonskid, deck safety depends upon a design that will keep crew aboard at sea as shown in Figures 3-11 and 3-12. Both of these side decks include all of the following:

- **Wide, unobstructed deck from bow to stern.** A good offshore side deck measures at least 18 inches wide and is unobstructed from bow to stern. Boats with high coach roofs and steep cabin sides will need even wider decks to allow a person to pass along them when the boat is heeled. To test the side decks, try walking the length of the lee side deck with the boat heeled 20 to 30 degrees.
- **Strong handholds always within reach.** A person should be able to reach a handhold strong enough to take his or her entire weight from any position on the deck. Acceptable handholds include dedicated handgrips along the coach roof, stays, stainless steel bars near the mast, or stainless steel cages over dorade vents (which also keep sheets from fouling the cowl). Lifelines should never be used as handholds because of the chance of their breaking. Walk around the boat and consider the common problem areas: stepping onto the side deck over the coaming, between the coach roof and the staysail stay, and at the mast.
- **High toe rail or bulwark that does not trap water.** When a monohull is heeled, footholds become as necessary as handholds. That means a toe rail or bulwark at

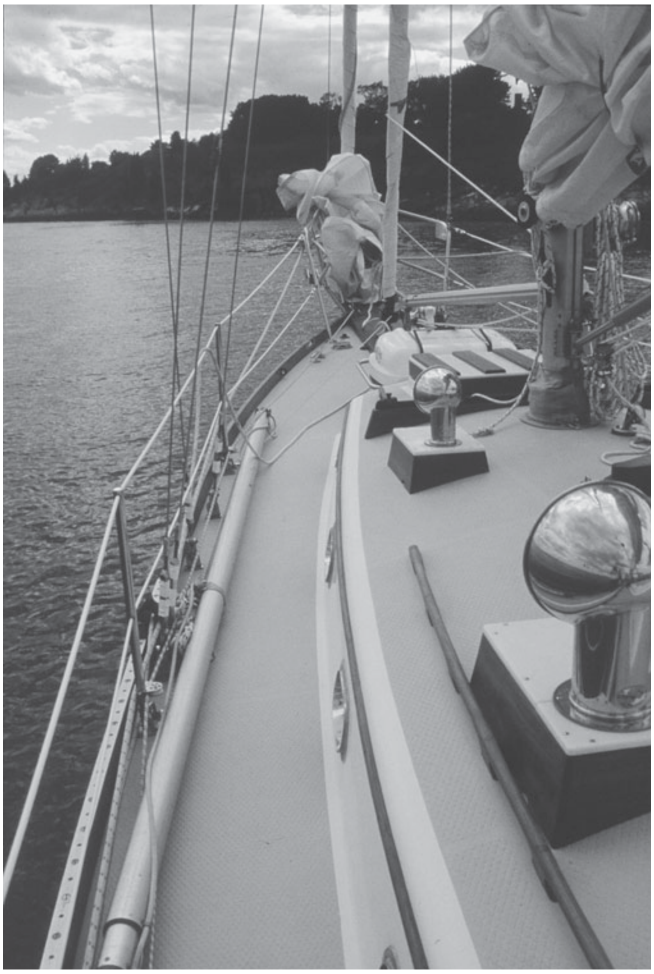


Figure 3-11.
Silk's side deck.

Figure 3-12.
Hawk's side deck.

least 4 inches high and strong enough to support several hundred pounds of weight. To keep the toe rail from trapping water and increasing the likelihood of leaks aboard, an open toe rail with holes every few inches (as on *Hawk*) works best. If the toe rail or bulwark is solid, as on *Silk*, the side deck should have several scuppers to drain water off the deck.

- **High lifelines with strong stanchions.** Lifelines provide the last defense against going overboard, not the first. When the full weight of a person hits wires and stanchions, they all too often fail. However, they can help you regain your balance if you still have one good handhold or foothold to support most of your weight. To be of any use, lifelines should be at least 28 inches high, well above knee level. Otherwise, they're more likely to assist a fall overboard than to prevent it. Stanchions should be strong enough that they won't bend if hit by the full weight of a person.

The side deck shown in Figure 3-13 would not make a good platform at sea. Getting by the main stays and ratlines would be difficult, especially with the boat heeled over. The handholds stop just before the stays and do not continue to the front of the coach roof. The bulwark will trap a lot of water on the side deck, and there are too few scuppers to drain it adequately. The tapered stanchions are undersized, though they are well secured to the bulwark.

All too often, designers seem to treat mid-deck spring-line cleats as an afterthought. On many boats, they prove too small to be of any use, with no way to make a line lead fair to them without chafing on the toe rail. Or they get left off entirely, as on older Swans. Given that, when in use, spring cleats hold two lines while other cleats hold one, they should be just as big as if not bigger than the bow and stern cleats—a minimum of 8 inches long; 12 inches is not excessive on a 45-foot boat (all *Hawk*'s cleats are 16 inches). Chocks or hawseholes in the bulwarks need to be oriented to allow lines to reach spring cleats from almost any angle (Figure 3-14).

Figure 3-13.
The side deck on this 40-foot boat would prove problematic at sea.

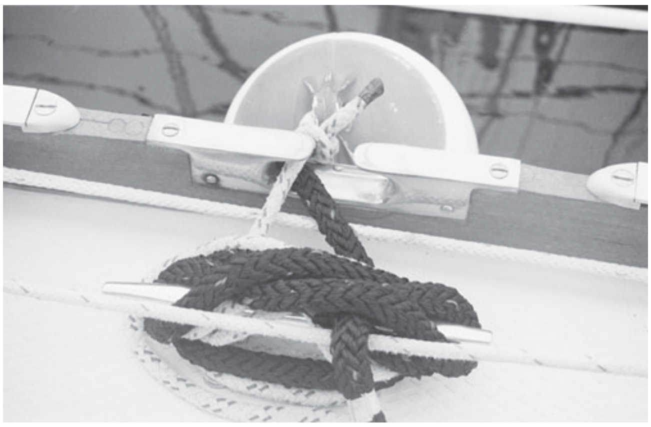


Figure 3-14.
Silk's spring cleat could hold two oversized lines in proper figure eights and had a solid chock that led lines fair from any angle.

Figure 3-15.
Anchoring platform on a Hood 50, a 50-foot fiberglass boat used for coastal sailing and racing.

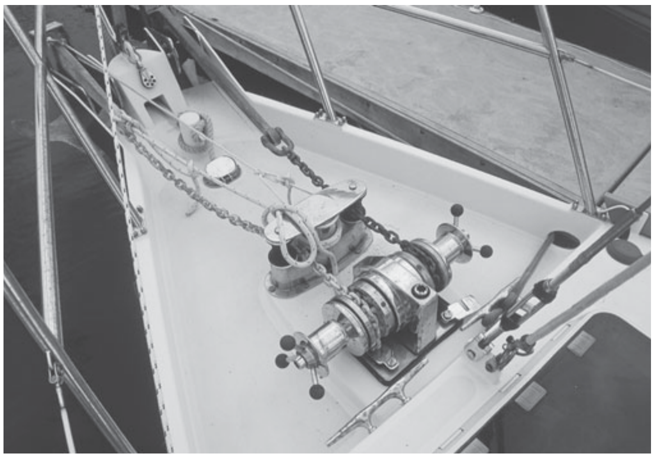


Figure 3-16.
Anchoring platform on a Waterline 48, a 48-foot steel boat that has completed two Pacific circles.

Well-designed anchoring platform. One of the easiest ways to distinguish an offshore cruising boat from its coastal counterpart is to look at the anchoring arrangements (Figures 3-15 and 3-16). Coastal and racing boats spend most of their time tied up in marinas, and their crews rarely if ever actually set an anchor. Cruising boats spend most of their time at anchor, and their crews deploy and retrieve heavy anchors and hundreds of feet of chain on a daily basis. A properly constructed, well-thought-out anchoring platform makes handling that equipment straightforward (Figures 3-16 and 3-17).

Figure 3-17.
Anchoring platform on a 52-foot custom Morrelli & Melvin catamaran.

To be fully functional an anchoring platform must be set up to allow two large anchors to be deployed or retrieved and should include all of the following:

- **Two large, properly designed anchor mounts.** On monohulls, the anchor mounts should be far enough forward of the stem of the boat so that anchors cannot swing into the topsides. A boat with a plumb bow will require a bowsprit. Bow rollers should be at least 3 inches wide, turn easily under pressure, fit snugly in the anchor mount without binding, and be strong enough not to compress or deform under large loads. The cheeks on either side of the roller should be well rounded and flared outward to prevent chafe when the rode is at an angle to the boat. Welded pipe makes excellent, chafe-free cheek plates. To keep the rode from jumping out of the mount, the cheeks need to be at least 2 inches higher than the top of the bow roller, and there must be provision to secure the rode or anchor in the mount.
- **Two or more big, stout cleats with proper fairleads.** Cleats should be large enough to hold at least two docklines cleated in proper figure eights. A line or rode passing over the bow rollers should lead fair to the bow cleats. A chock through the toe rail or a hawsehole through the bulwark (as shown in Figure 3-16) should be designed to create a chafe-free lead to each cleat for docklines. Cleats should be strong enough to hold up to two-thirds the displacement of the boat, as they may be called upon to do just that if the boat ever lies to a parachute in a storm.
- **Large windlass with both rope and chain gypsies.** Boats over 35 feet long should be equipped with a windlass, which should have both rope and chain gypsies so it can be used to retrieve a mixed rode as well as to take someone up the mast. Powered windlasses must be equipped with a manual override system that generates sufficient power to retrieve the boat's normal ground tackle.
- **Solid bow pulpit.** The bow pulpit is used as a platform for trying to read coral waters and as a ladder to reach the jib. It should be strong enough to take the weight of a large adult without flexing.

In comparison, on the coastal boat (Figure 3-15), the stemhead fitting contains a single anchor mount for a 45-pound anchor with a small bow roller and no cheek plates. The cleats are small and not adequately secured to the deck, and the chocks are poorly placed and too small to handle multiple docklines. The decades-old windlass does not have a manual override and lacks the power to lift a big anchor and all-chain rode.

On many modern production boats, the windlass is installed in a recessed deck locker and the chain falls into a small, self-draining chain locker below it. This creates far more problems than it solves. Such lockers are too small to hold adequate chain for an offshore boat. They are situated high in the front of the boat, the worst possible place to store heavy chain. But worse, when a bow wave rises up around the bow, the waterline rises as well, submerging the drain on many of these boats and causing water to flow into the locker to the level of the waterline when underway. This additional weight in the bow—along with the weight of the chain itself—will make the boat pitch much more than it should, slowing progress to windward.

In addition, it is virtually impossible to use a recessed windlass for the second anchor, for taking someone up the mast, or for winching the boat into a dock using a bow line. The location of the cleats almost always means that the snubber runs across the locker, blocking the doors, and the small drain holes in the locker often get clogged with seaweed or mud, leaving the windlass submerged. Try to avoid buying a boat with this arrangement, or look for ways to reconfigure the bow platform to overcome some of these deficiencies.

Seaworthy Interior

All interiors that are safe and comfortable offshore share certain attributes. These include a well-laid-out seagoing galley, enough seaworthy bunks, and adequate handholds and footholds. We also prefer a light, bright interior to keep things from getting gloomy when sitting out a gale.

Seagoing galley. Figures 3-18, 3-19, and 3-20 show three galleys on boats ranging from 34 feet to 52 feet long. All three possess the essential attributes to make them not only usable but also safe at sea. Unless you are

Figure 3-18.
S&S (Tartan) 34 galley.

Figure 3-19.
Cal 39 galley.

Figure 3-20.
Custom 52-foot catamaran galley.

planning to remodel the galley entirely, make sure you buy a boat with a layout that meets these basic parameters. Galley design is much less critical on a multihull, though the basic points still apply.

- **U-, G- or aisleway galley layout.** Almost every task in the galley requires two hands, which means the combination of body bracing and footholds must be enough to hold the cook in position even when the boat is heeled to 30 degrees or rolling hard from side to side. A U- or G-shaped galley layout gives the cook plenty of options for wedging in securely while doing normal galley tasks. Such a galley can be fitted even on very small boats, though there will only be one position for the cook to work in. On larger boats, a galley that lies along either side of the passage leading to the aft cabin creates much more workspace, allowing more than one person to work in the galley at a time.
- **Gimballed propane stove that can be locked in place.** A proper liveaboard stove should have three or four burners, should have an oven large enough to roast a Christmas turkey, and should run on propane. A proper seagoing stove on a monohull should be gimballed and able to swing freely to a 30-degree angle in either direction. It should also be fitted with a stout lock to secure it in rolly conditions in port or at sea. A crash bar should be mounted across the front of the stove to provide a strong point for the cook to lean against when working over the stovetop and to help prevent anyone from being thrown into an open flame.
- **Deep double sinks as close to the centerline as possible.** For offshore work on a monohull, the sinks need to be a minimum of 8 inches deep so you can keep enough water in them to wash dishes when heeled over. They should be located as close to the centerline as possible to ensure that they will drain and not backfill at any angle of heel. The sinks will provide one of your few secure places to put dishes, bowls, and ingredients

when cooking at sea. Two are much better than one, though on a boat under 35 feet it may be difficult to find the room without sacrificing all counter space.

- **Adequate footholds and bracing.** When working in the galley, there's no way to adhere to the old adage "One hand for the boat, one hand for yourself." Picture yourself getting something out of the hot oven while it swings in a rolly sea. You'll be crouched in front of the stove, making a safety belt useless, with both hands poised to catch whatever delicacy you've managed to create. To remain in position, you'll need solid footholds or something to brace your back against. The cabin sole needs to have a good nonskid surface—olive oil spilled on a varnished sole can turn a galley into a skating rink.
- **Accessible lockers with high fiddles.** From the safety-belted position in front of the stove, the cook should be able to reach the back of every galley locker and the far corners of the icebox. Lockers located behind the gimballed stove should not jeopardize important parts of the cook's anatomy, especially when the burners are lit. Lockers need high fiddles to prevent everything from falling out when opened. Sliding doors are preferable to hinged ones, as they will allow you to retrieve frequently used items without spilling the lot. Positive latches on all doors will keep them secure during gales.

Seaworthy bunks. No boat can become a permanent home without good, comfortable sleeping areas for use in port and on passage. To sleep well, you need to be able to stretch out completely. All berths should be at least 6 feet long and, ideally, 4 inches longer than the tallest person. Single berths for use in port should be a minimum of 24 inches wide; sea berths should be narrower to prevent the sleeper from being thrown around in rolly conditions—a minimum of 20 inches to a maximum of 24 inches. To comfortably sleep two, double berths need to be at least 4½ to 5 feet wide at the shoulders and 2½ feet wide at the foot.

Boat manufacturers tout how many people their boats can sleep, but they're only talking about sleeping when the boat is at rest. All too often, they overlook the need for berths that are usable when a boat is running downwind in a trade wind sea or close-reaching in heavy weather. Many large, modern boats with designer interiors—curved settees and separate seating nooks in the saloon and a walkaround double bed in the forward or aft cabin—have no workable sea berths at all. Sea berths are vital equipment: they determine how well you sleep at sea, which in turn determines your level of alertness and ultimately your safety.

While "hot bunking"—sharing a berth with another crewmember on a different watch—works fine on racing boats for short periods of time, it leaves crewmembers without any personal space and is not a viable solution for longer passages. Further, when becalmed, hove-to waiting to enter a remote port, or in the most severe weather, all crewmembers are likely to be below and in sea berths at least part of the time. Therefore, each regular crewmember needs a good sea berth, and if you ever intend to take on extra crew, you will need enough sea berths to accommodate them as well.

The forepeak berth cannot be considered a usable sea berth on most monohulls. Trying to sleep forward of the mast on any boat under 60 feet or so in trade wind conditions will mean spending half your time in the air—not an arrangement you'll want to live with for the long term.

To minimize motion at sea, good sea berths are parallel with the boat's centerline and as close to amidships as possible. On many boats, the settee seating doubles as sea berths with the addition of a lee cloth. Curved settee seats do not work as sea berths; the settees need to be straight and long enough to accommodate a tall crewmember. Although the settee location may be the most comfortable, this puts the off-watch right in the middle of any on-watch activity and limits the usefulness of the saloon for other crewmembers.

On monohulls, pilot berths—berths located above and outboard of settee seating, against the hull sides—provide a private space out of the main traffic flow. They allow the main saloon to be used for its primary purpose rather than becoming a tent camp during a passage, and they make excellent sea berths on any boat that's large enough not to require that space for stowage.

Larger boats will generally have an aft cabin with a single or double berth, and many smaller boats will have a small quarter berth. While the motion aft is a bit more pronounced than in the middle of the boat, the aft cabin or quarter-berth solution gives the off-watch real privacy and takes up less prime stowage area than pilot berths.

Adequate handholds and footholds. Nonskid, handholds, and footholds are just as critical to safety below as they are on deck. The cabin sole needs to be made from a good nonskid material like teak and holly or cork, or it needs to be finished with a nonskid coating. You should be able to reach a good handhold from any point in the interior even when the boat is heeled over. A good handgrip provides a full-fisted grip, not a finger hold. Short crewmembers may have difficulty reaching handgrips mounted overhead when the boat is heeled over. Vertical posts at counter or table corners make much better all-weather grips. Handholds and footholds are inexpensive and easy to install.

Many catamarans lack handholds completely, and this is a mistake. Although you won't use them while coastal cruising or in calm offshore conditions, when things start to get boisterous they become just as essential as on a monohull.

Many traditional, all-wood interiors are so dark they can be claustrophobic. A white roof liner of molded plastic, or white paint on the cabin trunk, can change the entire feel of a boat (see the A Real World Example: Reinventing *Ginny* section in Chapter 10). Beyond that, every area needs good lights for reading and working. Modern LED lights stay cooler, last longer, and use less electricity than fluorescent or incandescent bulbs.

Seaworthy Design and Construction Details

A boat can get the layout above and below right and still be wrong for offshore voyaging. To make sure a boat will prove to be a comfortable and practical long-distance voyager, you need to look also at design and construction details hidden inside lockers and behind ceilings. These include adequate stowage, accessible spaces, a high-quality engine installation, weatherproof ventilation, and watertight design and construction.

Adequate stowage. Most offshore boats carry an average of 2,000 pounds of personal belongings, food, fuel, water, and other things per crewmember (see the Why Weight-Carrying Ability Matters sidebar in Chapter 10). For that reason, an offshore boat needs much more of its interior volume devoted to stowage than a coastal cruiser of similar size.

To be most useful, that stowage should be divided into small compartments. Locker doors and drawers must all lock securely in place so they don't spill their contents at sea. Drawers should be notched on the bottom of the front edge so they must be lifted up before they will open. They should also have a small block on the bottom of the back edge that will stop the drawer from pulling out entirely. When comparing several boats, take a good look at the amount, location, and accessibility of stowage.

Accessible spaces. To fix anything, you first have to be able to get to it. Down below, that means complete access to the engine, every part of the bilge, every tank, every deck fitting, and every piece of equipment.

Good engine access means you can easily reach the oil dipstick; fuel and oil filters; air filter; water, fuel, and oil pumps; injectors; starter motor; and gearbox. Good plumbing access means you can reach every tank, through-hull, and seacock. Good electrical access means you can find and inspect every bus bar, terminal, and switch. At some point you will also need to reach the steering system, autopilot ram, and windlass motor. Good access to mechanical equipment is near the top of the list for experienced voyagers buying second boats (see the Second Boats sidebar below).

Bilge access is almost as critical. Can you access the entire bilge from bow to stern? Pull up floorboards and open the chain locker and the area under the forepeak bunk and uncover as much of the bilge as possible. You should be able to access every area of the bilge along the centerline of the boat—if not with your hand, then with a short length of wire rod. You should be able to reach all seacocks within 1 minute.

In addition to being accessible, a well-constructed bilge channels water to a deep sump and keeps it there until it is pumped overboard. Many flatter-bottom modern designs have small sumps, and water tends to overflow into the rest of the bilge and onto the cabin sole.

Limber holes should be drilled in all structural members that might otherwise trap water, and you need to be able to inspect those limber holes and clear them of trapped silt and sand. If the head has its own shower pan and a separate drain overboard, you still need to be able to access the bilge underneath. If not, you will have to find another way to clear the limber holes under the head pan liner.

The bilge needs to drain from bow to stern without trapping water anywhere along the way. Take several buckets or a hose and pour water down the hawsepipe. Start from the chain locker and work back to the sump, tracing the path the water takes and noting where it pools and sits. Mold and mildew will grow in any area that traps water, eventually resulting in rot and unpleasant odors.

Bilge drainage has to work when the boat is at an angle, not just when it is flat. When you take a boat sailing, turn off the bilge pump and fill the sump. While beating on either tack, go below and figure out where the water has gone. It won't be in the sump! On most boats, water will pool amidships under settee berths or aft under the galley stove or nav station. Don't worry if a small amount of water is involved and returns to the sump quickly when you come back upright. But if more than a few gallons find their way out of the sump and don't return when the boat comes upright, you will have to locate and drain the area that is retaining the water as part of your refit.

Dirty tanks are an occupational hazard of offshore voyaging. Often, you cannot be certain of the quality of water and fuel. Some minerals cause scaling, and on older boats, the tanks will probably need to be cleaned as part of a refit. Removable hatches allow tank access for inspection and cleaning; these hatches should be accessible without dismantling the interior.

Deck fittings should be easily accessible from below so that they can be rebedded. If fittings are not accessible, you may have to add access panels through bulkheads, ceiling liners, or locker trim pieces. Boats with no interior trim or moldings will be simpler to work on, but they may not be as aesthetically appealing. You will need to find a balance between appearance and convenience that works for you.

TABLE 3-8. IDEAL VENTILATION BY AREA FOR THE TROPICS			
Location	**Hatches**	**Portlights**	**Dorades**
Main living area	Two to four large, adjustable	Two to four on each side of boat	Four
Galley	One	One	One
Heads	At least two of any type plus louvered door		
Sleeping cabins	At least two of any type plus louvered door		

High-quality engine installation. Proper engine installation and diesel tank construction will save untold heartaches down the line. To keep oil and diesel out of the bilge, the engine should be mounted over a solid fiberglass or metal engine pan. It should be bolted to mounts, which are in turn bolted and glassed to structural frames. In the event of a capsize, there must be no chance of the engine breaking loose.

Contaminated fuel causes most engine problems. The diesel tank needs to have a sump—an indentation in the bottom of the tank where the dirt and water that settle out of the fuel can pool. The outflow from the diesel tank should be located above this level. This sump must be drainable, even at sea. Otherwise, a fuel problem could result in an engineless passage, or you could ruin your engine with seawater or dirt.

Weatherproof ventilation. Many production boats lack sufficient ventilation for the heat and humidity of the tropics. Poor ventilation contributes to the growth of mold and mildew and makes for damp, uncomfortable berths at sea. In high latitudes, it leads to condensation. Offshore boats need large opening hatches, ideally one for each major living space aboard (Table 3-8). High-quality opening ports should be located throughout the boat, but at a minimum in the head and galley. Catamarans with large saloon windows should have louvers or mesh screens fitted to keep the area from becoming a sauna in the tropics.

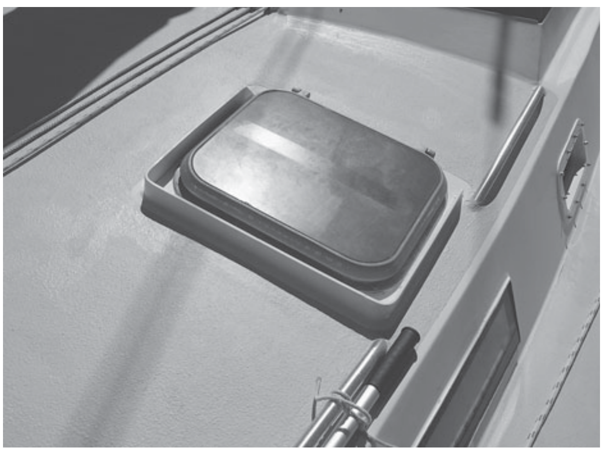
Ports and hatches cannot be used for ventilation on monohulls in boisterous conditions at sea. On most boats, dorade vents are the only source of ventilation in heavy weather. Four large dorades should be considered the minimum on a 35-foot boat. All ventilation, including dorades, must be watertight in extreme conditions. Crews on boats with all the ventilation options shown in Table 3-8 will never have difficulty keeping cool whether hove-to in a gale at sea or tied up in a windless marina. Most production boats will need to have their ventilation upgraded to be comfortable in the tropics as discussed in the Improve Your Boat's Ventilation section in Chapter 4.

Watertight construction. A watertight boat starts with a strong, rigid, well-built hull that isn't prone to flexing and working. Older teak decks can be a major source of leaks, and replacing or removing them will involve a significant investment. On many newer boats, teak decks are vacuum-bagged in place without mechanical fastenings, making them much less prone to leaks. However, teak is heavy, hot in the tropics, expensive, environmentally unfriendly, and increasingly difficult to obtain, and works no better as nonskid than various types of paint. Unless your taste runs to classic boats, you'll be better off avoiding teak decks all together if you have the choice.

Beyond that, the following construction details all contribute to a dry boat:

- Strong, commercial, ocean-rated hatches with structural crosspieces supporting the Lexan or acrylic and either set on plinths above deck level or protected by wavebreaks (Figure 3-21).
- Ocean-rated opening portlights installed so they drain onto side decks instead of pooling water at the bottom of the port; no portlights located below the waterline at normal angles of heel.
- A properly constructed companionway, which on monohulls includes a watertight seahood surrounded by drainage channels (Figure 3-22).
- A fully weatherproof door (see Figure 4-5) or strong, easy-to-use hatchboards that can be fixed in place at sea.
- Strong, positively locking hatches for deck and cockpit lockers with channels around them to drain seawater (Figure 3-23).
- A hull-to-deck joint built with overlapping flanges or completely glassed over with several layers of fiberglass.

Figure 3-21.
Hawk's wavebreaks protect the hatch seal from taking the full impact of a wave.



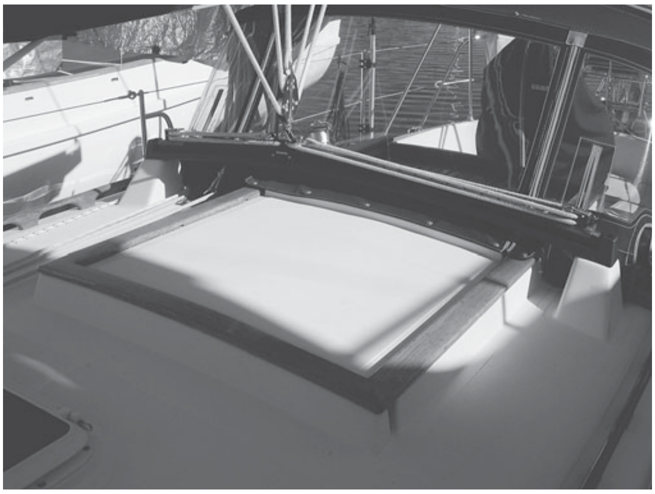


Figure 3-22.
Seahood with drainage channels protecting the hatch.

Figure 3-23.
Strong, positively locking cockpit locker with drainage channels.

- Stanchion bases mounted on a solid toe rail or on solid fiberglass pads raised above deck level to keep them out of water pooling on the deck (Figure 3-24).
- Solid stainless steel backing plates installed wherever bolts go through the deck.
- A watertight way to seal the hawsehole at sea.
- Ultra-high-molecular-weight polyethylene (UHMWPE) rudder bearings.
- Dripless stuffing box.
- High-quality bronze (Marelon for metal boats) seacocks.
- Double stainless steel hose clamps on all drainage, engine, and plumbing hoses.

Finally, make sure that diesel tank and water tank breathers are protected from flooding to prevent salt water from siphoning into your tanks. *Silk*'s diesel tank

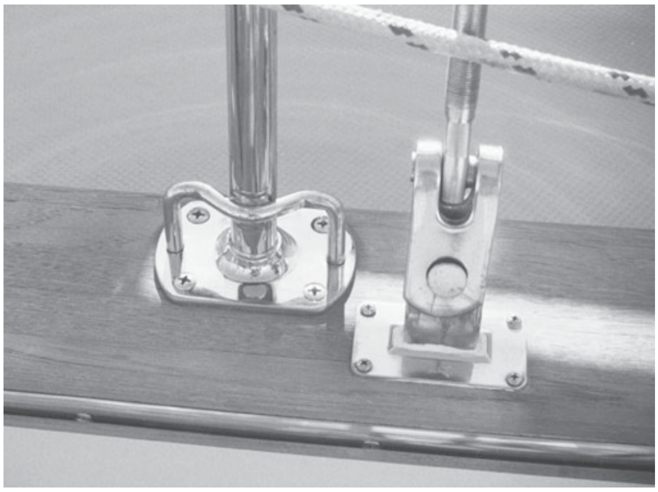


Figure 3-24.
Stanchion bases mounted on the toe rail.

breather was located in the cockpit, below the level of the cockpit seats. On one occasion, a breaking wave filled the cockpit, and salt water siphoned through the breather into the diesel tank. It took us half a day in rolly seas to pump out the diesel tank sump and bleed the engine.

Very few boats will have all of these construction details, and some boats that have successfully completed long voyages haven't had most of them. But the more of these items you can check off for the boat you eventually buy, the drier and safer it will be.

Smell offers the very best proof of a dry boat. Any hint of mildew or dampness in the air when you first open the boat up should make you dig deeper. But if it smells fresh and sweet after being shut up for several days or weeks, you can be almost sure that it will be watertight.

Satisfying Aesthetics

No matter what this chapter suggests, acquiring a boat is not a linear process. You bring to it all sorts of preconceptions, experiences, prejudices, and knowledge. It often begins before the idea of going cruising has even been voiced aloud. At some point while walking along a dock in some marina, a boat caught your eye, and for an instant you could picture yourself at her helm approaching a distant landfall with her sails bellied out by trade wind breezes. That moment will come back to mind when you make the decision to go cruising and begin actively searching for the right boat. Whatever boat you eventually decide upon should touch you in just that way.

Feeling good about your boat and finding it pleasing to the eye do matter. When asked about picking a boat for offshore cruising, many experienced voyagers put aesthetics at the top of the list. That's because loving your

SECOND BOATS

When it comes to boats, experienced sailors quip that it's best to do a "quick" circumnavigation, and then, when you've figured out your cruising style and where you like to sail, buy your ideal boat and spend the next decade exploring the world. But for those trying to get the boat right the first time around, knowing what attributes these second boats share provides some valuable insights.

We have met thirteen couples who completed a long voyage and sold their boat, only to buy another boat a few months, a few years, or a few decades later and head off again. All of them bought a larger boat, on average 10 feet longer. Most of them wanted to buy a metal boat, though not all of them found a metal boat that met their standards and that they could afford. Their first boats averaged 33 feet long, with the longest measuring 44 feet; 9 were fiberglass and the rest wood. Their second boats averaged 43 feet long, with the longest measuring 62 feet; 6 were metal, 5 fiberglass, and 2 wood. Six of the second boats were production boats (2 of them Hallberg-Rassys); 7 were custom or semicustom boats, 3 of those purchased used. Three of the 4 new custom or semicustom boats were partially or completely built by their owners.

Everyone had their own "must-haves" for their second boat, and although some of these were unique to the crew's needs or cruising plans, a surprising number of attributes ended up on almost every list. More than half of the second boats had the following in common:

- Hard dodger or pilothouse
- No wood on the exterior
- Watertight bulkheads in bow and stern
- 2 to 3 inches of insulation above the waterline
- Wet locker or head near the companionway for shedding foul-weather gear
- Spacious engine room/workroom to keep noise and dirt out of the main living area
- Total engine accessibility
- Extra fuel and water tankage to extend the cruising range (200 gallons of each on many second boats)
- Spacious sail locker with direct access to the deck through a large hatch
- Dedicated sea berths
- Separate guest cabin

But second boats have more in common than their layouts. Most of the couples who wanted metal boats were not primarily concerned with strength. Rather, they were interested in making the boat truly watertight. On *Hawk*, as on most of the other second boats that are metal, we have tried to eliminate any holes through the deck. Cleats, stanchion bases, handgrips, and dorade vents have all been welded to the deck, and genoa tracks have been bolted to a piece of flat bar welded to the deck. Wavebreaks divert water away from the hatch seals, and the hard dodger protects the companionway from waves washing down the deck.

The second boats, though bigger, all have well-thought-out sail handling arrangements so that one person can easily raise, reef, and douse all working sails. Their anchoring platforms make it easy for one person to handle large anchors and all-chain rodes, and cleats and winches are positioned to allow maximum flexibility when tying up. Most of the boats have multiple self-steering options and a way to control the self-steering while staying protected from the elements. These attributes make a boat safe and easy to sail shorthanded, a high priority for experienced couples.

boat will help you overlook her faults, and every boat has faults. If you get a thrill motoring up to your boat in the dinghy and think she's the best-looking yacht in a crowded tropical anchorage, you'll resent it less when the head clogs or the generator breaks down.

Some old salt likened finding the right boat to finding the right spouse: no matter how rational you try to be about it, at some point you may just fall head over heels in love. Hopefully it will be with a sturdy, seaworthy, well-built boat, and the rest of your crew will feel the same way.

The Test Sail

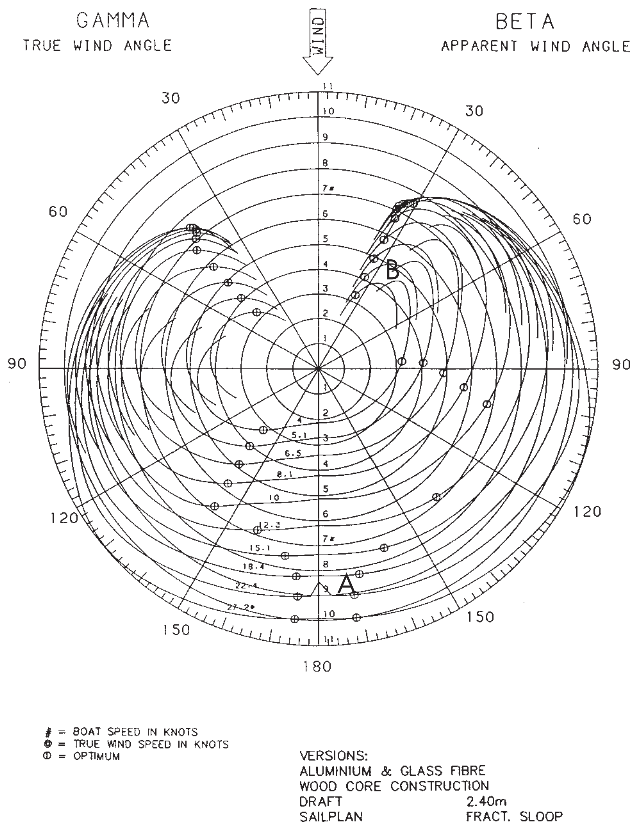
A boat that sails well requires less fuel, puts less wear and tear on its equipment, keeps its crew safer, and gives them a greater sense of satisfaction than one that does not. In a perfect world, no one would buy a boat for bluewater voyaging without first sailing it or a sister ship on a long offshore passage. In the real world, most of us have to make a judgment about a boat's sailing capabilities from an hour or so of coastal sailing.

You can learn a great deal about how a boat sails even before you step aboard if you can obtain a polar diagram for the boat. Like the stability curve, this diagram captures in one neat summary page a tremendous amount of detail about how the boat should act in the real world. The polar diagram summarizes the boat's predicted sailing speed in flat water for each angle of true and apparent wind in true wind speeds ranging from less than 5 to over 25 knots.

Figure 3-25 shows the polar diagram supplied by the designer for our current boat, *Hawk*. In the diagram, the circle represents various wind angles, with true wind angles from 0 to 180 degrees around the left half of the circle and apparent wind angles over the same range in the right half of the circle. The concentric circles moving out from the center represent boat speed. The scales for wind angle and boat speed create a sort of bull's-eye upon which the performance of the boat can be graphed.

The curved lines that begin at about 31 degrees on the true wind side and continue around counterclockwise to about 28 degrees on the apparent wind side chart the boat's expected performance in a given amount of true wind (as shown by the numbers just above these curves running outward from the center, just to the left of the boat speed numbers). The places where the curves overlap represent headsail changes that reflect the boat's normal sail inventory. Thus, in 18.4 knots of true wind running close to dead downwind (160 degrees apparent), *Hawk* should sail at just over 8 knots under a 1,700-square-foot spinnaker (A on Figure 3-25); in 6.5 knots of true wind, *Hawk* should be able to sail at 5 knots 28 degrees to the apparent wind (B on Figure 3-25) under her blade jib.

Figure 3-25.
Polar diagram for Van de Stadt 47 Samoa design constructed in aluminum. (Courtesy Van de Stadt Design)



Many manufacturers provide polar diagrams for the boats they build. As with stability curves and performance ratios, these are subject to manipulation, and they can be difficult to compare across manufacturers. Rating agencies like the RORC and the U.S. Sailing Association create comparable sailing performance data for all rated boat models (see the Performance Information section in the resources for this chapter in Appendix 1). The USSA's IMS certificate, for example, includes enough information to construct a rough polar diagram for a given boat. These can be purchased from USSA for a modest fee. More sophisticated information is provided by some rating agencies for a higher fee.

Polar diagrams show a boat's theoretical best speed in flat water in racing trim, which will be considerably faster than what a given boat will actually manage fully loaded in large waves offshore. They are most helpful in comparing the sailing performance of several boats. But polar diagrams tell you nothing about how a boat feels while sailing (whether she pounds or pitches, yaws or rolls) or how balanced she is (how much helm it takes to keep her on course).

Reliable self-steering depends upon a well-balanced boat. A well-balanced boat requires little rudder to hold her on course and little force to apply that rudder. In a perfectly balanced hull, the amount of helm required to hold the boat on course does not change with the angle of heel. A poorly balanced boat will round up or fall off as the wind gusts and the angle of heel changes. The amount of force required to hold such a boat on course increases with wind speed; the crew will be constantly adjusting the steering or the sails to stay on course. The boat will have to be reefed early for the self-steering to operate.

The only way to find out how a boat balances and sails in cruising trim in moderate waves is to go out and sail it. Assuming you can't take the boat on an offshore passage, you should try to sail the boat or a sister ship at least twice, once in a strong breeze and once in light air. Take the boat out and sail it on all points of sail. If you have a polar diagram for the boat, you want to see how close the boat's actual performance comes to the optimum, which will tell you something about how much the boat's true weight and windage affect performance.

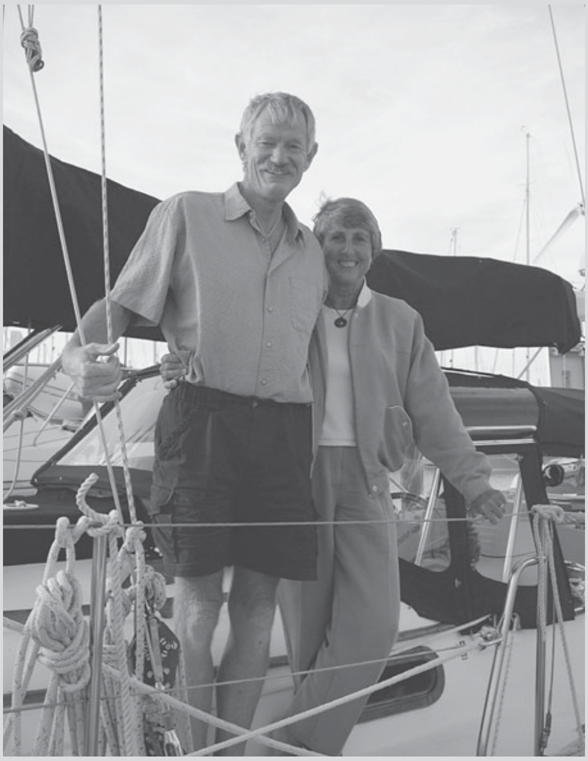
To get a feel for a boat's ability in a strong breeze, take the boat out on a day with wind speeds of 15 to 18 knots

ONE COUPLE'S SEARCH

Tom and Christine Harper are Kiwis who were living and working in the United States when they began their boat search. They have now been sailing their Peterson 44, *Mahurangi*, for five years (Figure 3-26). Tom told us how they found their boat:

> "When we first went looking for a cruising yacht we had no cruising experience, just coastal sailing in other people's boats (the cheapest option). I was looking for a stout Westerly 43 or Crealock 37 that could sail anywhere in any conditions. Having been vicariously educated by reading Hiscock, Chichester, and others, I was sure we needed a boat that could take on the North Atlantic.
>
> "But when we looked at such boats, Christine said, 'They look like sewer pipes inside'—cramped and claustrophobic. She wanted a boat that would be a home and could be lived in comfortably. Her ideal was along the lines of a Hans Christian 43. But I looked at these and thought they would sail poorly. My ideal was a fast, safe passagemaker, and hers was a comfortable liveaboard cruiser. It hadn't occurred to me that we would be living on the same boat!
>
> "Unfortunately, not many boats end their cruises in Seattle, as it is hard to get up the west coast from Panama, so we didn't have many boats to pick from. We got ourselves a good broker who showed us a lot of boats, but none seemed to do the trick except those way beyond our means. Eventually we found a Spindrift 46—the perfect boat. We both remember the log being open to the page where the boat entered Papeete, Tahiti—a seductive thought. We would have said yes, but our business was headed into a slowdown, and it didn't seem like the right time to be spending a large amount.
>
> "So on to more boat shows. These are useful, and we came home armed with lots of brochures and neat ideas, but the price tags were scary. We had decided that a boat in the 39- to 45-foot range could satisfy all our ideals of safety and comfort and accommodate family visits without overcrowding. But new boats in this length range were up in the $300,000 to $450,000 price range, and we needed to fit into the $100,000 to $150,000 range.
>
> "So back to pre-loved boats. From Seattle we took trips to San Francisco and Fort Lauderdale to see a greater range of boats. We saw a Peterson 44 in San Francisco, and although it was in poor shape we liked the practicality and layout. Back in Seattle after several weeks of absence, we caught up on the local magazines and found a Peterson 44 for sale and still available. We looked, and it was the one, and here we are.
>
> "All in all, it was a two-year process. But most important, the search gave both persons involved the chance to look at a range of options, get educated, talk to a lot of people (not just brokers), and figure out what was important. If you do all that, and agreement can be found, then you'll select the right boat."

Figure 3-26.
Tom and Christine Harper on their Peterson 44, *Mahurangi*, in New Zealand.



minimum, strong enough so that close-hauled the boat will need at least one reef. You'll learn more with more wind—20 to 22 knots ideally—and seas of at least 3 to 4 feet. Under appropriate canvas, the boat should be capable of maintaining at least 4 knots and making forward headway tacking into the wind and waves at 2-minute intervals for ten tacks. If the boat comes to a standstill in the middle of a tack, it will not be able to tack in larger seas.

Sailing close-hauled, it should heel no more than 30 degrees in these conditions, and preferably around 20. You should be able to steer the boat with one hand on all points of sail. The autopilot should be able to steer the boat dead downwind without jibing the main. The boat's motion should not be excessive on any point of sail; it should not pitch, pound, or slam going to windward or yaw or roll going downwind.

If the boat has any vices, it will become ill-mannered under a bit too much canvas. Shake out a reef and overpress the boat. Though the lee deck may be awash going to windward and the boat may yaw more going downwind, it should remain manageable and in control on all points of sail. You may no longer be able to control the helm with one hand, but you should be able to do it with two hands without using more than moderate force. If the rudder is properly sized for the boat, you should also be able to bear off from a close reach without easing the sails. If you can't do so in these wind speeds, you may well find yourself in serious trouble some dark night when a squall hits, and the boat rounds up and won't bear off.

If you're still not worn out, put the reef plus another back in. See how the boat sails when slightly undercanvased on all points of sail. How much speed does it lose? Does it start to wallow or hobbyhorse? Can the wind vane and autopilot still steer the boat? If it's able to handle both a little extra and not quite enough sail, you'll spend a lot less of your time reefing and raising sails in squally tropical conditions where 30-knot blasts alternate with nearly windless periods.

Are you managing to do all this sail handling with just two people? Would it be possible to do it single-handed? If not, you'll need to carefully consider whether or not the boat can be retrofitted so one person could handle it alone.

In evaluating all of this, take into consideration the quality of the sails and how well tuned the rig is. If the boat hasn't had any attention in five or ten years, you can expect to gain as much as 5 degrees in pointing ability and lose up to 5 degrees of heel when close-hauled with new sails and a well-tuned rig.

Although not, strictly speaking, part of sailing performance, you will want to test the boat's abilities under power while you're out. The boat needs to be able to push its way through the waves at cruising rpm if it is to be able to stand out to sea over a river bar into an onshore breeze. It must power up from a standstill into those waves in less than 30 seconds if it's not to get carried into shallow water before it gets way on.

On a trade wind circumnavigation, you will spend more of your time in apparent winds under 10 knots than over 20 knots. To get a feel for a boat's ability in light air, take the boat out on a day with true wind speeds of no more than 5 to 8 knots, preferably with a large swell left over from a dying breeze or in an area with a lot of motorboat wakes. Then sail the boat on all points of sail and try to discover when it loses steerageway. To get an accurate sense of the boat's abilities, be patient; ease the sheets beyond what you normally would, and give the boat 10 minutes or more to settle in on any course.

Lee helm and excessive helm movement both destroy light-air performance by increasing rudder drag. A well-designed boat will have a totally neutral helm in light air and need almost no rudder movement to stay on course dead downwind. In less than 8 knots of true wind and a slight swell, a boat capable of maintaining steerageway downwind and of sailing close-hauled at 4 knots or more while tacking through less than 110 degrees will do very well in light, offshore conditions.

We buy our boats to sail offshore, so it only makes sense to learn as much as we can about sailing performance before we buy. Yet all too often, people purchase offshore boats without ever having sailed them. If you manage to do everything I've suggested in this section, you shouldn't uncover any major surprises when you start sailing your boat offshore.

THE SEARCH PROCESS FOR THREE CREWS

When each of our crews began their search, they all wanted a safe, seaworthy boat with a proven record offshore that was within their budget. Beyond that their key priorities were quite different, as shown in Table 3-9.

After several months of learning about boats, going to boat shows, wandering marina docks, and reading anything boat-related they could get their hands on, each couple had developed screening criteria and narrowed their search to a dozen or so brands that met their requirements. Table 3-10 shows the criteria each had selected, based on their budgets and their priorities.

To find a boat within their budget, Susan and Simon Simplicity knew they would have to look at older boats under 35 feet long. To make sure the boat would be seaworthy, they considered only boats with an LPS of at least 130 degrees that met the other screening values for stability. That requirement determined boat type—that kind

TABLE 3-9. PRIORITIES IN ORDER OF IMPORTANCE FOR EACH COUPLE		
Simplicitys	**Moderations**	**Highlifes**
Lowest possible total cost for seaworthy boat	Separate cabin for each child	Sufficient room for family and friends
As simple as possible to minimize costs	No more than 45 ft. long	Easily handled by two people
Excellent stability	Good resale value	Close to new to minimize maintenance during voyage
		Fully equipped with all the luxuries

of stability would be easiest to find in an older traditional voyager.

It took Susan and Simon six months to find *Simplicity*. They realized after less than two weeks that their boat was not going to be listed by a yacht broker and was not going to be on any of the brokerage databases they had spent hours searching. Instead they started haunting marinas and boatyards, looking for boats that had been all but abandoned. They followed up on a dozen, only to find that half were out of their price range and half were not for sale.

Simon found *Simplicity* sitting on the hard in a rundown boatyard he stopped to visit on a trip to Perth for his postdoc. It took him several days to trace the owner,

TABLE 3-10. OFFSHORE CRUISING BOAT SEARCH CRITERIA FOR THREE COUPLES			
	Simplicitys	**Moderations**	**Highlifes**
Type	Traditional	Catamaran	Performance cruiser
Size (ft.)	~30	38–42	~50
Age	Senior	Middle-aged	Nearly new
Particular preferences	High stability: LPS >130°	Three-cabin layout	Ketch for ease of sail handling
Budget for boat	\$15,000	\$120,000	\$425,000
Budget for refit	\$15,000	\$80,000	\$75,000
Total Budget	**\$30,000**	**\$200,000**	**\$500,000**

but in the end, they purchased the 30-year-old, 33-foot, heavy-displacement boat for \$16,000, leaving them \$14,000 to refit the boat and purchase equipment. The survey found some minor osmotic blistering and a bulkhead that needed to be rebonded, but otherwise the boat seemed in fine shape. They were certain that when the time came to sell the boat, they would be able to recover the \$15,000 they had borrowed from Susan's parents in order to pay off the loan.

Michael and Molly Moderation were planning to put more than half their total assets into a boat, so they were concerned about resale value. After much discussion with Max and Mindy, they decided they needed a separate cabin for each child. They started out looking exclusively at monohulls. They went to several boat shows, but sticker shock quickly discouraged them. They turned to the used boat market and started looking at 10- to 20-year-old boats. Though quite a few boats met their other criteria for a price they could afford, they found that not many monohulls of that age had a workable cabin arrangement for a family.

Gradually they started to consider the advantages of a catamaran, but the only older cats on the market had been chartered, and they had already decided they would not buy an ex-charter boat. Eventually they found several cats in their price range under 40 feet long, but although these had space enough for all four of them, they all preferred the layouts on several 40-foot catamarans. They were in no hurry; it would be five years before they had saved enough money to make the break, and they assumed something would come along sooner or later.

They had been working closely with a yacht broker who had taken an interest in their search. Three years after they had first started looking, he called them to say that a 13-year-old, 40-foot, brand-name catamaran had just been listed for \$160,000 by a "motivated" seller. The boat had never been chartered. It had done extensive coastal cruising around the UK and had most of the equipment they would need for offshore sailing, though some of it was dated. They offered \$135,000 and the owner countered with \$150,000. Eventually they settled on \$145,000, leaving them \$55,000 to refit the boat. They had the cat thoroughly surveyed by a well-respected surveyor, who uncovered no structural defects.

Hugh and Hilary Highlife wanted a large, comfortable boat that could be easily handled by two aging crewmembers. They traveled extensively, looking at a huge variety of boats and sailing about a dozen. They decided they wanted a ketch to make sail handling easier, which greatly limited the number of boats available. They were never able to find a boat that incorporated everything they wanted in 50 feet, and ended up buying an 8-year-old, 52-foot, production fiberglass ketch.

The boat had been manufactured in Europe and sailed to the United States, where it had been purchased by a couple very similar to them. That couple had refitted it completely. But a sudden heart attack had scuppered the other couple's cruising plans, and the boat had been put back on the market. The survey showed the boat had no structural defects, was well built, and had been well maintained. They paid $430,000 to buy the boat, which left them $70,000 for upgrading equipment. Because the boat is a brand well recognized in Europe, they were confident they would be able to recover most of their investment at the end of the voyage.

TWO BOATS, TWO VOYAGES

We have now sailed two very different boats over 35,000 nautical miles each on two very different voyages (Table 3-11). When we were looking for our first boat, we had virtually no offshore sailing experience and no firsthand knowledge of what type of boat would suit our needs. We were planning a standard trade wind circumnavigation and knew that would entail mostly downwind sailing.

We built our second boat to cruise the high latitudes. During our tropical circumnavigation, we had figured out what was important to our cruising style. Based on that, we had developed a shortlist of attributes for the "next" boat (see the Second Boats sidebar above). According to experienced high-latitude cruisers, the boat needed to be capable of going to windward in

TABLE 3-11. *SILK* AND *HAWK* COMPARED: BASIC MEASUREMENTS

	Silk	*Hawk*
Voyage	Westabout trade wind circumnavigation by way of Panama and South Africa	Eastabout high-latitude circumnavigation by way of Iceland, Chile, and Australia
Design	Shannon 37	Van de Stadt 47 Samoa
Material	Fiberglass, cored decks	Aluminum
Underbody	Modified fin keel with centerboard, skeg-hung rudder	Fin keel with bulb, spade rudder
Rig	Double-headsail ketch	Fractional sloop with inner stay
LOA (ft.)	37.75	46.92
LWL (ft.)	30.8	39.42
Maximum beam (ft.)	11.5	14.75
Working sail area (sq. ft.)	750	1,277
Draft (ft.)	4.3/7.5	6.9
Ballast (lb.)	7,000	14,000
Published displacement (lb.)	17,500	30,000[1]
Half-load displacement as cruised (lb.)	21,500	37,000

[1]Published displacement less estimated 2,000 pounds for weight savings as built.

(continued on next page)

30 knots and the accompanying seas, or we would spend a lot of time hove-to waiting for weather; it also needed to be easily driven and to sail exceptionally well in light air, or we would end up motoring a large percentage of the time. But we couldn't sacrifice strength to get this sailing performance. The boat had to be strong, simple, and durable to stand up to cruising in rugged, remote areas with almost no repair facilities.

The two boats we ended up with turned out to be quite different along just about every measurable parameter (Tables 3-11 and 3-12). Calculating the ratios based on published displacement numbers puts our Shannon 37, *Silk*, right on the border between traditional voyagers and performance cruisers. Her underbody, with its modified fin keel and skeg-hung rudder, closely resembles the Valiant 40's, and her DLR of 267 is only a bit heavier. But most of her other ratios put her in the traditional category.

Our Van de Stadt Samoa, *Hawk*, is an early IOR design dating from 1978, and her ratios straddle the border between performance cruisers and racer/cruisers. Though her fractional rig, fin keel, spade rudder, and relatively wide beam look similar to many of the racer/cruisers being built today, she displaces more, carrying much of her ballast in a bulb at the end of a fin keel. Thanks to that extra displacement, her DLR and motion comfort ratios fall within the performance cruiser category, but the rest of her ratios fall within the racer/cruiser group. Her overall displacement gives her good weight-carrying ability and makes her comfortable at sea, while her ballast ratio allows her to carry plenty of sail area.

The two boats are very different to sail, handle very differently in heavy weather, and behave very differently under power. While some of this difference is due to size, most of it reflects their types—a double-headsail ketch with modified fin keel and ratios close to a traditional voyager versus a fractionally rigged sloop with a modern underbody and ratios close to a racer/cruiser. The differences between them may help you decide which type of boat makes sense for you.

As Table 3-13 shows, *Hawk* is a much more capable boat to windward than *Silk*. *Hawk* ac-

TABLE 3-12. *SILK* AND *HAWK* COMPARED: THE RATIOS

Ratios	Published Values	
	Silk	*Hawk*
DLR	267	219
SA/WSA	~2.5	~2.7
SA/D	17.8	21.2
L/B	2.9	3.0
Ballast ratio	34%	45%
Motion comfort	30.9	28.8

TABLE 3-13. *SILK* AND *HAWK* COMPARED: SAILING PERFORMANCE AT HALF-LOAD DISPLACEMENT

	Silk	***Hawk***
Close-hauled best apparent wind angle/speed:		
Flat water (degrees/knots)	38/5.5	28/7.5
Big seas (degrees/knots)	45/4.0	32/7.0
Tacking angle including leeway:		
Flat water (degrees)	100	87
Big seas (degrees)	120	98
Degrees of heel close-hauled	30+	~20
Theoretical hull speed (knots)	7.3	8.4
Overall average passage speed[1]:		
Miles per day/knots	117.7/4.9	148/6.2
As percentage of hull speed	66.9	73.3
Best day's run without current (mi.)	168	200
Best as a percentage of hull speed	95.5	98.1
Maximum speed ever attained (knots)	9.4	16.9

[1]After more than 35,000 nautical miles sailed in each boat.

celerates more quickly and is more easily driven through the water than *Silk*. But to get the most out of her, we work harder trimming, reefing, and raising sails, and the self-steering works harder keeping her on course. Whereas we could trust *Silk* to average things out in shifty conditions and to handle just about anything for 15 minutes until we got some sail off, aboard *Hawk* we have to pay more attention to when the weather might change so we're not caught with full sail up in a sudden squall. We keep much better watches on *Hawk;* we got a lot more sleep on *Silk*.

Although *Silk* was livelier than *Hawk* due to her smaller size, her motion can be described as softer and slower. Her relatively low ballast ratio combined with its relatively high placement in the hull meant she tended to roll back up from a wave about as quickly as she went down. *Hawk*'s much lower and heavier ballasting means she fights getting pushed over in the first place, then snaps back when the pressure comes off. For the most part, that translates into less motion on *Hawk*, but when she does get knocked, the recovery is more likely to toss things around (including us).

In heavy weather, *Silk* could almost always be left to her own devices. Because of her size and stability, it takes much more serious weather before we start worrying about tactics on *Hawk*, but then we have to manage her more actively than we did *Silk* (the heavy-weather performance of the two boats is discussed in the *Hawk* vs. *Silk* sidebar in Chapter 22).

Silk powered well, but when backing up in close quarters we never had any idea which way she was going to turn. Her large skeg prevented the prop wash from having any noticeable effect on her direction. *Hawk*'s fin keel and spade rudder make her able to turn around within a little over her own length, and in a strong wind, she backs up better than she goes forward.

For all their differences, both boats proved well suited to the voyages we undertook with them. Even more important, each boat suited our skill level at the time. *Silk* took care of us and forgave us our many mistakes. To sail *Hawk* well demands all the skills we have gained, but in return we have a boat better able to cope with the more extreme sailing we have done on our second voyage.

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PART II

Refitting and Equipping the Yacht for Bluewater Voyaging

ACCORDING TO AN old saying, the two happiest days in all sailors' lives are the day they purchase their boat—and the day they sell it. Obtaining a vessel suitable for bluewater cruising ends one long, time-consuming process, but it begins another. Before you can sail away and start living your dream, you will need to turn whatever boat you have bought into a comfortable liveaboard home and set it up for offshore sailing. Most people take years to get a boat ready to cruise; a very few take months.

The next seven chapters look in detail at this process, starting with upgrading and updating the basic systems and ending with detailed refit plans and budgets for three boats. Though it comes last in this part, the refit plan comes first in real life. A good refit plan will make the process as time and cost efficient as possible.

Two other old sayings claim that "boat" stands for "break out another thousand" and that a boat is "a hole in the water into which you pour money." To help you avoid pouring money into the wrong things, this part focuses on deciding what improvements to make and what gear to carry. With very few exceptions, specific brands of equipment will not be discussed. Sailing magazines, websites, and boat shows will provide you with up-to-date information on brands and models (see the Part II resources in Appendix 1 for some good sources of information on specific brands).

Your refit budget—what's left in your boat budget after buying the boat—determines how much you can spend. Every boat, even a brand-new custom one, requires an investment of time and money before you can head over the horizon. As with buying the boat, it's very easy to spend too much on the refit and end up with too little in the cruising kitty. Yet most overspending occurs on equipment that isn't essential to the safety of the voyage. The chapters that follow will help you prioritize your wish list and balance your budget limitations against the crew's desires.

CHAPTER 4
Upgrading for Offshore

MOST PEOPLE WHO buy a cruising boat are well aware that they will need to invest additional money in equipment such as sails and refrigeration, and by the time the deal closes they have drawn up an extensive list of items to be purchased. But before investing in a watermaker, take a step back and make sure the plumbing system doesn't need to be upgraded. Getting the basic features and systems right before adding new equipment will save money, time, and energy correcting problems after the fact.

This chapter considers the range of upgrades most cruisers make to the basic structure and fittings of a fiberglass boat to prepare it for the rigors of offshore voyaging. Every boat, no matter how new or recently refit, will need some modifications to make it suitable for living aboard and sailing thousands of offshore miles every year. The upgrades required may be as simple as adding a few handgrips and a dodger on a brand-new custom boat or as extensive as rebonding bulkheads to the hull or replacing the core around every deck fitting on a 20-year-old production boat. Many people underestimate the investment required to upgrade the hull, deck, and basic systems. If they buy the goodies and gadgets before they realize the extent of necessary structural upgrades, they will almost certainly run short of money before the refit is complete.

COMMON UPGRADES TO OLDER PRODUCTION BOATS

This section focuses on those things almost all cruisers end up modifying or upgrading on older fiberglass boats either before they leave or within the first few years of their voyage. In a few places, it discusses techniques that will help make your refit a success, such as properly bedding deck hardware to prevent leaks. But overall this chapter is designed to help you figure out *what* needs to be done, not *how* to do it. Once you know the "whats" for your boat, you can choose from among dozens of books on various aspects of refitting a boat to help you with the "hows." The Refit Resources section in the resources for this chapter in Appendix 1 will give you a place to start.

We know people who have stripped a 20- to 30-year-old, 40-foot boat back to a bare hull—rebuilding every bulkhead, rebonding the hull-to-deck joint, replacing every wire and every plumbing bit—in the process spending as little as $70,000 or as much as $250,000. Most would-be cruisers lack the confidence, if not the skills, to undertake such a project, and the details are beyond the scope of this chapter. If you're contemplating this alternative, however, Appendix 4 sets out the range of improvements that may be necessary for boats of different ages.

Make Your Boat Watertight

In constructing a fiberglass boat, builders start with a watertight hull and deck and then cut holes through it. No fiberglass boat will ever be totally watertight again. New materials and techniques like carbon fiber chainplates bonded to the hull and deck hardware mounted on solid fiberglass pads set above the level of the deck have brought us a step or two closer to leakproof fiberglass boats, but for now we have to live with the reality: any

TABLE 4-1. MAKING THE BOAT WATERTIGHT	
Boat Age	**Watertight Projects**
20+ years	• Replace/remove teak decks • Replace/rebuild hatches • Replace/rebuild ports • Replace glazing in fixed hatches
10–20 years	• Replace/reseal deck locker lids • Rebuild companionway hatch • Repair any core damage
5–10 years	• Reglaze, recoat, rebed hatches • Reglaze, recoat, rebed ports • Rebed all deck hardware
New–5 years	• Reseal mast base • Upgrade/strengthen stanchions • Make deck pipe watertight • Upgrade backing plates on deck hardware

fiberglass boat over 10 years old will have a few leaks. Take that same boat out and cross an ocean with it, and before you're done it will have a lot of leaks.

Table 4-1 lists the things that may need to be done to eliminate leaks in boats of different ages. In this table and the others in this chapter, the projects for boats of a specific age include everything listed for that age and everything shown for younger boats. Thus, on a boat more than 20 years old, you should work through the entire list shown in Table 4-1. Once you've gotten the boat watertight, keeping it that way will require regular maintenance.

One key to minimizing leaks is to fit hardware bolted through the deck with proper *backing plates*—stainless steel or aluminum plates slightly larger than the footprint of the deck hardware. The bolts that hold the hardware in place pass through the deck and into these plates and then through nuts that hold the bolt in place. Backing plates are meant to spread the forces on the deck hardware and prevent the bolts from being pulled out of the deck. But they also provide rigidity and help keep the hull from flexing around the fitting, breaking the sealant, and enlarging bolt holes. Adding backing plates to deck hardware that shows signs of leaking will make it more likely you can get a long-lasting seal.

Finding Leaks

Finding leaks can be just as hard as fixing them. Water coming in around a portlight or hatch will often run along the inside of the headliner and emerge half a boat away from where it entered. A piecemeal approach will only prove frustrating. Just when you think you've cured that drip into your galley lockers, a little rough weather will show that you cured something but not that leak. Systematically locating and fixing all problem areas at once will prevent frustration in the long run.

To come up with a complete list of necessary watertight fixes, start with a thorough examination of every hole through the deck from both the inside and outside of the boat. Don't ignore even the smallest sign of water intrusion (see Figure 4-4), for a tiny drip in port will turn into a major leak on your first passage. Carefully inspect the following areas:

- **Deck hardware and chainplates.** Start on deck at the bow and examine every deck fitting and each chainplate, including not just cleats and stanchion bases but also pad eyes, sail tracks, winch bases, and rope clutches. Look for small rust spots weeping from bolts, rusty bolt heads, and worn caulking. Localized rust around a specific bolt head almost always indicates a leaking deck fitting. If you scrape at caulking around the base of a deck fitting and it comes up wet or dirty, you have a leak. On the interior, inspect the fitting for rust on the underside, rust marks or weeping from underneath, and water trails below. Salt water leaves visible marks on most surfaces even after it dries. With deck fills and scupper drains, check for a loose hose clamp before you assume the fitting itself is leaking.
- **Hatches.** If your hatches are the older wood-and-acrylic type (Figure 4-1), look for rust, dirt, or corrosion around screw heads. Examine the wood-to-plastic and wood-to-wood seams for any signs of dirt or dampness. On commercially made aluminum hatches, look for any misalignment between the hatch and its base, any gaps or dirt in the caulking below the hatch, and any white powder on the

Figure 4-1.
Older wood and acrylic hatches may need to be replaced if they show evidence of leaking. (Note the solid dinghy chocks in the foreground and background as discussed in Chapter 7.)

Figures 4-2 and 4-3.

Leaks through hatches typically leave obvious areas of warped and discolored wood on the hatch surround.

aluminum, which indicates aluminum corrosion. On all hatches, inspect the gasket for deterioration. Press up on the glazing around the edges of the hatch from below. This will reveal gaps where the sealant holding the glazing to the frame has failed. Any problems in these areas means the hatch will need to be rebuilt or replaced. If the hatch seems fine but you find dirt or water trails, mold, warping, darkened or discolored wood, or any other signs of water damage on the surround below the hatch (Figures 4-2 and 4-3), find out if the boat has ever been heated in cold weather. Dripping water from condensation can cause signs of water damage unrelated to hatch leaks. If the boat has never been heated, the hatch will need to be rebedded.

- **Opening ports.** Look for water marks or dirt in the port surround or on the cabin trunk below the port. Scrape out a little caulking from around the port on both the inside and the outside. Any dirt or visible gaps in the caulk mean the port should be rebedded. Press on the glazing and make sure it doesn't flex or separate from the frame. Check the gasket for cracking, wear, or other signs of deterioration. Any problems with the glazing or the frame mean the port will need to be rebuilt or replaced.

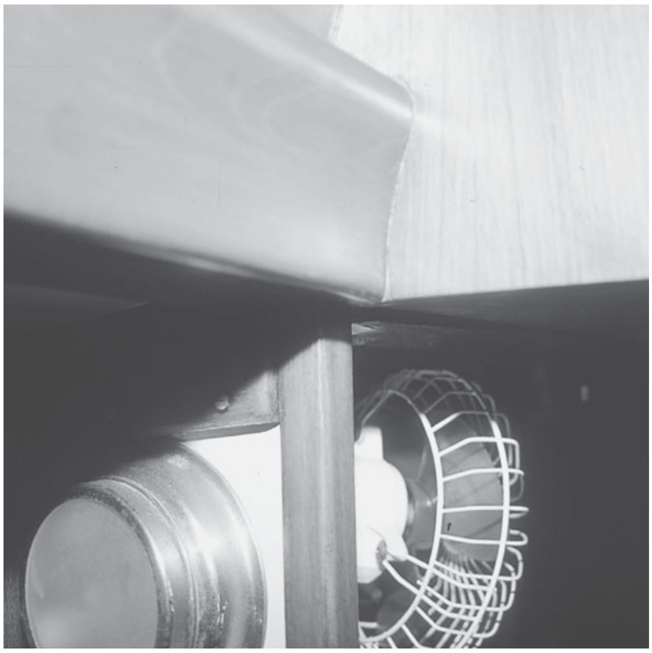


Figure 4-4.

A much smaller leak may leave only a discolored line, like the one starting at the top center of the photo and running down the corner between the bulkhead and the drip rail under the portlight.

- **Fixed ports.** If the boat has nonopening ports, these should be inspected in exactly the same way as opening ports and hatches. If you can flex the glazing with your hand, it's not strong enough. Replace it with something thicker. Polycarbonate (Lexan) glazing expands and contracts with temperature changes. If you're planning on cruising in cold weather, replacing it with tempered glass will prevent leaks down the line.
- **Companionway.** Look for any of the signs of water damage or leakage already discussed around the companionway. Most companionway leaks occur through the hatch slides or under the front edge of the hatch. If the companionway does not have a full seahood covering the sliding hatch, you'll want to add one (refer back to Figure 3-22). If a seahood is present, you may need to rebed it and replace the gasketing in the slides. Washboards are rarely completely watertight in a direct wave impact but should keep rain and waves out in all other conditions. If they do not, they need to be modified or replaced. Some new boats have watertight doorways instead of a hatch on the companionway. On

Figure 4-5.

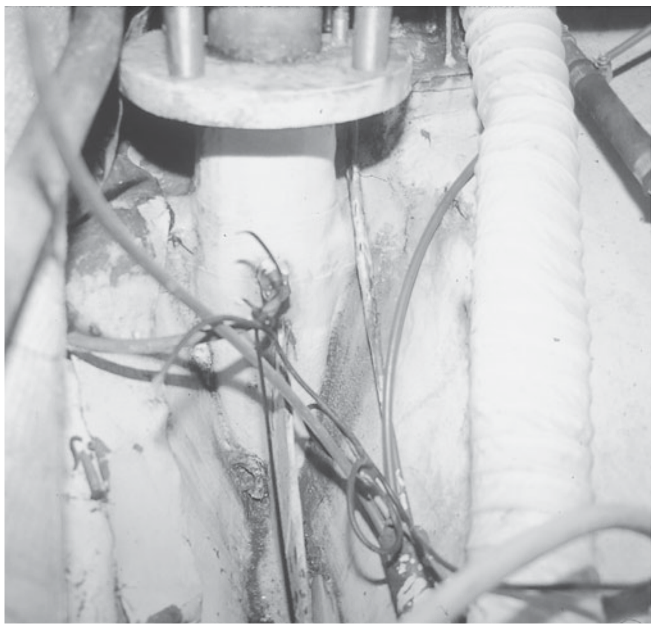
This aluminum Dutch door on *Hawk* bolted into the original frame for the hatchboards but was significantly stronger and more watertight.

some boats, it may be possible to retrofit a watertight door that slides into the companionway frame as we have done on *Hawk* (Figure 4-5).

- **Deck hatches/locker lids.** Deck hatches and external locker lids should be inspected in exactly the same way as the hatches that open into the interior of the boat. Look for signs of water intrusion around cockpit lockers, the anchor locker, the sail locker, the propane locker, and any other space accessed from the deck. Pay particular attention to the gaskets on these lockers, as they are often not up to the task and will need to be reinforced. These areas are rarely as clean and dry as the interior of the boat even without a leaking hatch, but you'll still be able to spot problems. The rust marks in the stern locker in Figure 4-6 were below the hatch shown in Figure 4-3 and indicate a serious enough leak to warrant replacing the hatch completely. Freeman Marine (see the Other section in the resources for this chapter in Appendix 1) makes a variety of absolutely watertight hatches for use on Coast Guard and commercial vessels. We installed one on *Hawk*'s foredeck for accessing the chain locker, and it has proven to be one of the best investments we made in fitting out the boat.
- **Mast boot and mast collar.** Mast boots need to be resealed regularly to keep both salt water and rainwater out. Check the mast where it enters the boat for signs of weeping, rust, or dirt. If the mast boot has not been resealed in the last few years, assume you will need to do so before setting off. Bolts in mast collars may leak as well, especially if the collar is not designed to distribute the load correctly. Check the interior side of the bolts for signs of weeping, rust, or dirt. Leaks in this area are more than a simple annoyance, as they can lead to serious mast corrosion.
- **Mystery leaks.** A boat's history always comes back to haunt you in the form of leaks. If the original bolt holes weren't filled when the genoa track was replaced or the deck fitting for the holding tank pumpout was installed through an area of cored fiberglass that wasn't sealed with epoxy, then you will have a mystery leak. The best way to locate these is by following the faint traces of water and dirt to their source, but it can be a frustrating process. The key is to not ignore any sign of water intrusion, no matter how slight. The faint discoloration in the wood shown in Figure 4-4 was caused by water entering where the wiring and piping from an on-deck propane tank penetrated the coach roof. The water migrated inside the head-

Figure 4-6.

These rust marks in a stern locker indicate a serious leak through the hatch shown in Figure 4-3.



liner before exiting at the corner of the bulkhead and the cabin top.

Once you've finished the initial inspection, the next step is to test the hatches and ports to find additional leaks. The only effective way to do this is to sail to windward in big waves with water breaking over the decks for at least an hour. This is a useful test for other components of the boat in any case. A high-pressure water hose makes a poor substitute because it does not saturate a large enough area, and the water does not pool and sit on deck while the boat is working.

To prepare for the test, open each hatch or port, including all deck hatches, and clean the gasket thoroughly. Then cover the gasket with talcum powder. After the test sail, open any hatches or ports that have leaked and see if the ring of talcum powder has been broken. If so, the gasket needs to be replaced. If not, take a close look at the edges of the glazing, which may have lifted and allowed water through. If the gasket and glazing appear intact, the hatch or port itself might be warped and need replacing, or it may just need rebedding.

Finally, if your boat has cored decks, remove a portlight and a couple of deck fittings from different parts of the boat. (Pick ones you've already decided need to be rebedded.) Then probe into the bolt holes and around the edges of any openings to see if the core is mushy or wet. Scrape at the core with a bent nail or an awl. If you find anything but solid fiberglass or epoxy, then you have some water intrusion into the core. Unless the fitting was installed by an owner who didn't replace the core with solid fiberglass, even one questionable area around one portlight or fitting signals the potential for a major problem. Your refit list just expanded to include pulling every deck fitting, hatch, and portlight, fixing any damage to the core, and rebedding everything. This is a lot of work, but it may well save you from having to deal with large areas of serious core failure and delamination in a few years' time.

Fixing Leaks

Any boat older than 5 years will need to have at least some of the through-deck hardware rebedded. To successfully keep water out, the hardware has to be rebedded properly, which means using the right sealant and applying it the right way.

Four types of sealant are commonly used in the marine industry, each having its strengths and its best uses. Table 4-2 compares the four. For bedding acrylic (Plexiglas) or polycarbonate (Lexan), use silicone. For the rest of your bedding needs, polyurethane adhesive-sealants (like 3M 5200) offer the highest adhesion, while polysulfides will create a longer-lasting, more flexible bond. Polyethers combine the ease of use and rapid cure rates of silicones with stronger adhesion. Don't use a polyurethane adhesive-sealant if you think you may *ever* want to remove the fitting.

TABLE 4-2. COMPARISON OF MARINE SEALANTS

Sealant	Uses	Properties	Best Uses	Limitations
Polyurethane	To form a permanent bond	• Highest adhesion • 10-year life • Tack-free in 24–48 hours, cures completely in 3–7 days[1]	• Metal to fiberglass • Wood to wood, metal, or fiberglass	• Incompatible with acrylic and polycarbonate • Do not use if bonded items might ever need to be separated • Not very chemical resistant
Polysulfide	To form a flexible, removable bond	• Two-part, medium adhesion; one-part, low adhesion • 20-year life • Most chemical resistant • Cures to sandable hardness in 24–48 hours, completely in 10–20 days	• Two-part for teak decks • One-part only to reinforce mechanically fastened joints • Where bonded surface needs to be sanded, painted, or chemical resistant	• Incompatible with polycarbonate and acrylic • Two-part messy and slow curing; one-part not as adhesive
Polyethers	To form a flexible bond with minimal cure time	• Medium adhesion • 20-year life • Tack-free in 1–2 hours; cures completely in 2 days	• Bonding fiberglass, wood, glass, or metal • Where bonded surface needs to be sanded, painted	• Incompatible with some acrylics and polycarbonates
Silicone	To form a flexible gasket with relatively low adhesion	• Lowest adhesion • Most flexible • 20-year life • Cures completely in 24 hours	• With plastic, even acrylic and polycarbonate • Where flexibility is key • Good for isolating dissimilar metals	• Not for heavy-duty structural or underwater use

[1]Quick-cure versions are tack-free in 1–2 hours and cure completely in 2–3 days.

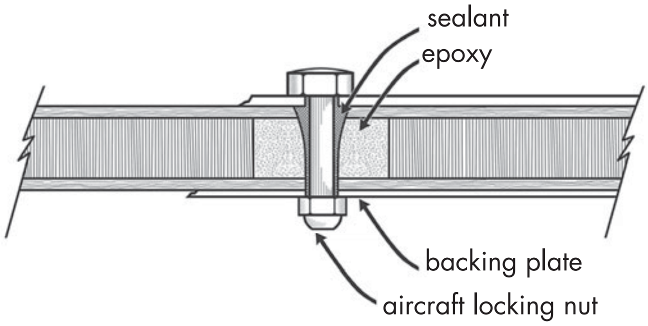


Figure 4-7.

The finished product: an epoxy-filled area around the bolt hole and a gasket of sealant around the bolt itself. (Fritz Seegers illustration)

Once you have determined the appropriate sealant, follow these eight steps to create a watertight seal (as in Figure 4-7):

1. **Remove hardware.** Leaky deck fittings usually present few problems to remove. If the head of a recalcitrant bolt or screw becomes mangled, use a Dremel tool to shape the bolt head into a hex or to create a new slot to facilitate removal by a wrench or a large screwdriver. Hatches and portlights bedded using polyurethane cause the biggest problems. A heat gun may help, or you may be able to work a thin wire into the bond and saw it back and forth. Some specially formulated solvents (like JWB Environmental's Anti-Bond 2015 for removing 3M 5200) may also do the trick.
2. **Sand all surfaces and clean thoroughly with solvent.** Even the best caulks do not bond to surfaces that have dirt or leftover sealant on them. After you have removed the hardware, sand off any dirt, old sealant, corrosion, or rust until the metal surface is bright and shiny. Scrape away the old caulking on deck and sand with fine-grit sandpaper. Wipe down the hardware and the deck with acetone, mineral spirits, or kerosene. Do the same with the backing plate, bolts, and the underside of the deck where the backing plate is attached. Replace any bolts that are bent, stripped, or otherwise compromised.
3. **If the bolt holes were properly sealed and the core is absolutely dry, skip to step 6. Otherwise, drill out the bolt holes and the core around the holes.** Drill out the bolt holes to get rid of any dirt or old caulking. Remove at least an inch of core from around the circumference of the bolt hole to create a barrier to the passage of moisture and a rigid tube of epoxy that will resist bending and compression. Use a nail bent at a right angle and attached to a drill to clear the core from the area around the bolt holes. For portlights and hatches on cored hulls, use an oversized router bit to dig out the coring from between the fiberglass layers for at least an inch all the way around the cutout.
4. **Seal the core and fill the hole with thickened epoxy.** Tape the bottom of the hole. Fill to deck level with epoxy and allow it to sit for a few minutes, then remove the tape and allow it to drain into a cup. This coats the far reaches of the drilled holes with a thin layer of epoxy. Retape the bottom of the hole, and thicken some epoxy with high-density filler. Fill to deck level once again and let cure completely. This creates a solid core of epoxy into which to sink the bolt. For portlights and hatches, sand the edge of the cutout, clean it with acetone, and seal it with thickened epoxy to prevent water from migrating into the core.
5. **Drill and tap new bolt holes.** Once the epoxy has hardened, use the fitting to mark the exact location for each bolt. Carefully drill each bolt hole, making sure the hole is absolutely vertical.
6. **Dry-fit hardware and tape.** Trace around the hardware, and then tape along your traced lines. Put tape on the top of the fitting. This makes cleanup easier. If the hardware did not have a proper backing plate, you should have had one made, preferably in stainless, but alternatively in thick (8 mm or thicker) aluminum.
7. **Apply sealant liberally to create gasket.** This is no place to economize. Apply sealant to the fitting and the deck. Spread evenly with a putty knife. Apply sealant liberally around the head of each bolt, insert into the hole, put the nut on the bolt, and tighten. Do not overtighten! While some sealant should be forced out from all sides, enough should remain to form a gasket between the metal and the deck. Allow the sealant to cure fully before tightening the bolts further.
8. **Clean up.** Before the sealant dries, scrape off any excess with a wooden wedge. Before it cures, clean up any sealant on the deck. For silicone, use soap and water; for polysulfide, polyurethane, and polyether, use mineral spirits (paint thinner) or kerosene. Be careful to keep solvents away from your newly sealed fitting.

Leaks through chainplate covers can sometimes be eliminated by inserting a piece of neoprene between the deck and the cover when rebedding the cover. We've had mixed luck with this solution for other deck hardware, though some cruisers swear by it for all their deck fittings including cleats, sail tracks, and stanchion bases.

When rebedding portlights, you will greatly increase their strength by through-bolting the inside and outside halves of the frame together. Make sure to seal all previous screw holes with thickened epoxy if you need to drill any new holes.

Many older boats have original hatches made from wood and fiberglass (Figure 4-1), and these tend to be a primary source of leaks. The best alternative may be to replace these with new, high-quality aluminum or stainless steel hatches, available from several manufacturers. If you cannot afford to do that, or if the aesthetics of your boat depend upon the old style of hatches, several modifications can reduce leaking substantially.

These older hatches tend to leak along the coaming lip even when the hatch is well dogged. To fix this problem, replace the gasket material with 10- to 12-pound hollow neoprene, such as 3M's professional-quality, neoprene weather stripping. Add a second gasket along the top edge of the hatch coaming. Though you may need to have someone stand on the hatch to dog it, once dogged the seal should be watertight. High-quality weather stripping can also be used to keep water out of cockpit lockers and eliminate leaks through companionway hatches.

If you found any sign of leaking around the mast, remove the mast boot and whatever seal is underneath it, and carefully examine the mast collar. In some cases, the collar is not designed to distribute the load correctly, or mast wedges have caused unequal loading. If you find any signs of rubbing, corrosion, or cracks on the mast, get some advice from a rigger. The vast majority of mast failures we are aware of on larger boats with highly loaded masts have occurred at the partners. If your mast collar shows signs of leaking from such stresses, you will need to reengineer it to eliminate these stresses before rebedding the collar and resealing the mast boot.

Leaks around the bases of stanchions are endemic on many boats. Everything from fender boards to sailboards gets tied to lifelines. When hit by a wave, these items place a tremendous force on stanchion bases. Fenders tied to lifelines lever against stanchion bases when they get dragged along a pier. Keeping your lifelines unencumbered and tying fenders to cleats or through the toe rail will go a long way toward preventing leaks through most stanchion bases.

But even that won't help when it comes to lifeline stanchion gates. When getting on and off the boat, most people pull on the gates; the constant levering will loosen even well-bedded bolts. Lifeline gates may also be the least well engineered piece of equipment on the average boat. Whatever bracing exists on most gates does not offset the levering loads (Figure 4-8). They tend to be

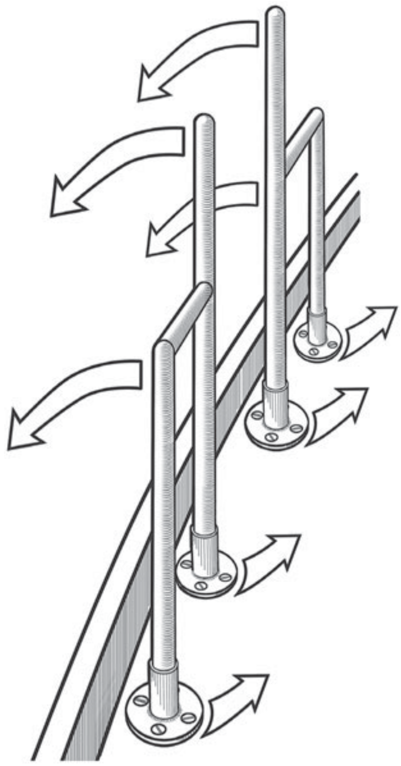


Figure 4-8.
The bracing on most lifeline gate stanchions does nothing to offset the forces the gate experiences. (Fritz Seegers illustration)

located in areas of the deck that trap water, so their bases are often submerged in a heavy sea or a hard rain. On many boats, these bases leak into such critical areas as the navigation station, the pilot berth, or the galley.

If any of your stanchion bases sit in water much of the time, consider mounting them on the toe rail (refer back to Figure 3-24) or on a fiberglass pad to raise them above the water. If your stanchion base is poorly engineered, add additional bracing to increase its rigidity. An angled brace installed from the top of the gate to the top of the toe rail (Figure 4-9, left) or braces that bolt into the side of the toe rail (Figure 4-9, right) will protect the stanchion base from being levered when people board.

Finally, the amount of water that can come in through the anchor chain pipe on a rough weather passage can easily make it look as if the boat is sinking. Modeling clay, plastic bags, canvas covers, and duct tape, along with dozens of other solutions we've heard about, won't make a watertight deck pipe. Only three alternatives seem to work.

The first is an old-fashioned teak plug about 6 inches long and the circumference of the deck pipe, with an eye on the bottom for attaching the chain after taking it off the anchor and a loop on the top for pulling it out again. When the teak gets wet, it will swell, and it does a wonderful job of sealing the hole completely after a day or so

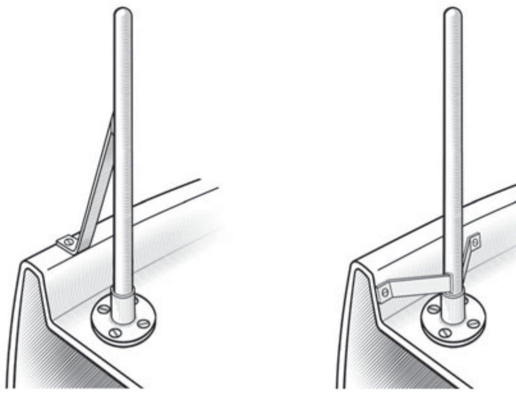


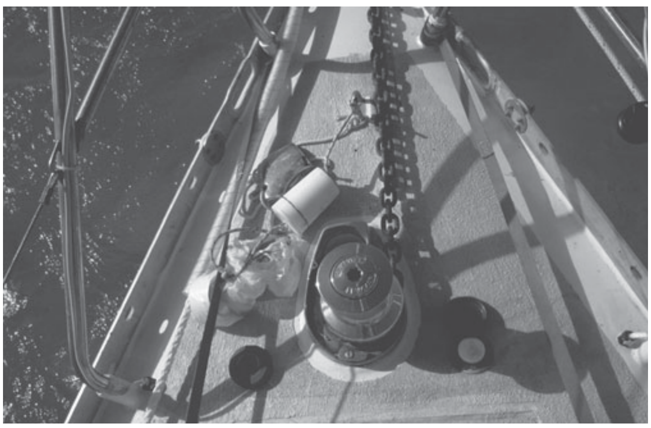
Figure 4-9.
Reengineering stanchions can make them much less likely to leak. (Fritz Seegers illustration)

on passage. If the plug gets too tightly wedged, it can be removed with a halyard. If you cannot find a large enough piece of teak, as has been the case for us on *Hawk*, you can use some sort of plastic (we used Delrin) and bed it in place with silicone (Figure 4-10).

Alternatively, several people we know have had good luck with the spray-on expanding-foam insulation available at hardware stores. They leave the chain attached to the anchor and spray in enough foam to seal the hole. When they drop the anchor the foam plug usually comes out in a couple of large chunks, but sometimes it can be a bit messy to remove. If all else fails, Steve Dashew recommends stuffing a large Nerf ball down the hawsepipe, a solution we have also used with good results.

It takes persistence and commitment to keep a fiberglass boat that regularly completes offshore passages dry and watertight. But if you do most of what is discussed in this section before setting off, and then rebed fittings on a regular rotation as part of your routine maintenance

Figure 4-10.
Our Delrin plug ready to be installed before a passage.



schedule, you can almost count on finding a dry bed down below.

Improve Your Boat's Ventilation

Most boats built in temperate latitudes lack proper ventilation for the tropics. Any shortcomings in a boat's ventilation will become apparent on the first passage with strong winds forward of the beam or in the first tropical downpour in 90° heat and 90 percent humidity. On most boats, getting organized to meet the ventilation challenges of the tropics will be one of the least costly things you do before you go, but it will dramatically improve the quality of your life afloat.

Airflow Basics

Managing ventilation starts with understanding how air moves through a boat. First, air needs a way to get into the boat and a way to get out again, and the openings letting air in need to be balanced by those exhausting it, or the flow will stall. Second, an open hatch or dorade vent facing into the prevailing breeze interrupts the airflow over the deck and deflects air downward, into the boat. Third, an open hatch or dorade vent facing away from the prevailing breeze will deflect air upward, creating a partial vacuum in its lee. This negative pressure will pull air out through a dorade or hatch. Given these basic concepts, airflow can be manipulated.

For example, when the boat is pointing into the wind and several forward-facing hatches are open, the companionway acts as a large exhaust vent, especially if a dodger covers the companionway, creating negative pressure behind it. There are times when strong trade winds cause too much air to flow through the boat this way, but choking off the airflow by closing the hatches most of the way makes the boat too hot. Reversing the airflow will often produce a comfortable breeze. Opening any aft-facing hatches and orienting any dorades opposite the prevailing wind will exhaust air out the front of the boat. To replace it, air will be drawn in through the companionway, and that airflow will increase if any forward-facing hatches or panels on the dodger are opened.

Airflows can work against one another, resulting in less air moving through the boat though more portlights and hatches are open. For instance, if the companionway is exhausting air from the rest of the boat using negative pressure, opening hatches on a hard dodger or unzipping the window in the front of a soft dodger will introduce positive pressure into that area. The result will be a confused flow of air under the dodger and less air moving through the boat.

All of this demonstrates the value of flexibility in the ventilation system. A broad range of intake and exhaust

THE INS AND OUTS OF STAINLESS STEEL

Steel alloyed with chromium and other metals like molybdenum or nickel rusts less than normal steel and has been designated "stainless." In the presence of oxygen, the chromium forms an inert skin that resists corrosion. There are some 500 grades of stainless steel available, and when adding stainless fittings to the boat, remember that stainless means just that—it stains less, but it is not stain free. That means it is not completely rust free, and in the corrosive marine environment, lower grades of stainless will rust copiously after a few months. More important, they will lose strength and eventually fail.

Most marine-grade stainless steel is *austenitic* stainless, meaning the alloy contains nickel. It just so happens that nickel renders the steel nonmagnetic, so if you're ever trying to buy fittings in a household plumbing or hardware store, take a magnet along. If the sink drain you're contemplating is labeled stainless but attracts the magnet, it won't hold up in the marine environment.

Much of the stainless sold in chandleries is designated 304 and contains 18 percent chromium and 8 percent nickel. The 316 stainless alloys have higher nickel content and also include about 2 percent molybdenum, which makes them significantly more resistant to corrosion and surface oxidation than 304. Always buy 316-grade stainless for any potentially high-load application like chainplates, lifeline stanchions, pulpits, backing plates, and so on. If you can afford it, you'll spend a lot less of your time polishing rust off your stainless if you buy 316 for every stainless application aboard.

Note that 316 stainless steel's ability to resist corrosion depends upon the presence of oxygen to bond with the chromium. Problems arise with most stainless alloys in a deoxygenated environment. Stainless that passes through the deck or underwater fittings in poorly aerated areas like a centerboard trunk or rudder shaft may be subject to corrosion, and the problem will be virtually invisible until something fails. Failures can also occur where water works its way into microscopic cracks or scratches on a fitting like a shackle. The lack of oxygen in the crack will lead to crevice corrosion, which can be severe enough to cause a sudden failure of the fitting.

Avoid using 316 stainless for underwater applications or where there might be a problem with oxygen circulation. Where stainless chainplates pass through the deck, they should be pulled out and inspected regularly for any signs of cracking or corrosion. Other stainless steel fittings like shackles should be regularly inspected for small cracks developing along load lines.

options—including ports, hatches, and dorades for each area of the boat—will keep air circulating even in tropical downpours. Table 3-8 in the previous chapter summarizes the ideal ventilation by area for a boat that will spend much of its time in the tropics.

Any boat should have good airflow in the main living areas in dry, windy conditions at anchor with the hatches and companionway open. But even in the breeziest conditions, airflow stagnates in some areas for lack of an adequate number of openings to handle both intake and exhaust. To find ventilation problems, set up a good breeze through most of the boat and then light a candle and investigate every cabin, looking for any place where the flame stands upright, undisturbed by any draft. The larger the boat and the more compartmentalized the interior, the more areas of stagnant airflow it will have.

Quarter berths and aft cabins often pose the biggest airflow challenge, especially if they have doors that are kept closed for privacy. Portlights are only useful for exhausting air at anchor, so another type of opening will be required for air intake. Deck structures often block the wind and keep it from reaching deck hatches or dorades located on the aft deck. The best solution is to add a deck hatch on the forward end of the aft cabin, positioned so it's clear of a soft dodger or so that the dodger can be opened to allow air to reach the hatch (Figure 4-11).

A couple of other solutions will improve airflow in otherwise enclosed spaces. For large aft cabins, windscoops can reach above deck structures to direct air down through an open hatch. For smaller cabins or quarter berths without any deck openings, it may be possible to install a portlight into the cockpit footwell (Figure 4-12). If the boat does not have a watertight stern bulkhead, installing a louvered access hatch through the partition between the quarter berth and the cockpit locker or lazarette and leaving the locker or lazarette hatch open will also create some air circulation. On boats without

Figure 4-11.
A hatch placed on the aft edge of the coach roof just in front of the dodger makes the best air intake for an aft cabin or quarter berth.

Figure 4-13.
This catamaran uses a combination of tinted windows and venetian blinds to cut solar gain, and has ports through the fixed forward windows for ventilation.

much deck structure and with forward-facing lazarette hatches, this can pull a great deal of air into the boat.

As a last resort, a fan in the cabin combined with a few discreet, decorative holes cut through the top of a bulkhead, or louvers or cane in the door, will draw air into the cabin, where it can be exhausted through a portlight. Some combination of these options may be necessary to upgrade the ventilation in an enclosed area to acceptable levels for the tropics.

The extensive glass surface area in deck saloons and pilothouses makes them hotter than other parts of the boat, so they need more ventilation but often have less. UV coatings, double-paned glass, tinted glass, reflective screens, and exterior covers or louvers (Figure 4-13) all reduce the solar gain, though they also reduce visibility, especially at night. Some combination of these in addition to two to four large opening hatches (Figure 4-14) will be necessary to keep these areas livable in the tropics. Otherwise, the only way to keep large deck saloons or pilothouses cool will be with air-conditioning.

Most screens reduce airflow by about 75 percent, so they should be avoided if possible. In areas where mosquitoes, sand fleas, or biting flies are a problem, anchoring in a good breeze a half-mile or so away from shore will keep the critters from reaching you. Mosquitoes are most active at dusk, so putting screens in for an hour or so before sunset and taking them out again when it is dark will keep the insects from boarding the boat without restricting ventilation too much.

Airflow Challenges

The ventilation situation changes completely when water from rain or spray starts to enter the boat along with

Figure 4-12.
A portlight can be installed in the cockpit footwell to ventilate an otherwise enclosed aft cabin.

Figure 4-14.
Opening deck saloon hatches, like those in the Oyster deck saloon designs, allow adequate ventilation to offset solar gain from the large window areas.

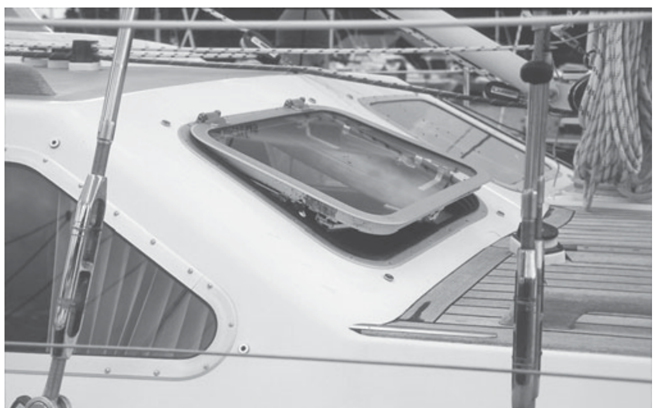


Figure 4-15.
A simple, easy-to-set-up harbor awning will keep the boat cool and well ventilated in hot, windless weather and in squalls that bring little wind.

Figure 4-17.
A small tarp secured over a hatch to prevent rain from entering.

the air. Good ventilation becomes a matter of getting air into the boat while keeping water out. A waterproof, well-made dodger that covers the entire companionway and extends aft for an additional 3 feet or more will protect the companionway and any portlights in the cockpit footwell, allowing them to remain open through squalls. With the wind anywhere forward of the beam, this provides plenty of exhaust capability. The trick is getting air into the boat.

A full-length harbor awning can shelter all the hatches aft of the mast, so they can be kept open during squalls. The awning should start from the mast and extend back to the bimini, if the boat has one, or all the way to the stern if it doesn't. This awning will also prove valuable in hot, light-wind conditions by shading the deck and keeping it cooler while funneling any breeze into open hatches.

A number of companies make fully battened awnings designed to allow a person to walk down the side deck under cover, and others make complicated awnings with side curtains that roll down and with various systems for collecting rainwater. In the real world these features are rarely used, and most of these awnings are expensive, difficult to stow, and too cumbersome to put up. Any good canvas maker can make a simple, inexpensive harbor awning with just a few long battens to stow, but it will probably only be chest-high along the side decks (Figure 4-15). Though a bit inconvenient, this does keep the rain out of the hatches better than a higher awning, even when the wind comes up a bit.

Figure 4-16.
A small sprayhood on an aft-facing hatch.

When rain is accompanied by strong winds, harbor awnings will need to come down, or they'll make the boat sail at anchor and "jig" at a dock, straining ground tackle or mooring lines. In these conditions, sprayhoods designed to cover an aft-facing hatch (Figure 4-16) or a small tarp suspended from a halyard over a hatch and secured at the corners (Figure 4-17) will keep rain out while still letting in a good deal of air. The tarp has the advantage of flexibility, as it can be rigged over the most useful hatch and oriented to keep the rain out even when the wind is not over the bow of the boat.

A good tarp that can serve a variety of useful purposes from awning to drop cloth can be made out of a 4-foot square of heavy canvas. The edges should be hemmed and grommets installed in each corner and halfway along each edge. A webbing loop sewn into the middle of the square can be used to attach a halyard to position it over a hatch.

When the wind gets too strong and the rain too torrential, all hatches need to be closed. At this point, air can be exhausted from areas that must stay dry but must be taken in only through openings where water can be isolated and drained without getting into the rest of the boat. A portlight located in the cockpit footwell and protected by the dodger will be useful when the wind is over the bow even in torrential rain. A small hatch or portlight located in an area where water won't do any damage, like the head or, better yet, a shower stall, can also be used to bring air into the boat in wet conditions and will greatly improve air circulation.

For getting air into the boat and keeping water out, nothing beats Olin Stephens's wondrous dorade ventilators, named for the first boat to carry them. The airflow through a dorade vent increases with the square of half the diameter of the through-deck pipe. To be most effective, through-deck pipes need to be as large as possible. A 4-inch-diameter pipe should be considered the minimum, but 5 or 6 inches is preferable. The higher off the deck the cowl of the vent, the more airflow it will receive. To be useful, cowls should be at least 12 inches above deck level; more is better.

Dorades need to be properly engineered. The through-deck pipe should terminate at least 3 inches above the deck (Figure 4-18), and there should be at least 2 inches between the top of the pipe and the top of the dorade box. The bottom of the intake pipe and the top of the exhaust pipe should overlap slightly, and there should be at least 2 horizontal inches between the two pipes. A baffle placed between the pipes and extending down from the top of the box to a level just below the pipe openings keeps water from entering the through-deck pipe. The cowls need to be as large as possible—at least the diameter of the through-deck pipe. You should be able to rotate the cowls, and 1-inch-square drainage holes should be cut into the corners of the box. The vent should be equipped with a removable screen for use in mosquito-infested ports. For extreme conditions, when the dorades could flood the boat in a capsize, the dorades must be able to be closed off completely. A plate that screws into the bottom of the through-deck pipe inside the boat or into the top of the box on the outside of the boat when the cowl has been removed will make a dorade virtually watertight.

Solar vents and mushroom vents just don't measure up to the dorade vent for tropical use. Both are too close to the deck to get a clean flow of air, and mushroom vents don't create the necessary pressure differential to move air into or out of the boat. Solar vents rely on a fan to move the air, but combining electrical and mechanical parts with saltwater exposure limits longevity and reliability.

When a hard rain and strong wind restrict exhaust and intake options, airflow will necessarily be reduced, but fans can help make up for that by keeping air circulating. Every berth should have a fan set up to direct air across it, with variable settings that allow the amount of air to be controlled. A fan in the galley will keep the cook cool and help prevent seasickness on passage.

The problem at sea is similar to the problem in a tropical rainstorm, and the solutions are also similar. In calm conditions on passage, many people leave hatches and portlights open to get extra ventilation, but all too often they end up closing them only *after* a wave has thrown itself down below. That happened to us a couple of times with unpleasant results, and then we made a rule that all hatches and portlights have to be closed and dogged when we start seeing whitecaps. The only exceptions are those that open into "wet" areas of the boat, such as the head, or those that are fully protected from spray, such as the portlights in the footwell of the cockpit. On a downwind passage, these footwell portlights bring a nice breeze into the aft cabin where sea berths are often located.

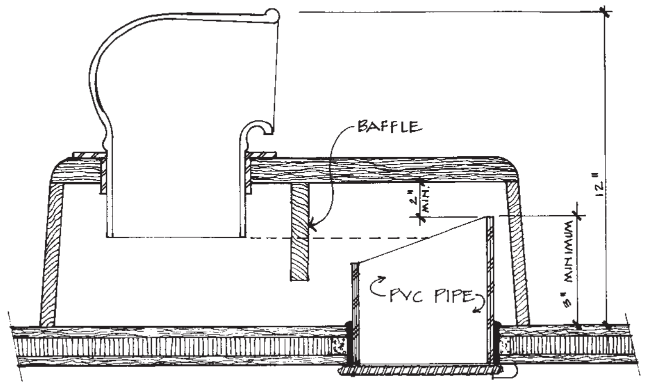


Figure 4-18.
Attributes of a well-designed dorade ventilator. (Lyanne Schuster illustration)

The dodger itself needs to have good airflow so the person on watch won't get overheated or seasick from a lack of ventilation. Hard dodgers and pilothouses should have at least two small hatches, and soft dodgers should have zip-away panels that allow air to flow through part of the front of the dodger. Ideally these panels will be located on either side of the companionway, so that the companionway remains protected while the on-watch crew gets good airflow.

When conditions get a bit rougher, the last hatches and portlights need to be closed. Maintaining adequate ventilation then becomes much tougher on most boats. With a good dodger, the top hatchboard can be left out of the companionway in all but the worst conditions. The companionway will continue to function in an exhaust capacity upwind and an intake capacity downwind but will require the assistance of dorade vents oriented in the appropriate direction to provide any noticeable movement of air. Boats with too few or poorly designed dorades will be all but impossible to keep properly ventilated on a rough-weather tropical passage.

We know of two alternatives for keeping a small amount of air moving through a boat in ultimate storm conditions. The first is to design an overlapping lip that creates a small windscoop between the hatchboards (Figure 4-19). If running downwind, a surprising volume of

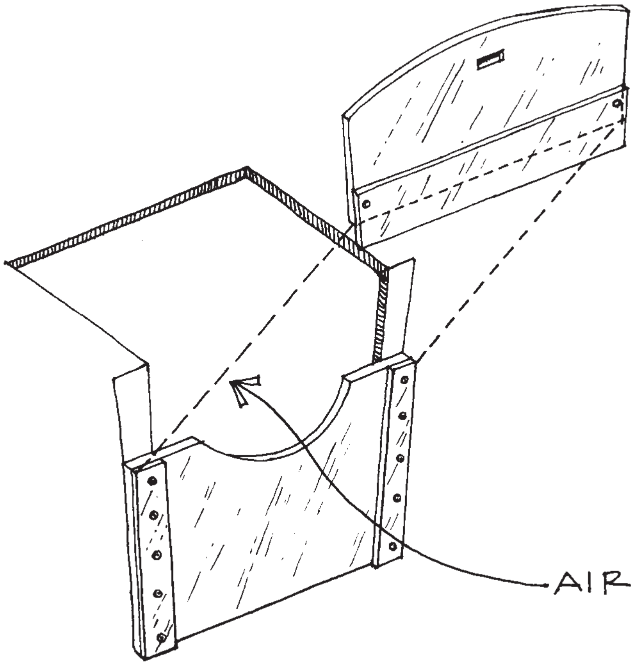


Figure 4-19.
A small windscoop designed into *Silk*'s Lexan hatchboards brought some air into the galley in rough weather. (Lyanne Schuster illustration)

air will find its way through this tiny opening and, if the galley lies near the companionway, may mean the difference between a hot meal for the crew and a cold meal or none at all.

Second, Rolf Shapiro and Deborah Bjelke—who have sailed the high latitudes aboard their steel boat *Northern Light* for the last three decades—recommend attaching a hose to the bottom of the dorade through-deck pipe and running it into the bilge. The hose needs to be the same diameter as the through-deck pipe and must be attached in a watertight and very secure fashion. This means the dorades do not need to be closed off, and it allows air to come into the boat in the worst of weather. If a wave breaks into the dorade, it is directed into the bilge, and if the boat is capsized, the dorade vents cannot flood it. In conjunction with a few fans, either one of these solutions will keep the air from becoming totally stale below.

Good ventilation on a liveaboard boat matters not just every day but every minute, and not just to crew comfort but also to the longevity and structural integrity of the boat. Getting ventilation right takes little more than some innovative thinking and a small investment in canvas and fans, but it pays big dividends.

Improve the Anchoring Arrangements

A boat either has a good anchoring platform or it doesn't, regardless of age and size. A boat like the Tartan 34 (S&S 34 in Australia) has a much better anchoring platform (Figure 4-20) than the one on the 50-foot boat shown in Figure 3-15. If your boat does not have a good anchoring platform, make upgrading it a priority.

Figure 4-20.
The anchoring platform on this 34-foot boat meets all the requirements outlined in Chapter 3.

If your boat lacks foredeck space, consider adding a bowsprit. Figure 4-21 shows a rugged stainless steel bowsprit that could be retrofitted to many boats. A boat that is sensitive to weight in her ends would not do well with such a large platform; the approach shown in Figure 4-22 would be more appropriate.

Many chain boxes are located high in the bows, which is not a problem on a coastal boat carrying a few feet of chain and a rope rode. But an offshore boat needs to carry a minimum of 75 feet of chain in the chain locker; most carry 300 feet. That kind of weight will impair the performance of almost any boat, causing it to pitch and hobbyhorse excessively, unless it can be moved well down and aft. There are several ways to go about doing this, the most common of which is to run a PVC pipe from the deck pipe down to a chain box under the forepeak bunk. To minimize the likelihood of the chain jamming, the pipe should be led as far aft and as high above the bottom of the locker as possible (Figure 4-23). Otherwise,

Figure 4-21.
A solid stainless steel bow platform that could be fabricated for most offshore boats.

the chain will stack into a cone and jam the pipe every time the anchor is retrieved.

The deck pipe can let in a huge amount of water when sailing hard on the wind. Although this should be plugged on passage, safety demands that an anchor be ready to run when sailing coastwise. That means that the chain locker must be set up to remove any water that gets into it. Self-draining chain lockers sound great in theory, but as discussed in the Sea-Safe Deck Layout section in Chapter 3, they often don't work well in practice. Most people we have met with boats under 45 feet have had to seal a self-draining locker, move the chain box aft, and create some other way to drain the water that comes in through the deck pipe.

On older boats, the chain locker communicates with the bilge, and anything that comes in through the deck pipe will find its way to the sump if the bilge drainage is set up well. This solution has the advantage of simplicity

Figure 4-22.
A similar platform offers most of the same advantages but is considerably lighter.

Figure 4-23.
The PVC pipe could be led farther aft in *Hawk*'s chain locker for better weight distribution; however, it is high enough that the chain never pyramids and jams under the pipe.

and uses the boat's existing systems to remove any water. But it has the disadvantage of bringing a great deal of water below in certain situations, and with it mud and dirt that can easily clog smaller bilge pumps. Unfortunately, there is no single, optimal solution to getting rid of water that finds its way into the chain locker.

If the boat has a watertight bulkhead and the chain locker lies below the waterline, a pump will have to be used to remove any water that gets into the locker. This is the situation on *Hawk*. A small pipe welded into the base of the watertight bulkhead on the centerline of the boat was designed to drain water from the chain locker into the bilge. We have plumbed that to our electric bilge pump using a T-fitting so we can switch between pumping the bilge and pumping the chain locker. Most experienced cruisers we know have come to some sort of similar solution.

I consider pressure water optional; we don't have it on *Hawk* and rarely miss it. But I would not be willing to do without our deck washdown pump. Not only does this keep sand and mud out of the anchor locker, but it also allows us to rinse the boat before collecting rainwater and to clean up after we've been engaged in a major project on deck.

Bear in mind two final points in organizing your anchoring platform. First, anchors need to be secured at sea so that they cannot break loose and damage the boat. They should be fastened both at the shank and at the crown. On *Hawk*, we secure the crown using a line through holes in the cheek plates, and we lash the shank against a U-bolt in the deck (Figure 4-24).

Second, both asymmetrical spinnakers and Code Zeros (reachers set on removable furlers as described in the Upwind Sail Combinations and Sail Handling section in Chapter 5) need to be fixed to a strong point at the stemhead

Figure 4-24.
Hawk's primary anchor secured for sailing.

TABLE 4-3. REVITALIZING THE MAST AND STANDING RIGGING	
Boat Age	**Mast and Standing Rigging**
20+ years	• Replace entire rig
10–20 years	• Replace standing rigging • Reinforce mast • Rebuild/repaint mast • Replace mast wiring • Replace navigation lights
5–10 years	• Replace any suspect rigging • Reinforce goosenecks • Reinforce boom at vang fitting
New–5 years	• Inspect mast/rig • Add staysail stay • Add running backstays/checkstays • Install spreader lights • Tune rig

in front of the headstay. If you plan to outfit your boat with either of these sails, you will need to build an attachment point into the stemhead fitting. Asymmetrical spinnakers create large shock loads when they collapse and fill in an ocean swell; Code Zeros will produce loads as large as those the headstay must withstand. Therefore, the stemhead fitting will need to be as strong as a chainplate, and you'll want to factor that into your anchoring platform design. On *Hawk*, the headstay chainplate extends beyond the bow roller. We attach our Code Zero and our asymmetrical spinnaker to the Spectra pendant spliced to the shackle at the forward end of the chainplate (just visible in front of the headstay turnbuckle in Figure 4-24).

Revitalize the Rig

If you do nothing else before you set sail, make sure the spars and standing rigging are sound. Any problems with either should be clearly stated in the survey, along with recommendations for upgrading them. If you are taking your current boat and have not had a survey done, take the mast out of the boat and hire a good rigger to go over every inch of the rig and make recommendations for upgrading it to offshore standards. Find a rigger who has worked on offshore racing yachts, not round-the-buoys racers and coastal boats.

Table 4-3 itemizes the things that may need to be done to upgrade the mast and rigging on boats of different ages. Most catamarans depend upon only three stays to keep the rig up. The loss of any one will drop the mast. Karl and Jill Matzke sailed a Kennex 445 around the world. They ended up adding an inner forestay and running backstays after losing their mast off the Costa Rican coast when the forestay parted at the top swaged fitting. Karl says, "At this point we do not see [the normal] configuration as offshore-ready. Around-the-world racing multihulls have multiple stays, and in our view cruising catamarans should as well to eliminate single-point failures."

Unless you plan to replace the entire rig, you should make your own inspection to confirm what the surveyor or rigger has found and to identify any other problem areas. Start at the masthead and work down to the heel fitting, inspecting every weld, every fastener, every sheave, every terminal, every spreader, every stay, and the entire length of the mast track. Take along a magnifying glass, a bit of 600-grit sandpaper, a screwdriver and needle-nose pliers, an oily rag, and an indelible ink pen to mark any small cracks or stress areas you find. On a second round you may also need a grinder and a drill. If the mast is more than 5 years old and has never been out of the boat, make a first inspection with it up, and then pull it to check the mast heel and mast step. Any repairs will be much easier to carry out with the mast out of the boat.

To find problem areas, inspect the following:

- **Welds.** Use the magnifying glass to look for cracks in typical problem areas including the headbox and masthead crane, around spreader bases, the tangs, and the gooseneck and vang attachment points to the mast and the boom. Even the tiniest crack in a weld can indicate a big problem, for the crack may originate in the interior of the mast and run through the entire weld. On a mast that has been painted, all that may be visible is a hairline crack in the paint. You will need to very delicately grind this back to see if the crack penetrates the weld.

- **Fasteners.** Corrosion between an aluminum mast and stainless steel fasteners can result in blistering paint, chalky white deposits on the mast and the fastener, and loose or damaged fasteners. Stress may cause deformation in the mast wall surrounding the fastening or hairline cracks in the paint on a painted mast and crazing in the anodizing on an anodized mast. Check for any of these signs around each fastener. If a large number of fasteners show signs of corrosion, you should strip the mast of all its fittings and refasten them following the recommendations in the Preventing Corrosion between Dissimilar Metals sidebar below.
- **Tangs and terminals.** Inspect each fitting where a shroud or stay attaches to the mast. Look for any sign of deformation, cracking, wear, or stress. Remove mounting bolts for tangs and inspect the fitting with the magnifying glass for crevice corrosion.
- **Sheaves.** Clean each sheave and make sure it spins freely and shows no signs of corrosion. Replace any that are deformed or excessively worn.
- **Mast wiring and fixtures.** Make sure each light works on the mast. Check the voltage at each light fixture and compare it to the voltage at the base of the mast to gauge voltage drop. Do a radio check with the VHF to determine broadcast range. Inspect wires where they leave the mast, looking for any signs of chafe or wear. Look for signs of corrosion or water saturation in the wires at the base of the mast. If the insulating material seems damp, peel some back and see how far water has wicked up the wire. Large voltage drops, wet wires at the mast base, and intermittent problems with lights or broadcast strength on the VHF all indicate that some or all of the mast wiring will need to be replaced.
- **Mast track.** If the mast has an external track, inspect it for any damage, including small scratches, gouges, or nicks. These will need to be sanded or ground away. If the track is badly damaged, it will need to be replaced. Check that each fastener is centered and flush with the track, shows no signs of corrosion, and cannot be tightened further. Make sure the joints between track sections are absolutely smooth and show no signs of wear.
- **Spreaders.** Check for corrosion where the shrouds pass through the spreader tip. Make sure there is no sign of cracking, stress, or deformation around the spreader bases or along the spreaders themselves. Each spreader should bisect its shroud. Adjust them if necessary.
- **Wire rope/rod rigging.** If the standing rigging is made from wire rope or Dyform wire, run a slightly oily cloth down each stay. Closely inspect any area where the cloth snags for fishhooks or stranding. Examine each stay where it enters the terminal for broken strands. Replace the stay if you find a single broken strand or fishhook. It is difficult to identify problems with rod rigging through a visual inspection. If the mast is out of the boat, inspect rod rigging for any kinks or deformation. Replace it at any sign of either.
- **Cutouts.** To prevent weakening of the mast section, cutouts where halyards exit the mast should be oriented vertically instead of horizontally and staggered up and down. The mast wall should show no signs of deformation or stress in the area of the cutouts. Cracks may radiate outward from square corners on cutouts. A small hole (⅛ inch in diameter or so) drilled at their termination point will stop the crack from going any farther. Rounding any square corners will prevent cracks from developing.
- **Swages/compression fittings, toggles, and turnbuckles.** Inspect for rust, cracking, elongation, corrosion, or any other signs of wear.
- **Mast heel.** Check for any signs of corrosion around the base of the mast. On boats more than 20 years old with a stainless steel mast step, the heel may be completely corroded and may have become welded to the mast step. In that case, the mast will have to be cut away from the step. Replacing a stainless mast step with aluminum, adding a drain, and, on a keel-stepped mast, raising it so it is 6 inches or so above the level of the bilge will prevent this from happening again.

Even if you can find no evidence of problems with the standing rigging, it should still be replaced if it has seen a certain amount of wear. Riggers usually recommend replacing all standing rigging after a circumnavigation, after three or four ocean crossings, after five or six years of seasonal ocean racing, or after ten to twelve years of seasonal coastal cruising. Err toward replacing the standing rigging if your boat is more than ten years old or has spent more than five years cruising. It's well worth doing this job as part of a total refit in your home port rather than chancing a rigging failure at sea and having to deal with the aftermath in a remote port.

For offshore work, stays should be sized so that the working load is no more than 25 percent of the breaking strength. To save weight aloft, many coastal and racing boats have rigging sized to 50 percent of breaking strength. A good rigger will be able to give you an idea of the working loads for your standing rigging. If there is any indication from owners of sister ships, your own experience, the survey, or a rigger that the rigging may be undersized for what you intend to do with it, go up in size when you re-rig. If the boat has Norseman or Sta-Lok fittings and you can't afford to replace them with larger ones, use Norseman's Dyform wire rope when you re-rig to gain 23 percent in strength with the same wire diameter.

Rod rigging is both stronger for its size than wire rope and virtually chafe free. It is increasingly common on many cruising boats. We had rod rigging on *Silk* and found it to be both strong and highly reliable. However, the presses required to mushroom the ends if a wire needs to be replaced or shortened can be found in only a few places around the world. Also, rod rigging is easily damaged if mishandled when being taken off the boat or stowed. Given our plans to cruise remote areas without yacht facilities aboard *Hawk*, we decided to use Dyform wire rope. This has performed well over more than 50,000 miles, though we have had to take extra precautions against chafe on our sails.

Compression fittings like those made by Sta-Lok and Norseman are far less prone to failure than swaged terminals and are much easier to replace at sea. They are also much more expensive. If you have to replace the rigging on the boat and can afford it, use compression fittings throughout. If you can't afford that, use compression fittings on the forestay and backstay and swaged fittings elsewhere. Make sure to hire a competent rigger with a rotary hammer swaging machine. Carry a spare compression fitting for use at sea if a swaged terminal fails.

If you have decided to add a staysail stay to the boat, you will need to add a tang on the mast for the stay and another tang for a block to act as a halyard sheave. If the boat doesn't have a spinnaker pole and you decide to add one, you will also need to install a pole fitting or a pole track on the front of the mast. If you decide to add running backstays or checkstays, you will need to install a fitting on the back of the mast. The loads from these fittings can easily pull a mast that hasn't been designed for them out of column and lead to mast failure. Ask a rigger to make sure the mast is strong enough to take these loads and to figure out a way to reinforce it if it isn't.

If the staysail chainplate is attached to just the deck, it will pull up the deck. To prevent this, the chainplate needs to be tied into a structural component. The easiest solution on most boats is to attach the chainplate to the bulkhead separating the anchor locker from the living quarters, spreading the load over a 6- or 8-inch-long stainless chainplate through-bolted to the bulkhead. Make sure the bulkhead is properly bonded to the hull and strong enough to take the load.

The attachment points for the boom and the vang turn out to be a weak link on many boats. We know half a dozen cruisers whose booms have broken at the vang lug, and many more who have had to reinforce the attachment points for the gooseneck and those for the vang on both the mast and the boom. If you find any signs of cracking or wear in these areas, reinforce them before you leave by adding gussets (Figure 4-25) or by adding an internal sleeve and bolting on a large plate (Figure 4-26). Welding weakens a mast by removing the tempering, but bolting

Figure 4-25.
On *Hawk*, we had gussets welded to the mast fitting where the gooseneck attaches to strengthen it when cracks developed in the welds.

Figure 4-26.
We replaced the welded tang on the boom where the boom vang attaches with a bolt-on plate to dissipate the loads; it is bolted to an internal sleeve that strengthens the entire boom section.

PREVENTING CORROSION BETWEEN DISSIMILAR METALS

When two different metals are immersed in an electrolyte (any solution that conducts electricity, such as salt water), a small electrical current will move from the metal with the higher electrical potential to the one with the lower. Essentially, you have a battery. This current will eventually damage the less noble metal—the metal with the lower electrical potential—resulting in corrosion. Initially, this damage will be on the atomic scale, but if it goes on long enough it can destroy the metal completely. This is what occurs when two different metals in contact with one another—for example a stainless steel machine screw screwed into an aluminum mast—become wet with salt water.

Wherever dissimilar metals come into contact, they must be separated from one another by some sort of an insulator to prevent corrosion. Large fittings such as winches and pad eyes should be mounted on a nonconductive pad made from nylon, acrylic, neoprene, or some other gasket material. The pad should extend ⅛ inch beyond the edge of the hardware. All stainless steel fasteners should be completely coated with corrosion inhibitors such as Tef-Gel or Duralac. Wherever a stainless bolt head or nut may come into contact with an aluminum mast or boom, use one or more nylon or vinyl washers. If a stainless bolt is not tapped into the aluminum but instead passes through the aluminum with a nut on the other side, use nylon sleeves or heat-shrink tubing to cover the barrel of the fastener where it goes through the aluminum.

On a fiberglass boat, the only places where dissimilar metals absolutely cannot be avoided are on the mast and around the propeller. Problems can also occur in the plumbing system, but they can be avoided by using only bronze fittings below the waterline and high-quality plastic fittings elsewhere.

On an aluminum boat, it is much harder to avoid dissimilar metals and the corrosion problems that can result. But much of the stainless steel and bronze on fiberglass boats can be replaced with noncorrosive materials on aluminum boats—glass-reinforced nylon (aka Marelon) can be used in place of bronze for seacocks, and aluminum can substitute for stainless steel in cleats, hatches, ports, handgrips, stanchion bases, and stanchions. Where stainless steel must be used, careful attention to properly insulating it from the aluminum during the building process will prevent any serious corrosion problems.

on a fitting means using stainless fasteners that can cause corrosion, and the fitting itself may hide early signs of failure. Talk to a good rigger to determine the best solution for your mast. If you decide to weld, run the welds vertically instead of horizontally to prevent buckling at that point.

If the boat does not have them, consider installing spreader lights. On a pitch-dark night when something breaks at sea, spreader lights make it much easier to locate the problem and fix it.

When you have the rig back together, but before you sail away for good, hire an experienced rigger to go out with you and show you how to tune the rig. While the principles are fairly simple, having a professional show you the ropes and look over everything that's been done will go a long way toward ensuring that you have no unpleasant surprises on your first offshore passage.

Problem-Proof the Engine and Propulsion System

Marine diesels have become tremendously reliable and forgiving. We now expect them to perform flawlessly, like a well-made car, for many thousands of hours over a decade or more with minimal maintenance. But even today's marine diesels don't run forever. On many older boats, the engine will need to be rebuilt or replaced. You should know from the survey if you have to do a major overhaul before you buy the boat.

Although a rebuild can save a significant amount of money, we've seen many of them end with a full engine replacement a year or two down the line. If the engine is more than 20 years old or has already been rebuilt once, you'll be better off replacing it entirely. Otherwise, find a good diesel mechanic and have every part of the engine from the fuel system to the exhaust thoroughly checked to determine what else will need to be replaced, and ask for a complete estimate on the total cost of a rebuild. Then see what kind of a warranty you can get and compare the rebuild estimate with the cost of replacing the engine before rebuilding. If the estimates are within a few thousand dollars of one another, go with the new engine. The greater reliability and smaller size of a new marine diesel will make the exercise more than worthwhile. For a full list of upgrades that may be necessary to boats of different ages, see Table A4-2 in Appendix 4.

Engine Upgrades

Even on a brand-new engine, you may need to make some of the following upgrades before heading offshore:

- **Primary filter.** Every engine has a fuel filter just before the fuel pump, but that filter is designed to remove only microscopic contaminants and can be easily fouled by water or larger particles. Every cruising boat should have at least one additional filter between the tanks and the lift pump. This should be designed to separate out water and other contaminants and deposit them in a see-through bowl with a drain plug at the base of the filter. Most cruisers rely on Racor filters, made by Parker. When installing primary fuel filters, bear in mind that they need to be accessible so that they can be checked for contamination regularly and drained if necessary.
- **Raw-water intake.** The intake should be located so it will stay underwater on all angles of heel and in all sea states. This is rarely a problem on monohulls but can be on multihulls in storm-sized ocean waves. If there is any question at all on your boat, you may want to consider creating a sea chest, a large, below-waterline compartment with a single large intake from which salt water is drawn to supply all the various uses aboard.
- **Raw-water strainer.** An oversized raw-water strainer should be fitted after the engine intake seacock and before the raw-water pump in an accessible place inside the boat. It should be large enough that a small piece of cloth or a large jellyfish can't block it completely. If the engine intake seacock is difficult to reach, the top of the strainer should be just above the waterline, so it can be opened and cleaned without closing the seacock.
- **Exhaust system.** If a siphon forms in the raw-water system or water is forced into the exhaust by a large wave, one or more of the engine cylinders can be flooded. This is one of the most common engine problems offshore, and it is well worth doing some redesign on the exhaust system to avoid it. Siphon breaks on saltwater hoses clog frequently enough that routine maintenance may not prevent a problem. Replace the siphon break with a hose fitted with a large one-way valve that ends as high above the waterline as possible, ideally in a coaming in the cockpit. To prevent a wave from forcing water up the exhaust hose, a shutoff valve can be installed in the exhaust pipe. This has become a standard practice among many European boatbuilders, but the valve will only prevent water from getting into the engine if it is closed. You will need to develop a rule of thumb for deciding when it must be closed and for remembering to open it before you start the engine.
- **Oil change pump.** On many engines it's all but impossible to access the bolt to drain the oil pan. Most people change their oil by using a hand pump or drill-mounted pump to pull the oil out through the dipstick. However, that allows residue and sludge to build up in the bottom of the oil pan over time and makes for messy, frustrating oil changes. On *Hawk*, we have plumbed an electric impeller pump into the engine sump to change the oil. To operate the pump, we must turn on a breaker at the distribution panel and a switch on the pump and remove a bronze cap from the hose. This multistep activation routine prevents us from accidentally pumping the oil out of the engine. With this system, changing the oil takes about 10 minutes and never creates a mess.
- **Engine heater.** Plumbing a heater into the freshwater cooling system on the engine or generator enables you to heat the boat with the engine's hot water. A few chandleries sell simple marinized bus heaters consisting of a fan and heat exchanger. If you run the engine or generator for an hour or so a day to charge, this will provide enough heat to keep the boat warm and dry during a summer cruise in Maine or before a late-fall departure from New Zealand.
- **Engine controls.** On most boats the engine control panel and engine stop are located in the cockpit, where they are exposed to salt water, moisture, and UV radiation. After a few years of cruising, these need to be replaced, and the engine control panel can be extremely expensive. Many experienced cruisers put the engine control panel and engine stop under the shelter of the dodger, inside the companionway, or even down below in the engine room. If you have to replace the panel or are installing a new engine, find a dry, sheltered place for the engine controls.
- **Engine mounts.** Rubber engine mounts deteriorate over time, leading to engine alignment problems. If the rubber in the mounts is cracked, looks compressed, or is pulling away from the metal, the mounts should be replaced. Engine alignment should be checked once a year, as the mounts tend to settle over time.

Propellers and Propulsion System Improvements

The propulsion system may also need attention, even on newer boats. Before making any changes to the propeller shaft or transmission, you'll need to decide if you want to change your propeller. Your decision will depend upon your budget and your itinerary as well as your cruising style. A classic fixed-blade propeller has two, three, or four blades permanently affixed to its hub at a specified *pitch*, or angle to the water. Nothing beats a traditional fixed-blade prop for pushing a boat through the water, but the drag created by the surface area of the propeller blades slows a boat when sailing and the inability to change the pitch will make the propeller much less efficient in reverse.

There are three different approaches to reducing propeller drag under sail:

1. **Folding propellers.** These usually consist of two blades mounted on hinges. Under sail, the force of the water against the surface of the blades snaps them back parallel to one another behind the hub, limiting friction and turbulence to that created by the hub alone. When the engine is put into gear, centrifugal force pushes the blades open partway, and then the thrust of the turning shaft snaps them into place, usually with a noticeable "clunk." In reverse, the thrust may close the blades instead of opening them, making maneuvering in tight quarters difficult. These were the first of the low-drag propellers and can still be found on most racing boats because they offer the least resistance under sail. Racing ratings suggest an average speed increase of 4.1 percent over an equivalent fixed-blade propeller.
2. **Feathering propellers.** Each blade in a feathering propeller is affixed to the hub by a gear that allows it to rotate. Instead of folding the blades back behind the hub, water pressure on the blades feathers them—rotates them until only the edges face forward—greatly reducing resistance. Though feathering props create higher drag than folding props under sail, racing ratings suggest that they increase speed by 2.4 percent over the equivalent fixed-blade propeller. When the engine is engaged, the prop shaft drives the gear at the base of each blade to rotate it out of the feathered position. Once the blades reach their stops at a preset pitch, the propeller begins to spin with the prop shaft. In reverse, the blades rotate 180 degrees from their position in forward, which means they present the same leading edge and pitch in either direction. That makes them significantly more effective in reverse than a fixed-blade propeller. Luke, Martec, and Max-Prop, among others, make feathering propellers for cruising boats.
3. **Variable-pitch propellers.** These are designed to adjust the pitch of the blades to whatever is optimum for the given conditions. Like feathering propellers, they feather when the engine is off, and gears in the hub rotate the blades when the engine engages. But instead of being fixed by preset stops, their pitch varies with the speed and direction of the water flowing over them. As a result, they can deliver more power than feathering propellers through most of their range. Brunton's Propellers makes the Autoprop, a variable-pitch propeller that has been finding its way onto more and more cruising boats, including *Hawk*.

The poor performance of folding propellers under power makes them inappropriate for most cruising boats. The feathering or folding mechanism on any non-fixed-blade propeller can be fouled by marine growth, making it essential to keep them clean. Feathering propellers need to have the pitch set properly when installed. In many cases we are aware of, it has taken three or four tries to find the right pitch. Beyond that, each of the propeller types has its advantages and disadvantages as summarized in Table 4-4. You should consider changing from a fixed-blade propeller to one of the other types if you really care about sailing performance or if your boat performs particularly poorly in reverse.

Once you've decided on your propeller, you can turn your attention to other areas of the propulsion system that may need upgrading or replacing, including the following:

- **Shaft coupling.** At the transmission end, the propeller shaft attaches to a coupling, which bolts to the

TABLE 4-4. ADVANTAGES AND DISADVANTAGES OF PROPELLER TYPES

Type	Advantages	Disadvantages
Fixed	• Least expensive • Least complicated • Least likely to fail • Most power in forward	• Most drag under sail • Poor performance in reverse
Variable pitch	• Almost as good as fixed in forward • Best performance in reverse • Do not need to set pitch	• Most expensive • Most complicated • Slightly more drag than feathering or folding under sail
Feathering	• Low drag • Better in reverse than fixed	• Expensive • Complicated • Less power in forward than fixed • Pitch must be set correctly
Folding	• Least drag under sail	• Worst performance under power

transmission. If the prop-shaft coupling fails, the prop shaft can be pulled right out of the boat by the spinning propeller, opening up a hole large enough to flood and sink a boat in a very short time. If the shaft coupling is held in place by a pinned keyway, it will not normally fail. But where the shaft coupling is held to the shaft by a series of setscrews, the screws may work loose with vibration. To prevent that, replace setscrews with through-bolts that go right through the shaft, or drill small holes in each of the screw heads and tie them to the coupling with Monel wire. In addition, a stainless steel hose clamp placed around the shaft forward of the shaft seal will stop the shaft from leaving the boat if the coupling fails.

- **Propeller shaft.** If the propeller shaft shows any signs of wear, including gouging or scouring around the stuffing box or Cutless bearing, it should be replaced, and the cause of the problem should be remedied. Most problems on the shaft result from a misaligned engine or from overtightening the stuffing box.
- **Stuffing box.** Some sort of fitting keeps water from coming into the boat where the propeller shaft enters the stern tube. Until the last decade, most boats were fitted with a *stuffing box*, a gland filled with waterproof packing material. Stuffing boxes allow small amounts of water into the boat to lubricate the shaft. The packing material needs to be replaced regularly, and on most boats that requires a haulout. In the last decade, lip seals have all but replaced stuffing boxes on newer boats. Lip seals require almost no maintenance, let no water into the boat, and can't be overtightened so as to damage the shaft. We've had a Tides Marine lip seal on *Hawk* since she was launched nine years ago, and it has performed flawlessly. If you have a stuffing box and you make any changes to the propulsion system that involve removing the prop shaft, we highly recommend replacing the stuffing box with a lip seal.
- **Cutless bearing.** The bearing that allows the propeller to rotate within the stern tube wears over time and may need to be replaced on older boats. A poorly aligned engine will also cause wear, so even relatively new boats may need to have the bearing replaced. To test it, rock the prop shaft from side to side. If there's more than ⅛ inch of play, the bearing should be replaced.
- **Cutters.** Everyone gets something caught in the propeller at some point, whether it's a stern line that got sucked under the boat, a fishing net drifting in the open ocean, or monofilament fishing line tangled in kelp. Any of these can stop an engine and foul the propeller badly enough to damage the engine transmission or the gears in a feathering propeller. Some sort of a cutter on the propeller shaft just in front of the propeller can lessen the chances of a line doing major damage. We prefer the Shaft Razor for its simplicity and ease of installation (see the Other section in the resources for this chapter in Appendix 1).
- **Engine alignment.** Once you've upgraded the engine and propulsion system, the engine needs to be aligned to prevent problems ranging from a damaged transmission to vibration in the propeller.

Modify Your Boat's Interior

Once your boat's structure and basic systems have been upgraded to offshore standards, you can turn your attention to its interior layout and finish. When remodeling a house, most people start with the kitchen. The same can be said of boats. Galley design, functionality, and equipment have improved radically over the last few decades. Beyond the galley, other interior modifications will be specific to the design and layout of the boat, though a few projects, such as upgrading stowage areas, tend to be common to many older boats.

Galley Upgrades

The ideal offshore galley was described in the Seaworthy Interior section in Chapter 3, and whatever you can do to bring your boat more in line with that will make life much easier for the cook. Even the best-designed galley will probably need a few small improvements before it is fully offshore ready. The stove, icebox, and sinks may all require upgrading even on newer boats.

Propane—liquid petroleum gas (LPG)—and butane are available worldwide and can be substituted for one another. These have become established in developed countries for use in recreational vehicle and camping stoves, and in less-developed countries for cooking. CNG (compressed natural gas) is not available outside the United States, and propane and butane cannot be substituted for it. Alcohol and methylated spirits for alcohol stoves have become increasingly difficult to obtain as their use for cooking has declined worldwide. If your boat does not have a propane stove, install one if you have the money and space to do so.

A propane system must be installed correctly. Propane is heavier than air, and it will pool in the bilge if the tanks develop a leak and the locker communicates with the boat. To carry propane, you will need to create a sealed locker that is separated from the rest of the boat and drains overboard through a downhill drain in the bottom of the locker. If your boat does not have such a locker, the easiest solution may be to buy one of the fiberglass propane lockers with drains sold by chandleries for installation in a cockpit locker. The propane system should include a solenoid that must be turned on before propane will flow. The switch should be located in the galley, with a light that comes on when the solenoid is engaged so you can tell at a glance if the propane has been left on.

Make sure the stove cannot break free of its mounts in a capsize. A safety belt in front of the stove will allow the cook to work while leaving both hands free. Install pad eyes on either side of the stove and attach a strong webbing strap to them using snap hooks. From the belted-in position, the cook needs to be able to move around enough to reach most lockers and the refrigerator. We keep several extra snap hooks clipped to the pad eyes to allow us to lengthen the strap when conditions are less boisterous or for washing dishes and putting things away.

To be useful in the tropics, refrigeration must be able to keep the icebox at least 50° below ambient temperature. Doing that efficiently requires an exceptionally well-insulated icebox. You will need to upgrade the insulation on the icebox in most boats older than 10 years and in any boat built for coastal sailing. For use in the tropics, refrigerators need to have insulation equivalent to R-20, and R-30 for the freezer. That means a minimum thickness of 4 inches of foam (urethane or isocyanate) or the equivalent for refrigerators and 6 inches for freezers. Most boat iceboxes are much larger than they should be for efficiency in the tropics, so you should be able to increase the insulation without having to take up any more space in the galley.

Several companies have developed super-insulating vacuum panels rated at R-values equivalent to 6 inches of foam in a 1-inch-thick panel. Bear in mind that the rated R-value quoted by most manufacturers is measured at the very center of the panel; the value drops significantly near the edges. These panels cost an order of magnitude more than traditional insulation and must be installed perfectly and protected from puncturing to live up to their rating. Even then, they will deteriorate over time, though there has not yet been sufficient experience with them to know whether that means a few years or a few decades. A well-constructed icebox with 4 to 6 inches of foam will be significantly less expensive, easier to build, and less likely to fail than one using vacuum panels.

The box should be constructed with a U-trap or a valve on the drain to prevent cold air from leaking out the bottom. It should also have double seals on the hatch and should open at the top to limit the amount of cold air lost when the box is opened. Finally, it should be organized to allow items at different levels to be reached easily without having to take everything out of the box. Acrylic (Plexiglas) can be used to create shelves for this purpose, as shown in the well-organized icebox in Figure 4-27.

Figure 4-27.
This icebox is cleverly designed to allow access to the bottom without moving racks or shelves.

The boat's motion in a seaway will make it a challenge to find places where you can put something down and leave it without risk of breakage or spills. A gimballed stovetop offers the only stable surface in a rolling sea. Deep sinks can be used as a spill-proof spot to put things and will become the catchall for dirty dishes, for fruits and vegetables before and after you cut them up, and for greased bread pans while you shape dough into loaves. A cutting board that fits securely into the top of one of the sinks makes the most useful surface for slicing and dicing in a rolling sea. Make sure you can stow it conveniently when the time comes to do the dishes. If the boat lacks counter space, a hinged countertop (refer back to Figure 3-19) will extend the workspace.

Finally, very few boats have a place to store a full-sized garbage can in the galley, but this will be essential to daily life aboard. If it can't be fit under the sink, you'll have to get creative. You may be able to install the garbage can under an otherwise unused part of the galley countertop, perhaps by the hull side, with access through the countertop for removing the bag. Or you may be able to build a pullout locker that will hold a slightly smaller garbage can. In any case, you will need to come to a workable solution before your galley will be complete.

Other Interior Improvements

To be a good home a boat must have **comfortable places to sit**, yet the vast majority of boats lack this simple amenity. Consider where you will work at the computer for a few hours at a time, or where you will sit and read. Straight-backed settees, nav station bench seats, and cockpit seats all lack lumbar support and will give most people a backache after a few days on passage. We have followed the lead of offshore racers and installed a car-racing seat with proper lumbar support and shoulder bolsters to hold us in place in our nav station. This seat was both much less expensive and better made than the available "marine" chairs. The chair at my writing desk, in which I spend 6 to 8 hours a day on occasion, came from an office supply store. We simply removed the rollers from its feet and bolted it to the cabin sole. While you may lack the space to install such a chair, changing the angle on settee backs and having cushions made with proper lumbar support will go a long way toward creating a truly comfortable place to sit.

On boats older than 10 years, all the **cushions** will probably need to be replaced. The fabrics used should be rugged and of a color that won't show dirt unless you intend to keep them covered most of the time. Ultrasuede and similar fabrics wear well, look great, and clean up easily, but they are expensive. Good-quality upholstering fabrics treated to resist staining cost much less and hold up almost as well. On newer boats, dirty cushions can be professionally cleaned or, if you don't like the pattern, re-covered with a new fabric. To protect your newly upholstered cushions and greatly extend their life, buy or make lightweight dust covers for use on passage.

The cushions themselves should be at least 4 inches thick throughout the boat and made from high-resiliency (HR), closed-cell foam. Different densities can be used to create as soft or as firm a cushion as you prefer. These will be much kinder to your back than the standard 2 to 3 inches of flimsy foam found on many older boats. For the master cabin berth, the cushion should be 5 to 6 inches thick. Several manufacturers make custom innerspring mattresses for boats. If you have back problems, you may want to consider this option, though they can be awkward to get aboard or to move around.

If the cushions aboard are not old enough to justify replacement but are not thick enough to be comfortable, try putting some egg crate foam underneath them. This can extend the life of a tired cushion until it's worn enough to be replaced. In the tropics, putting the foam on top of the cushion in sea berths will increase air circulation and keep you cooler.

Where sea berths are directly against the hull side, as is often the case in aft cabins or quarter berths, some cushioning along the hull will make the berth more comfortable when the boat is heeled. On *Hawk*, our sea berths have canvas pockets fitted against the hull side (see Figure 20-4). We fill these with clothes on passage, and they provide comfortable cushioning when the berths are to leeward. Other crews use egg crate foam under the cushion and up the hull side to provide padding and insulation.

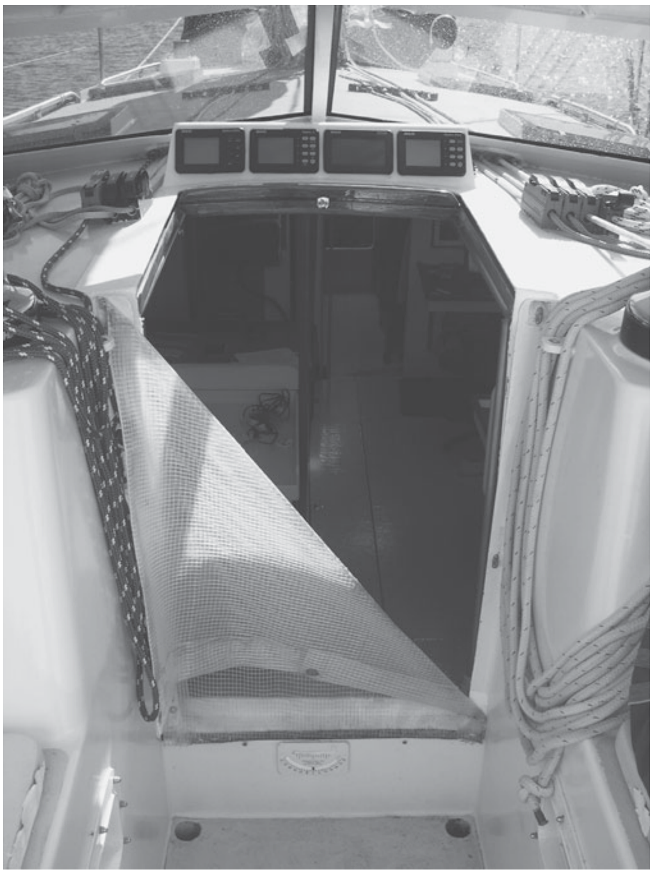
A **cloth** or **heavyweight plastic "door"** over the companionway allows you to shut out the world without having to put in the hatchboards. This prevents rain coming in when stern-to the weather in a marina or stern-tied to shore, provides some privacy in marinas or tight-quarters anchorages, and keeps the sun from shining into the main saloon in the late evening or early morning. Before we installed the watertight door on *Hawk* (Figure 4-5), we attached heavy-duty reinforced plastic around the companionway using Velcro and twist studs (Figure 4-28).

Increase Safety Above- and Belowdecks

Unless your boat has been extensively used offshore in a previous life, it will require some basic upgrades both on deck and down below, no matter how bluewater its pedigree. Very few of these are costly, but they will make a big difference in your comfort offshore.

When you're putting together your list of safety upgrades, get a copy of the "Complete ISAF Offshore Spe-

Figure 4-28.
Hawk's "door" was made from heavyweight plastic and allowed us to keep out the rain and wind and maintain privacy without having to put in the hatchboards.



COMMON ELECTRICAL AND PLUMBING SYSTEM UPGRADES

On older boats, the electrical and plumbing systems will have evolved over time so that whatever configuration you find aboard will result more from accident than planning. Many different people work on a boat during its lifetime, equipment gets added or removed, and related systems never get updated accordingly. A look anywhere in the bilge or near the electrical distribution panel on such boats will reveal a frightening spaghetti of wires and hoses.

Reforming a renegade electrical system starts by mapping, labeling, and testing every wire; finding every piece of electronic equipment, bus bar, and terminal; and removing extra wires, electrical equipment, and fuses that no longer have any use. Even if you've purchased a brand-new boat and have been handed a complete electrical diagram, you should take the trouble to verify what's shown and to make sure every wire has been properly labeled. To do this, invest in a good multimeter and learn how to use it.

A few electronic items that might take some time to locate include the fluxgate compass for the autopilot, the central processors for the autopilot and the instrument system, and the tuner for the SSB. Also, determine whether any equipment bypasses the electrical distribution panels. Charging systems such as solar panels, wind generators, and diesel generators are often fused near the battery box and do not go through an electrical distribution panel. Safety equipment such as automatic bilge pumps or alarms—for smoke, carbon monoxide, or propane—are often wired directly to the batteries so they cannot be turned off.

Table A4-2 in Appendix 4 shows the range of projects you may need to undertake to upgrade an electrical system, depending on the age of your boat. Nigel Calder's *Boatowner's Mechanical and Electrical Manual* (see the Refit Resources section in the resources for this chapter in Appendix 1) will prove invaluable in helping you tackle these projects. Mistakes in the electrical system installation can have the direst of consequences, from causing a fire aboard to electrocuting someone. If the boat needs a lot of electrical work and you intend to do it yourself, attend a seminar on the subject before you get started.

Work on the electrical system will be much easier with the proper tools. In addition to a multimeter, you will need a properly sized insulation stripper and a properly sized ratcheting crimper. With a good ratcheting crimper and proper connectors you will be able to produce perfect crimps every time, even in bad conditions at sea. Cheap "automotive" crimpers and soldering can be hit-or-miss propositions in difficult conditions.

Lighting has undergone a revolution since we started cruising a bit over a decade ago. A host of low-voltage lighting options now exist that can reduce electrical demand by 20 to 30 amp-hours per day, a significant percentage of the overall energy budget on many boats. The new fluorescent, halogen, and LED lights provide a range of options for many lighting needs with a tiny fraction of the electrical draw of the incandescent lights found on most boats a decade ago.

Make sure to install bright, highly focused reading lights in each berth and in the main saloon by any comfortable reading spots. A similar light should be fitted over the nav table for chart work. Red lights in the galley, head, and over the nav station will preserve night vision on passage. If these areas do not have fixtures that can be switched between white and red, it will be well worth the money to replace them.

If you plan to run a computer in the nav station, a car adapter can be purchased that will allow most laptop computers to be used with a 12-volt plug installed in the nav station. Even in port, this is preferable to running a computer on AC circuits, where it will not be protected from the power spikes and surges common in many countries. In addition to computers, most boats carry a host of electronic toys and tools, from digital cameras to CD players. A low-wattage DC-to-AC inverter installed in the nav station will allow you to charge the batteries for all these gadgets. For running sensitive electronics such as computers, printers, and stereos, the inverter will need to produce a true sine wave (TSW), versus the modified sine wave (MSW) of less expensive inverters.

Finally, if you have an engine or work room, installing a large 1,000- to 3,000-watt DC-to-AC TSW inverter will prove useful for running power tools and an industrial vacuum cleaner. This is a better solution than running the same tools through a transformer using shore power, because the difference in frequency will cause equipment to run poorly and may even damage it irreparably. Inverters should be sized so that 20 percent of the inverter rating in watts does not exceed the battery capacity in amp-hours. Thus, a 400 amp-hour battery bank can comfortably run a 2,000-watt inverter.

Like the electrical system, most older boats' plumbing systems will consist of a mishmash of hoses, fittings, and pumps, many not appropriate to their tasks. As with the electrical system, the best way to uncover problem areas is to diagram the plumbing system or confirm the plumbing diagram that accompanied the boat. Trace every hose; locate every pump; find every plumbing fitting; open and close every seacock. From a safety standpoint, the first priority in evaluating your plumbing system should be to ensure that all the seacocks in the boat are high quality, structurally sound, function properly, and are accessible. Beyond that, split or worn hoses, corroded fittings, leaking pumps, and rusty hose clamps will all need to be dealt with in your refit. Table A4-2 in Appendix 4 provides a list of additional upgrades that may be necessary on boats of various ages.

If your boat has not come equipped with a holding tank, you will want to add one. Only a few places in a few countries currently require holding tanks, but the restrictions are increasing and it's best to be prepared.

You can create a shower stall by glassing over the head sole and installing a shower sump to create a waterproof shower pan. A shower plumbed into the cockpit will get even more use than the head shower in the tropics. Manual freshwater pumps in the head and the galley will go a long way toward conserving limited water supplies. In addition, if you don't plan to install a watermaker, a saltwater pump in the galley will save a great deal of fresh water when cooking and cleaning up.

Unless located very close to the centerline, galley and head sinks will not drain well on one tack. A simple solution is to install a shutoff valve in the discharge line and to close it on the affected tack. However, you will be unable to use the sink again until you come off that tack. If you only have one sink in the galley, or if both galley sinks fill on the same tack, you will need to install a bilge pump to drain the sinks after use. The check valves in a small diaphragm pump installed in the discharge line will allow water to drain when the boat is flat, but stop water from coming into the sink when heeled over.

cial Regulations" published by the International Sailing Federation or the U.S. equivalent (see the Safety Upgrades section in the resources for this chapter in Appendix 1). These documents encapsulate knowledge accumulated from hundreds of thousands of hours of offshore racing. While they are densely written, and a few of the recommendations can be very difficult to retrofit, they provide many useful and proven ideas for making an offshore boat safer.

On Deck

First and foremost, on-deck safety means keeping crew on board. That involves everything from good nonskid to adequate attachment points for harness tethers. Unless the boat comes with nonskid molded into the deck, after ten years or so the nonskid will have been worn to the point where it will become a danger in the first gale at sea. To test the **nonskid**, pour ½ cup of vegetable oil on it and then try to walk across it without losing your footing. Throw a bucket of salt water over the oil and try crossing it again. See if you can keep your footing both barefoot and while wearing boat shoes. If you can't, you need to revitalize the nonskid using one of many excellent nonskid products. Coarse and fine nonskid additives for polyurethane deck paint work well for the side decks and coach roof. These allow you to adjust the concentration of nonskid to suit the area. On small high-traffic areas such as the place on the top of the coaming where you step to enter and leave the cockpit (Figure 4-29), use squares of rugged nonskid material backed with adhesive.

Several other on-deck safety issues need to be addressed on any boat, no matter the age or the size. These include the following:

- **Jackline attachment points.** On most boats, the jacklines run from bow to stern along the side decks. They need to be attached to something structural that would not get ripped from the deck during a capsize, either cleats or pad eyes through-bolted to the deck. On a 6-foot tether, a crewmember could

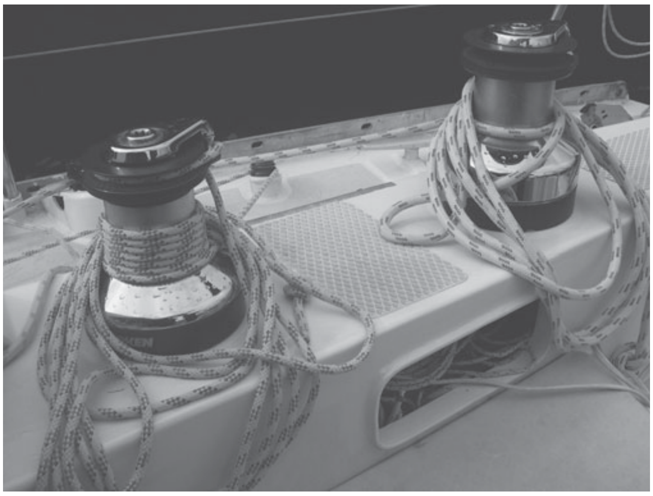


Figure 4-29.
We put Treadmaster on *Hawk*'s coaming to provide a nonskid surface for crossing to and out of the cockpit.

Figure 4-30.
Replacing the bolts holding the binnacle to the cockpit sole with eyes creates good tether points.

easily go overboard even if clipped to a jackline on the side deck, so crewmembers must learn to use handgrips at all times when moving up and down the decks even when tethered in.

- **Short tether attachment points.** Wherever crewmembers cannot spare one hand to keep themselves aboard, a tether short enough to prevent them from going overboard should be used. Attachment points for these should be placed anywhere crew are likely to be working with both hands, including the companionway, the helm station, the mast, and any headstays without roller furling. A U-bolt or tang should be installed just outside the companionway so crew can clip in on a short tether before removing the companionway boards. At the wheel, replacing the bolts holding the binnacle to the cockpit sole with eyes creates solid attachment points both in front of and behind the wheel (Figure 4-30) that can also be used to lock the wheel in place in heavy weather. Make sure to back these with oversized washers or backing plates. A stainless steel rod 10 inches or so long, installed in front of the mast an inch or so off the deck, makes a good attachment point and can also be used to stow spare halyards. Pad eyes can be installed near the bottom of each hank-on headstay.
- **Deck shade.** Adequate shade on deck is critical to keeping a good watch in the tropics as well as for preventing excessive sun exposure, which can cause dehydration, heat exhaustion, and skin cancer. A well-designed dodger large enough to shade the front half of the cockpit with the sun directly overhead should be considered an important piece of safety equipment. It should either be structural or strong enough to stand on. If it is not structural, it needs to be able to be folded down and stowed securely for ultimate storm conditions. In addition, you may want to consider adding a bimini to shade the back of the cockpit, but make sure it can easily be removed for windy conditions at sea.

If your electrical configuration and navigational requirements result in a number of bulky items that must be carried on deck, consider installing a **radar arch** (Figure 4-31). This makes an ideal platform for mounting solar panels, wind generators, radar, and antennas, and can also be used to support dinghy davits. But it will add significant windage to the boat. Although not that big an issue when running downwind in trade wind breezes, it will affect the boat's windward ability and its behavior in storm conditions.

Belowdeck

The single most important safety items down below are high-capacity **manual bilge pumps**. Most boats are fit-

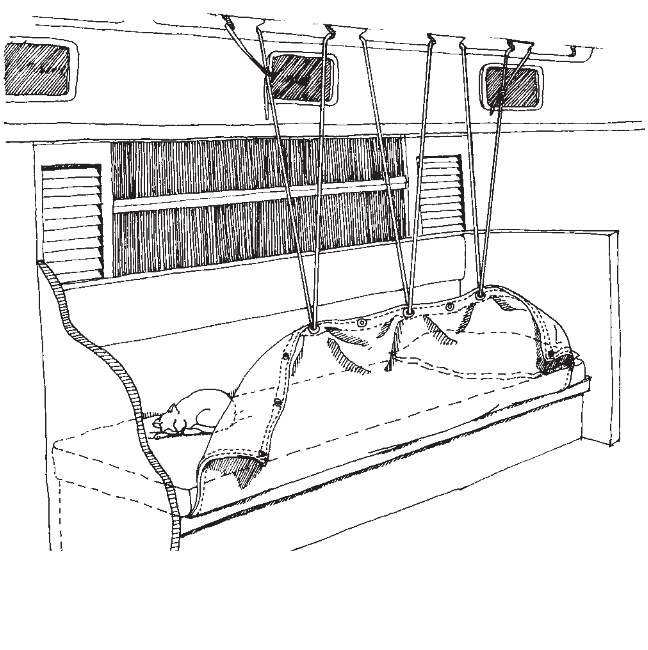
Figure 4-31.
This elegant radar arch keeps items that must be mounted on deck safely out of the way.

ted with an automatic electric bilge pump, but this will be useless if power is lost, and it will clog in any real flooding situation. An offshore boat needs to have at least two manual bilge pumps capable of moving 10 gallons or more of water per minute (gpm) that will work even if the batteries and engine have been flooded. Ideally, a 10 gpm pump should be fitted within reach of the helm station and a 30 gpm pump should be located down below within reach of the communications equipment in the navigation station. Finding space for a pump this size on a smaller boat can be difficult, but it should be considered a primary piece of safety equipment. These should be rugged diaphragm pumps plumbed so they exit the boat above the waterline on all angles of heel. Alternatively, they should be fitted with a vented loop as high in the boat as possible.

Chemical fire extinguishers should be placed in accessible locations throughout the boat. At a minimum, you should have one in the galley, one in the engine room, and one in the main saloon. Fix these in plastic brackets against bulkheads in recessed areas where they will be protected.

Good **lee cloths** are essential to offshore safety; without them, crewmembers will not get enough sleep and will gradually lose their judgment to fatigue. With the exception of small, single-person quarter berths, all sea berths will need to be equipped with a heavy lee cloth or lee board to hold the sleeper in place in a rolly sea. When thinking through your layout, try to organize at least one sea berth on each side of the boat for maximum comfort on each tack. If the berth is to be used on both tacks, both a board and a cloth give the greatest sense of security. On *Hawk*, we have two dedicated sea berths in the aft cabin equipped with boards and cloths (see Figure 20-4). We can use these on all angles of heel on either tack.

Figure 4-32.
On many boats, lee cloths can be secured by running a line to overhead grab rails. (Lyanne Schuster illustration)



The lee cloth should extend at least 1 foot above the cushion and up to 2 feet if there is adequate space overhead. A gap at the head and foot facilitates air circulation in the tropics and makes it easier to get in and out of the bunk. The bottom and top of the lee cloth should be hemmed to increase the strength of the material, and the bottom of the cloth should be attached to the berth using eight to ten #10 bolts (use screws if the underside of the bunk is not accessible) with large flat washers to prevent the material from tearing.

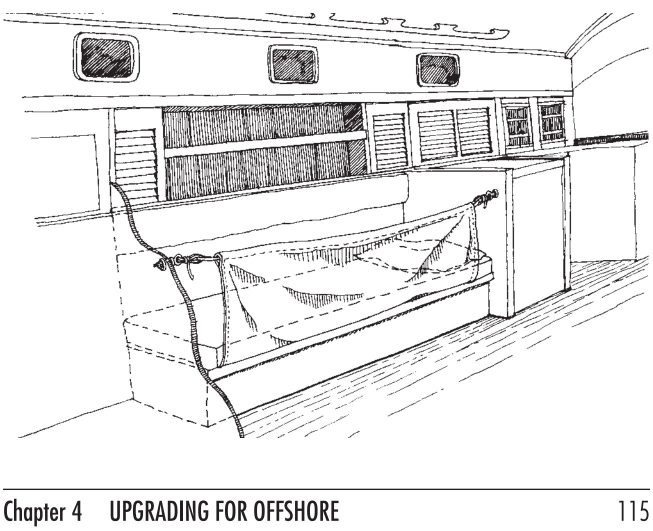
Lee cloths can be installed in a variety of ways. On most sea berths, the canvas lee cloth is bolted to the inboard side of the berth under the cushion. The cloth has grommets along the top edge, and lines are led through these to the overhead grab rail (Figure 4-32). Alternatively, a line threaded through the top edge of the lee cloth and fitted with snap hooks at either end can be clipped to pad eyes on a bulkhead (Figure 4-33).

If the sea berth will need to be used on the windward as well as the leeward tack, attaching the lee cloth to the outboard edge of the bunk can make it more comfortable. When the bunk is to windward, the lines can be tightened until the lee cloth pulls the mattress up, creating a cradle to hold the sleeper more securely.

On some settee berths, you can alter the width by sliding them in or out. Some aft cabin berths, especially the classic racing pipe berths, can be set at different angles depending on the amount of heel. In either case, the berth must lock securely in place to prevent the sleeper from being thrown out in a big sea. If the berth does not have a reliable locking mechanism, you will want to add one during the refit.

Even the shortest crewmembers should be able to reach at least one **handgrip** on any angle of heel from

Figure 4-33.
Alternatively, lines can be clipped to pad eyes in the bulkheads. (Lyanne Schuster illustration)



any point inside the boat. Shorter crewmembers will have problems reaching overhead handgrips when the boat is heeled. In narrower boats, these handgrips can be moved down onto the cabin trunk below the portlights. On wider boats, vertical posts that also serve to anchor one corner of the galley counter or saloon table can assist crew in moving through the saloon.

Fiddles serve a variety of purposes aboard, from keeping things from sliding off countertops in the galley to holding cushions on bunks and settees. Don't make fiddles more than 1 inch high on the dining table or on the nav station, where you may be trying to work over them. A 1-inch-high fiddle just about matches the height of a laptop, allowing you to work on the keyboard without the fiddle cutting into your wrists. Elsewhere, make fiddles up to 2 inches high. In places where you would rather not have to deal with fiddles in port, you can use removable fiddle rails of wood with posts sticking out of the bottom that fit into small holes drilled along the edge of the surface you wish to enclose. Totally enclosing the surface with fiddles will make it difficult to remove dirt and debris. Leave a gap of an inch at each end to create a crumb corner.

Many modern boats do not have fiddles to hold cushions in place, or the fiddles are too low to do the job. If your cushions slide onto the cabin sole when the boat heels or slip out from under you when you try to sit or lie on them, you'll need to secure them before heading off to sea. If fiddles cannot easily be retrofitted to hold them in place, heavy-duty Velcro can be used to attach cushions to furniture.

Beyond that, you will need to **stormproof all the stowage** aboard the boat. To do that, Alvah Simon, who wrote *North to the Night* about wintering over in the Arctic aboard his boat *Roger Henry*, suggests a useful exercise. Take a picture of the interior of your boat and turn it upside down. Now make a list of everything that wouldn't stay put, and figure out how you will secure it.

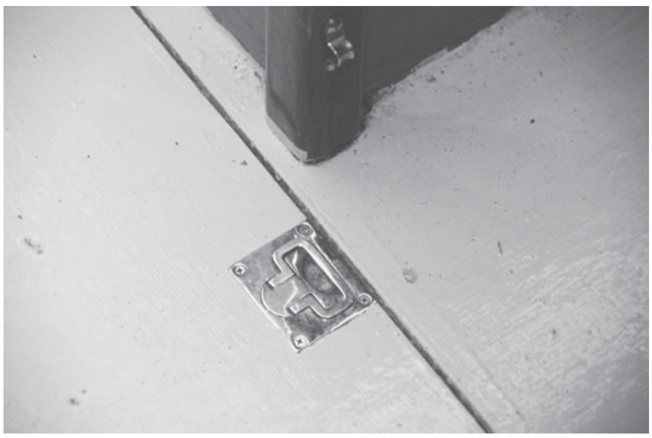
To pass this test, the following areas will need to be upgraded on almost any boat:

- **Refrigerator hatches.** Unless they can be locked in place, the hatches on most iceboxes and refrigerators will become dangerous projectiles capable of killing someone in a knockdown. If you can't retrofit a stout latch on the hatch, you can lock the hatch down with a wooden batten or metal rod anchored in the fiddle (Figure 4-34).
- **Floorboards.** In the event of a knockdown or capsize, whatever is in the bilge will fall on the floorboards. To prevent all of it from rocketing into the cabin, the floorboards need to have secure latches to hold them in place. Many production boats now come with good latches, but if your boat doesn't have them, you can purchase ones like those we use on *Hawk* (Figure 4-35) from marine chandleries.
- **Hatch locks.** Spaces under settees and forepeak berths accessed by overhead hatches also need to be secured in the event of a knockdown or rollover. The hatches need to be strong enough to take the weight of the locker's contents without breaking. They should be locked in place by stout latches or barrel bolts.
- **Battery tie-downs.** If the batteries break loose during a knockdown, they can do a tremendous amount of damage to machinery and people. On *Hawk*, we use ½-inch fiberglass rods (originally mainsail battens) threaded through sturdy battery boxes to lock the batteries in place. Fiberglass is stronger than wood but won't conduct electricity if it comes in contact with the battery terminals.

No matter how well prepared a boat may be, if it ever comes close to being inverted, the damage below will be extensive. But stormproofing your stowage will greatly in-

Figure 4-34.
A wooden batten anchored in the fiddle and closed with a barrel bolt secures this fridge hatch.

Figure 4-35.
These stout ABI latches can be retrofitted to secure the floorboards on almost any boat.



crease the chances the crew will escape without serious injury.

UPGRADING THREE OFFSHORE VOYAGERS

Our three voyagers—*Simplicity*, *Moderation*, and *Highlife*—started from very different places and required very different amounts of upgrading. Table 4-5 shows everything the three crews did to upgrade the structure and layout of their respective boats, and Table 4-6 gives an idea of how much they invested in money and labor-hours.

Simplicity's solid fiberglass hull was still sound, though the surveyor had found a few large blisters. But the bulkhead around the mast was no longer bonded to

TABLE 4-5. UPGRADES TO THREE OFFSHORE VOYAGERS

Upgrade	***Simplicity*** **(30-year-old, 33-foot cutter)**	***Moderation*** **(13-year-old, 40-foot catamaran)**	***Highlife*** **(8-year-old, 52-foot, cutter-rigged ketch)**
Remedy structural issues	• Rebond bulkhead • Strip bottom • Fill blisters • Reapply barrier coat • Antifoul	• Install backing plates • Replace core around deck fittings • Strip off old paint • Antifoul	
Make watertight	• Weatherstrip hatches, locker lids • Reglaze/refinish portlights • Rebed all deck fittings • Make teak plug for deck pipe	• Rebed all deck fittings • Rebed two ports, one hatch • Reseal mast base	
Upgrade insulation and ventilation	• Make harbor awning • Buy soft dodger (reuse frame)	• Add hatch in deck saloon • Add solar screens in deck saloon	• Add hatches in aft cabins • Install hard dodger
Improve anchoring platform	• New stemhead fitting for anchors • Replace cleats/fairleads • Install chain box under forepeak		
Revitalize rig	• Strip/restore/repaint mast • Replace all standing rigging • Install inner forestay/checkstays • Install low-energy navigation lights • Replace all mast wiring	• Hire rigger to inspect rig • Add inner forestay • Add running backstays • Reinforce boom attachment points • Replace two terminals	• Hire rigger to inspect rig
Problem-proof engine		• 2,000-hour service on engines • Install primary fuel filters • Add bus heater	• Add variable-pitch propeller • Add oil change pump
Improve interior	• Paint bulkhead • Install lee cloths • Restore floorboards/brightwork • Build removable table • Make new cushions throughout • Add saltwater pump in head/galley	• Install large garbage can • Make cutting board for sink • Rebuild icebox • Upgrade stowage areas • Replace all cushions below • Install lee cloths • Revarnish brightwork	• Install innerspring mattress in master cabin • Replace cushions in sea berths • Clean all cushions
Increase safety above and below	• Install new nonskid • Replace all stanchions/lifelines • Make chocks for dinghy stowage • Stormproof stowage • Upgrade handholds throughout • Install 30 gpm bilge pump	• Install two 30 gpm bilge pumps	• Move handgrips within reach • Install new handgrips • Install bimini • Stormproof all stowage
Other	• Rebuild toilet/replace hoses • Rebuild manual water pumps • Install additional water tank • Replace corroded wiring • Buy new cockpit cushions • Make cockpit table	• Buy new cockpit cushions • Replace electric water pumps • Install manual pump in galley • Add shower in cockpit • Add saltwater washdown pump • Replace all sanitation hose • Replace one toilet/rebuild other	• Rebuild pressure water pumps • Replace toilets with low-use freshwater toilets • Convert saltwater washdown to freshwater washdown

the hull, and her rig was not in any shape to withstand the rigors of the sea. She was leaking from an astonishing number of places even sitting on the hard, and most of her wiring was badly corroded. Her anchoring platform suited the coastal racing she had seen but was nowhere near what would be needed for long-distance cruising. Her 30-year-old engine wasn't in the best of shape. She had an alcohol stove aboard and only one sink in her compact galley. Simon and Susan started out by putting together a refit list as described in the Refit Plans for Three Offshore Voyagers section in Chapter 10. That totaled a bit over $30,000, more than twice what they could afford.

Undaunted, they started crossing things off the list. The single largest expense was for a new diesel engine, so they decided to make do with what they had and make do without it if it failed. Installing a propane stove got crossed off next. Gradually they whittled down the list to the things that had to be done to make the boat seaworthy and livable as shown in Table 4-5.

Susan and Simon could not afford to hire anyone to work on the boat. The upgrades shown in Table 4-5 took them about 600 hours to complete (Table 4-6). This did not include time spent figuring out what to do and how to do it. They worked nights and weekends while still devoting 40 hours a week or more to their postdocs. Each of them averaged about 20 hours per week on the boat, and it took them over six months to finish this first phase of the refit. Two experienced marine professionals working full-time could have done all the work in less than two months, but that would have cost an additional $20,000 or more. As it was, Susan and Simon needed to invest only a bit over $5,000 to pay for this part of the refit.

Moderation had been well set up for coastal cruising, but Michael and Molly needed to refurbish areas that had deteriorated over her 13-year life. These included the plumbing system and the seals on hatches and ports. In addition, they had to upgrade her systems and equipment for the more stringent requirements of offshore sailing.

TABLE 4–6. ROUGH ESTIMATE OF COSTS TO UPGRADE THREE OFFSHORE VOYAGERS (U.S. DOLLARS)

	Equipment/ Materials	Total Labor-Hours	Owner's Labor-Hours	Cash Outlay
Simplicity	$5,250	600	600	$5,250
Moderation	$10,000	325	200	$18,200
Highlife	$11,500	220	0	$22,000

Moderation's cored decks had proven sound during the survey, except for some small areas of water intrusion into the core near some of the deck fittings. Michael and Molly decided to pull and rebed all the deck fittings and fix any core damage this uncovered. They also resealed the mast boot. The main saloon area was hot in the summer, so they knew it would be a problem in the tropics. They covered the fixed glass with a mesh solar screen and added a large hatch in the cabin top.

They hired a rigger to inspect the rig, and he found several cracks on the mast and boom fittings. They reinforced these attachment points and ended up replacing two terminals that showed signs of corrosion. Like most catamarans, *Moderation*'s rig was held in place by only three stays. They installed an inner forestay and running backstays.

The two engines each had fewer than 2,000 hours of use, and compression-tested well, so the Moderations merely had them serviced and concentrated on the ancillary systems. They added primary fuel filters on both engines to ensure the cleanliness of the fuel. The boat was already fitted with feathering propellers, which they found worked well.

They added a high-capacity manual bilge pump in each hull for emergencies, and they rebuilt the icebox, more than doubling the insulation from 2 inches to almost 5 in most places.

When they put together their refit list, they thought the $45,000 left after they bought the boat would easily cover the improvements they needed to make. But shortly into this first stage of the refit, they realized that they were going to spend more than half of that just getting the basic boat into shape. That would leave them with a lot less money than they had planned for buying equipment. Michael decided to undertake a number of projects himself to save on labor. He ended up doing about 165 hours of work during the initial upgrading of the boat, saving well over $5,000 in yard labor costs. He concentrated on less-skilled work such as rebedding deck fittings, upgrading the plumbing system, and rebuilding the icebox.

Michael and Molly had expected this phase of the refit to take about two months, with the boat in a yard the entire time and a couple of people working on it full-time. In fact, it took close to six months, but they weren't too worried about the delays. The yard gave them a break on labor rates, and Michael could work at his own pace with the boat on the hard. In the end, they invested about $18,000 and 200 hours of Michael's labor into this phase of the refit.

Eight-year-old *Highlife* was fit out for a circumnavigation and had completed two major ocean passages before she was sold. Her basic structure and systems had already been fine-tuned for offshore and liveaboard work, and the previous owner had already completed a major refit. Just to be sure, Hugh and Hilary Highlife hired a rigger to go over every inch of the rig, while they inspected the boat for signs of water intrusion. They found it to be watertight, but they did add new hatches on the coach roof that opened into the two aft cabins to improve airflow in the back of the boat. They also moved the handgrips along the headliner down to the cabin side, where Hilary could reach them, and added several new handgrips in the deck saloon area.

One of their biggest investments in this phase of the refit was to replace the soft dodger with a fiberglass hard dodger large enough to give them complete protection while watch-keeping. They intended to operate a generator and a water-maker for several hours each day, so they decided to switch the toilets and the deck wash from salt water to fresh. This eliminated a major source of odors in the head and allowed them to use fresh water on passage to wash down the decks and keep sensitive equipment salt free.

Hugh and Hilary hired professionals to do all the work on the boat. They had the boat in a yard for a total of three months. This phase of the refit cost $22,000 and took six weeks with two people working almost full-time.

After completing the projects shown in Table 4-5, the basic structure and systems of all three boats had been upgraded to handle the demands of offshore sailing and liveaboard cruising. Now each couple could turn their attention to equipment lists and begin outfitting their boat to reflect their preferences and needs.

CHAPTER 5
Sails and Sail Handling

If you're fitting out a boat for cruising, presumably you like to sail. But unless you have previous offshore experience, the conditions you will encounter in the open ocean will differ significantly from what you're used to. If you want to sail as much as possible while maximizing your miles per day, you need to understand these differences and what they imply for the optimal sail inventory and sail handling aboard your boat. This chapter takes a close look at how offshore conditions differ from those found coastally and then examines the implications for sails and sail handling on voyaging boats.

OFFSHORE SAILING REALITIES

As we prepared for our first voyage, I worried about heavy weather and wondered how often we would encounter it. Shortly before we left, however, Evans gave me Lin and Larry Pardey's *Self Sufficient Sailor*. In that book, the authors analyzed their logbooks to determine the percentage of time spent at different wind speeds over ten and a half years of voyaging. They found that they had experienced gale-force conditions (Force 8 or higher—see Table 5-1) less than 1 percent of the time.

On our first offshore passage, we spent 72 hours in storm-force winds, and by the time I arrived in Bermuda, one-third of my time offshore had been spent in heavy weather. I was convinced the Pardeys' statistics were wrong, but in the course of 35,000 nautical miles aboard *Silk*, we never saw such severe weather again. By the end of our first circumnavigation, our averages ended up much the same as theirs. I cannot explain why Neptune chooses to humble new sailors, but our story is not unusual. It illustrates both the necessity of preparing for heavy weather and the likelihood that a multiyear tropical circumnavigation will include only a few days of gale-force or higher winds.

What wind and sea conditions will you experience? This section draws upon three sources to answer that question: the logs from our two voyages, data from offshore weather buoys, and the information in the *Atlas of Pilot Charts*. Each offers useful insights into average offshore wind speeds, directions, and wave heights, with significant implications for the voyaging sail inventory and sail handling systems.

Sea conditions are not the only reality that determines the appropriate sail inventory for an offshore voyage. Most cruisers who head offshore do so in a bigger boat with a smaller crew than they have been used to when sailing coastwise. Both factors require adjustments in the sails carried and in the way they are handled if the crew is to function well at sea while keeping the boat moving at close to its optimal speed. Even if you have sailed coastwise for many years in the boat you will take offshore, you will probably need to make some major changes in both the sail inventory and the sail handling systems to optimize it for passagemaking.

Offshore Sailing Conditions

As mentioned above, three sources of data help illustrate the actual wind and sea conditions you can expect to encounter while sailing offshore. First, I have analyzed our logs over the course of our two voyages, chronicling more than 500

TABLE 5–1. THE BEAUFORT WIND SCALE

Beaufort Number 0–12[1]	Descriptive Term	Average Velocity (knots)	Probable Wave Heights[2] (feet)	Deep-Sea Criteria
0	Calm	< 1	0	Sea like a mirror
1	Light air	1–3	0.25	Ripples with appearance of scales but without foam crests
2	Light breeze	4–6	0.5–1	Small wavelets, still short but more pronounced; crests have glassy appearance
3	Gentle breeze	7–10	2–3	Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses
4	Moderate breeze	11–16	3.5–5	Small waves, becoming longer; fairly frequent white horses
5	Fresh breeze	17–21	6–8.5	Moderate waves with more pronounced long form; many white horses; chance of some spray
6	Strong breeze	22–27	9.5–13	Large waves begin to form; white foam crests more extensive everywhere; probably some spray
7	Near gale	28–33	13.5–19	Sea heaps up, and white foam begins to blow in streaks along direction of the wind
8	Gale	34–40	18–25	Moderately high waves of greater length; edges of crests begin to break in spindrift; foam is blown in well-marked streaks along direction of the wind
9	Strong gale	41–47	23–32	High waves; dense streaks of foam along direction of the wind; crests of waves begin to topple, tumble, roll over; spray may affect visibility
10	Storm	48–55	29–41	Very high waves with long overhanging crests; surface of sea takes on general white appearance; tumbling of sea becomes heavy and shock-like; visibility affected
11	Violent storm	56–63	37–52	Exceptionally high waves; small- and medium-sized ships can be lost to view behind waves; sea is completely covered with long, white patches of foam; everywhere the edges of wave crests are blown into froth; visibility affected
12	Hurricane	64+	45+	Air filled with foam and spray; sea completely white with driving spray; visibility seriously affected

[1]The Beaufort Scale actually extends to Force 17 (117 knots), but Force 12 is the highest that can be identified from the appearance of the sea.
[2]Wave heights will be affected by fetch, current, bottom contours, and other variables; maximum wave heights can be more than double the average.

days and 65,000 offshore miles. Second, we downloaded data from offshore weather buoys managed by the National Oceanographic and Atmospheric Administration (NOAA). Among other measurements, the buoys record barometric pressure, wind direction, wind speed, dominant gusts, and wave heights. We analyzed hourly data for the entire year of 1999 for three different buoys from the National Data Buoy Center (NDBC) website (see the Weather Websites section in the resources for Chapter 19 in Appendix 1). The specific buoys included Buoy 41001, located 150 nautical miles east of Cape Hatteras; Buoy 44004, HOTEL, located 200 nautical miles east of Cape May, New Jersey; and Buoy 46006, SE PAPA, located about 600 miles southwest of Portland, Oregon, at 40°50.5′N 137°29.2′W. All three lie in temperate latitudes in areas reputed to have a relatively high proportion of strong winds.

Both sets of data have been carefully compiled to report *average* sea conditions. The data from our passage logs are based on sustained wind speeds that lasted for an entire watch period or more, so short-lived squalls are not included. The NOAA buoys average wind speeds over 8-minute intervals, as opposed to the 5- or 8-second averaging on most boats' wind instruments.

The *Atlas of Pilot Charts* (see the Planning Tools: Pilot Charts sidebar in Chapter 18) offers a third source of data on average wind and wave conditions offshore. These charts consolidate observations gathered over many years by ships at sea, weather buoys, and satellites to summarize average wind speeds, directions, percentages of gales and calms, significant wave heights, and a host of other useful information by month and by area.

Average wind speeds and angles differ markedly depending on latitude. For purposes of this discussion, I have used the following definitions (see Figures 5-2, 5-3, and 5-4):

- **Tropical passages.** Passages made between latitudes 30° north and 30° south.
- **Temperate and high-latitude passages.** Passages made north of 30° north latitude, south of 30° south latitude, or from the tropics to temperate or high latitudes.
- **Trans-equatorial passages.** Passages that crossed the equator, passing through the doldrums and variables on either side.

Based on these data, four conclusions can be drawn that help illustrate offshore sailing realities. Each of these has serious implications for the offshore sail inventory.

Relative Infrequency of Heavy Weather

As already alluded to, winds of Force 8 or over (34 knots or higher) are infrequent at sea. During the course of our circumnavigation aboard *Silk*, we encountered winds of gale force or higher less than 1 percent of the time. In our total sailing career spanning some 520 days at sea, including a predominantly high-latitude voyage aboard *Hawk*, we have experienced *true* winds of gale force or stronger only 1.8 percent of the time, for a total of 230 hours or nine and a half days. Of that, only 24 hours occurred on passages in the tropics.

Because we work hard to sail downwind as much as possible, we have experienced *apparent* winds of gale force or higher even less frequently than that—1.3 percent of the time, or 164 hours—all in the temperate or high latitudes. We have never experienced apparent winds of gale force on passage in the tropics. That is not to say that gale-force winds do not occur in the tropics, but outside of hurricane season, they are usually associated with the convergence zone between the northeast and southeast trade wind belts and can be forecast with some accuracy. When we have experienced gale-force winds in the tropics, they were short-lived (less than a watch period), or we were safely at anchor. Outside the tropics, the percentage of gales does increase.

The pilot charts confirm these observations. A prudent mariner paying close attention to seasons and the information on these charts could complete a tropical circumnavigation sailing only in areas where the incidence of reported gales averages 0 percent. That does not mean our mariner would never encounter a gale, for the pilot chart figures are *averages*. But it does mean that the chances of running into heavy weather can be made extremely small if that is the overriding goal.

Moving into temperate latitudes means increasing the risk of encountering a gale. While in the tropics, we have experienced true winds of Force 8 or higher 0.7 percent of the time. North or south of 30°, the percentage increases to 2.5 percent. The data from the NOAA buoys, all located in the temperate latitudes, confirm our observations but still show surprisingly low frequencies of gale-force winds. In 1999, Buoy 41001, off Cape Hatteras, recorded winds in excess of 34 knots just 0.6 percent of the time; Buoy 44004, off Cape May, 0.5 percent; and Buoy 46006, southwest of Portland, 1.1 percent.

Such percentages seem low given the reputation these North Atlantic and North Pacific areas have for gales, so it is interesting to check the results against the pilot charts. Over the course of an entire year, the pilot charts show winds over gale force about 2.5 percent of the time in the area that includes the Cape May and Cape Hatteras buoys and 3.3 percent of the time in the sea area southwest of Portland. While these seem surprisingly small percentages at first glance, they are three times those recorded by the buoys. However, each square on the pilot chart sums up all the gales recorded within an area 5° on an edge—over 90,000 square nautical miles of open ocean—versus the single-point reporting of the buoys. In summary, even in areas of the temperate latitudes reputed to have a high incidence of gales, the actual percentage of winds over Force 8 experienced in a year is in the low single digits.

During the course of a trade wind voyage timed to avoid both the tropical storm season and the winter storms of temperate latitudes, most cruisers will spend less than 1 percent of their time offshore in winds of Force 8 or higher. Over the course of several years, however, the odds say they will experience gale-force or stronger winds at least once while on passage, most likely in the temperate latitudes.

Relative Frequency of Light Air

Although heavy weather turned out to be much less frequent then I had imagined before we left, we experienced far more light air than we had expected. Over the course of our two voyages, we have spent 22 percent of our time in true winds of less than 10 knots (Force 3 or less). When looking at apparent wind, that figure increases to just over 30 percent, representing some 3,800 sailing hours or almost 160 days. Ten percent of our time offshore we've been in apparent winds of Force 2 (6 knots) or less. These figures do not change appreciably when looking at different latitudes.

The NOAA buoy data show similar or higher percentages of light air. Over the course of 1999, Buoy 41001, off Cape Hatteras, recorded true winds of less than 10 knots 29.8 percent of the time; Buoy 44004, off Cape May, 31.7 percent; and Buoy 46006, southwest of Portland, 17.9 percent. No wonder many new cruisers are surprised by how much time they spend motoring.

If you care about making progress during the one-third of your passage time spent in apparent winds of less than 10 knots with a big ocean swell, you have two choices. You can buy a boat with a big engine and lots of fuel tankage to motor through the calms, or you can equip the boat with large, stable, easily handled light-air sails and learn how to use them well.

Size and Persistence of Waves

Offshore sailors will only encounter heavy weather a few times during the course of a multiyear, tropical voyage, but they will have to deal with waves in excess of 6 feet on a daily basis. The boat will need to be set up to sail efficiently in waves even when winds are light.

I do not record wave heights in our log because it is so difficult to measure them with any accuracy from the deck of a small boat. The NOAA buoy data help quantify the waves we experience on a typical passage, however. The buoys record *significant wave height*, which is defined as the average of the highest one-third of all the wave heights during a 20-minute sampling period. That means the largest waves would be bigger than this average, though the majority of waves would be smaller. As sailors, the largest waves affect us the most whether we are trying to keep the boat moving in light air or employing storm tactics in heavy weather, so this measure is more useful than a straight average would be.

For Buoy 41001 off Cape Hatteras, over the course of 1999, significant wave heights averaged 7 feet and exceeded 10 feet 18 percent of the time. In the same year, Buoy 46006, southwest of Portland, experienced much higher waves. Significant wave heights averaged 9.6 feet and exceeded 10 feet close to one-third of the time. The difference illustrates how swell impacts wave height, as the West Coast buoy measures waves generated over the long fetch of the Pacific Ocean.

Significant wave heights of 12 feet and over are large enough to have an impact on shipping. The pilot charts show the percentage of time that significant wave heights exceed 12 feet by area, and this corresponds fairly well to the percentages calculated for the buoys. In 1999, the Cape Hatteras buoy recorded significant wave heights over 12 feet 10 percent of the time. The buoy southwest of Portland reported significant wave heights over 12 feet 22.8 percent of the time. Significant wave heights over 20 feet roughly reflect the incidence of reported gales, with the Cape Hatteras buoy recording waves in excess of 20 feet 0.6 percent of the time in 1999, and the Portland buoy reporting 4.2 percent.

Light winds do not necessarily mean calm seas. Despite recording winds of less than 10 knots 30 percent of the time in 1999, Buoy 41001 off Cape Hatteras shows significant wave heights of 3 feet or less only 7 percent of the time. The buoy off Portland recorded only 4 hours of significant wave heights under 3 feet in all of 1999, though the wind was below 10 knots almost 18 percent of the time. It takes 48 hours or more of winds under 10 knots for significant wave heights to drop below 3 feet on the East Coast buoys; on the West Coast buoy the swell keeps significant wave heights above 3 feet even after three or four days of light winds.

Most coastal sailors experience waves over 6 feet only a handful of times. But the vast majority of time you spend on passage, you will be sailing in waves that big or bigger, and they will affect the motion of the boat. Sails and sail controls need to be set up to keep sails drawing efficiently in big waves even when winds fall below 10 knots.

Consistency of Winds in the Tropics

Before we left on our first voyage I pictured us in the trade winds, running downwind with 20 knots or so over the stern day after day, making effortless miles toward our destination and doing hardly any sail handling at all. But most trade wind sailing is far from effortless and is punctuated by squalls at night in addition to regular wind shifts between southeast, east, and northeast.

Even so, our logs prove that the trade winds are by far the most consistent winds on the planet in terms of both direction and speed. Eighty-eight percent of the time on our westbound passages between 30° north and 30° south, the wind has been aft of 110 degrees apparent (Figure 5-1). That percentage drops by more than half for our passages in latitudes above 30° and falls to less than 40 percent for our trans-equatorial passages.

Wind speed is just as consistent as wind angle in the tropics. Close to a third of the time on westbound passages between 30° north and 30° south, we had apparent winds of Force 4 aft of the beam; almost three-quarters of the time we had apparent winds from Force 3 to Force 5 aft of the beam (Figure 5-2).

The temperate and high latitudes show no such consistency (Figure 5-3). Above 30° latitude, we experienced apparent winds of Force 4 aft of 110 degrees apparent 14 percent of the time and Force 5 forward of 70 degrees apparent 11 percent of the time. No other wind speed/angle combination occurred more than 10 percent of the time. Wind angles and wind speeds are almost as inconsistent on trans-equatorial passages (Figure 5-4), because the doldrums around the equator and the variables on either side can bring winds of any speed from any direction.

Our log gives another indication of the differences between the tropics and higher latitudes. I thought we did a lot of sail handling in the tropics, but it pales in significance when compared with what we have done in the temperate and high latitudes. Not including reefing

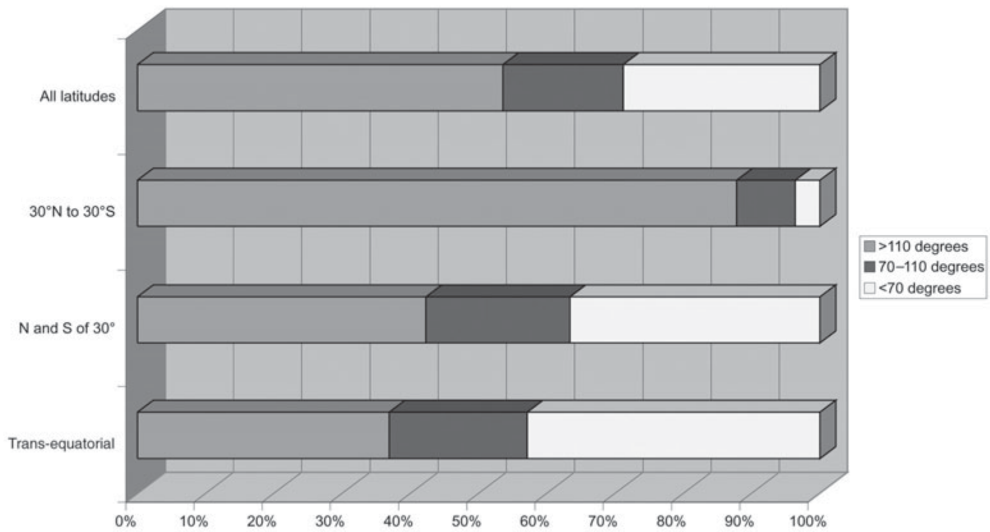


Figure 5-1.
Comparison of average apparent wind angles over the course of 65,000 nautical miles on passages made at different latitudes.

the main or furling the jib, we have rarely gone more than one full day without a major sail change when sailing offshore outside the tropics, and on many days our log records a sail change every watch.

This means that the ideal sail inventory and sail handling setup for the tropics differs significantly from that for the temperate and high latitudes. To sail efficiently in the tropics requires a sail inventory optimized for downwind conditions in light to moderate winds; to sail efficiently in higher latitudes demands a well-rounded sail inventory and efficient sail handling techniques that will not wear out a crew over the course of a long voyage. Ideally, a sail inventory for a proposed circumnavigation will meet all of these criteria.

Crew Size

The majority of offshore boats are crewed by one or two people. Sails have to be manageable by a single person on watch, or they won't get used. Safety equipment such as preventers has to be so quick and simple to use that it's almost as easy to do it as not. Sail controls need to be located in areas that are both safe and dry in heavy weather. Winches must be sized and positioned so that the smallest person aboard can work them with ease. Coastal boats do not need to meet these requirements, and very few do.

Time and effort put into optimizing the sail inventory and sail handling systems will pay off every day at sea through improved mileage and a better rested, happier, and more confident crew. We have found that the best sail-management ideas for us come from the shorthanded, long-distance offshore boats that compete in the Around Alone and Vendée Globe races. The sail lofts that work on the sails for these boats have proven best equipped to understand our needs for ease of handling and durability. With help from these lofts, Evans has adapted dozens of ideas gleaned from single-handed offshore racing boats and made them an integral part of our sailing aboard *Hawk*. As a result, each of us can easily manage *Hawk*'s 750-square-foot mainsail—one-third larger than the mainsail on a Swan 47—and her 1,000- and 1,500-square-foot light-air sails. The techniques we use will be discussed in detail in the Offshore Sails and Sail Handling section below.

Boat Size

Although average crew size decreases when moving from coastal to offshore sailing, boat size generally increases. Larger boats tend to have larger sails, which in turn generate much larger forces. As sail area increases, both sail construction and sail handling techniques have to change if the sails are to work efficiently and remain manageable for a shorthanded crew. Sail materials, construction, and handling on a superyacht have little in common with those on a 35-foot cruising boat.

There are two inflection points at which further increases in sail area precipitate a fundamental shift in the way sails should be built or controlled for optimal performance. The first occurs when mainsail performance is adversely affected by the weight, stretch, and construction techniques available with Dacron. On sloops and cutters, this point is reached between 45 and 55 feet of boat length; on catamarans it happens around 40 feet. To achieve optimal performance from the sails on a larger

Figure 5-2.
Apparent wind speeds and angles experienced over 20,000 nautical miles of tropical passages.

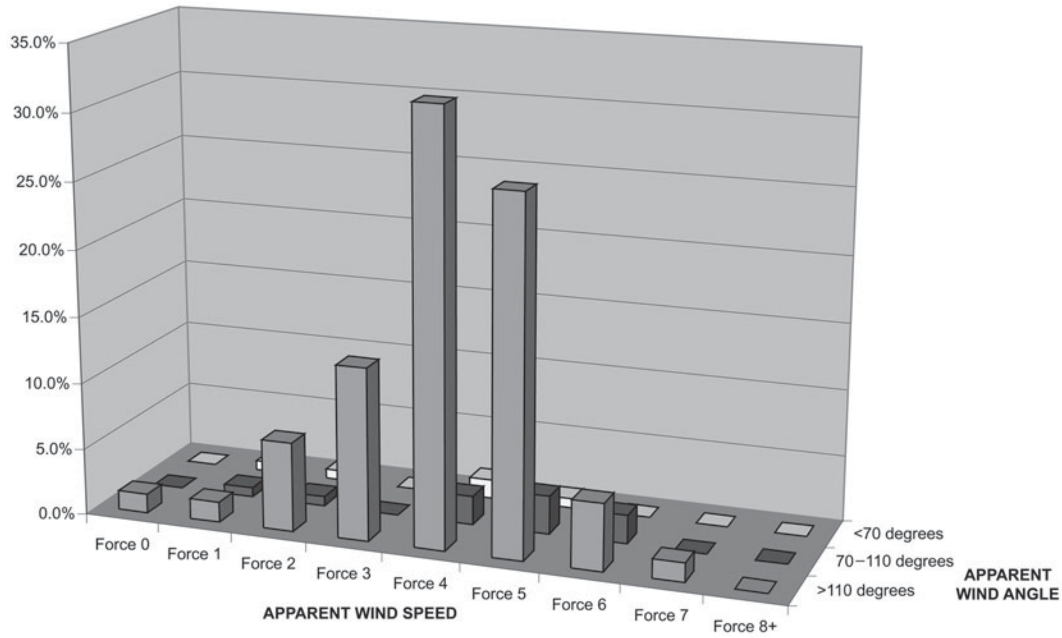


Figure 5-3.
Apparent wind speeds and angles experienced over 35,000 nautical miles of temperate and high-latitude passages.

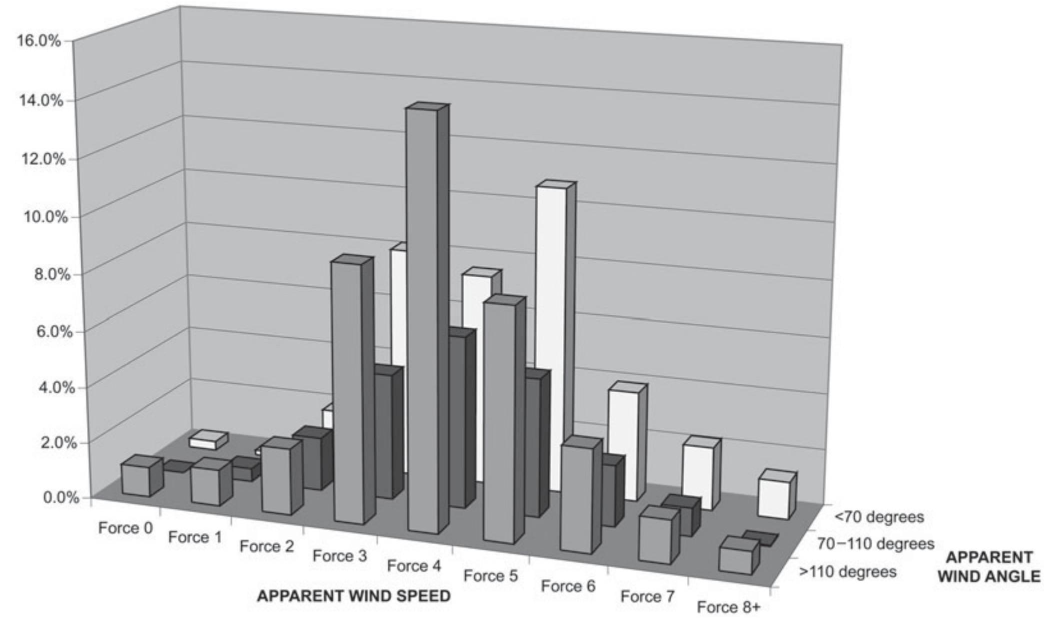
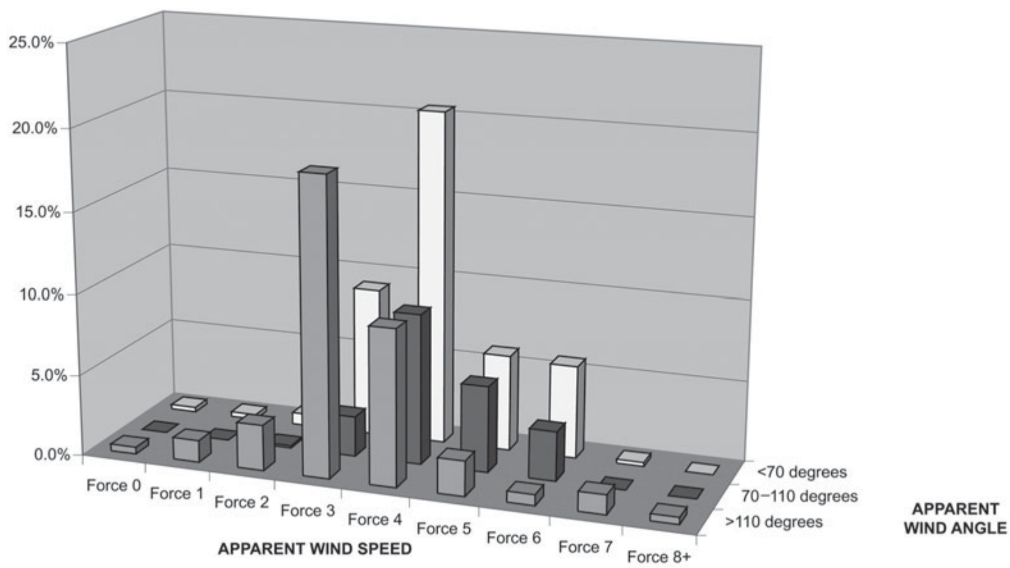


Figure 5-4.
Apparent wind speeds and angles experienced over 10,000 nautical miles of trans-equatorial passages.



boat requires the use of modern "post-Dacron" materials in sails and lines, radial instead of crosscut construction for the sails (see the Modern Sail Materials and Their Uses sidebar below), and more sophisticated sail handling equipment.

Let's put this in perspective, however. Although performance and ease of handling will improve with these investments, the boat will sail perfectly well without them. Quite a few cruisers with boats in this size range don't invest in modern materials for sails and lines or in efficient sail handling systems. Though they do not realize the boat's full potential, their boat speed is still significantly higher than it would be on a smaller boat. This performance satisfies them, and they don't deem an incremental improvement in performance worth the additional investment to achieve it.

The second inflection point occurs when the mainsail becomes too large to manage without some sort of furling system. Somewhere between 50 and 60 feet of boat length on moderate- to heavy-displacement cutters and sloops, handling the sail manually is no longer an option. Most boats of this size will have powered winches for the mainsail and powered furling systems to handle headsails. If something goes wrong—the hydraulic pump breaks or the furling unit jams—the crew has few options for controlling the sails. Though some cruisers put these same systems on boats smaller than 50 feet, in most cases they can still control the sails manually if something fails. Somewhere over 55 feet or so, these systems become essential to managing the boat and vastly increase the boat's complexity.

In the real world, these two inflection points relate strictly to sail area, not to boat length. Some designers of larger boats, including Amel and Dashew, build ketches in order to reduce the sail area in each sail to ensure that all sails can be handled manually in the event of gear failure. Ultralight-displacement boats need less sail area to drive them at hull speed, so even large ULDBs can be sailed without relying on mechanical aids. We have met couples cruising a Santa Cruz 52 and Farr 58 using the same sail handling techniques as we use on 47-foot *Hawk*.

Less obvious factors also affect the sail handling requirements on larger boats. Larger boats are faster on average than smaller boats simply because they have longer waterlines, and that additional speed has some interesting implications for sails and sail handling because of its effect on apparent wind. If a boat averages 5 knots in 12 knots of true wind, the maximum wind across its decks will be 17 knots, the minimum (when sailing off the wind) about 7. Flying only its working sails and without reefing, the boat can be kept sailing at close to its optimal speed on all points of sail. If a boat's average speed in 12 knots of true wind goes up to 10 knots, however, the apparent wind increases to a maximum of 22 knots while sailing upwind and decreases to just a few knots downwind. On this boat it becomes necessary to reef going upwind and to fly a large, light-air sail (and possibly to sail at higher angles) off the wind in order to keep the boat moving at its higher average speed.

Evans experienced an extreme example of this apparent-wind dilemma when he crewed on a 105-foot sloop from New Zealand to Fiji. Downwind, the boat needed close to 20 knots of true wind before sailing made more sense than motoring; going to windward, a first reef was set at around 10 knots of true wind, and with 20 knots of true wind there was a gale blowing across the decks. Not only did the boat's large sails require sophisticated sail handling equipment, including hydraulic furling on the headsails and mainsail and powered primary winches the size of garbage cans, but the amount of sail handling greatly increased over what would have been necessary on a 40-foot boat.

Therefore, as waterline length increases and average speed with it, the range of apparent winds a boat must deal with also increases, which means the boat must be set up to routinely handle a wider range of wind speeds.

OFFSHORE SAILS AND SAIL HANDLING

As we've seen, managing a large boat with a small crew requires easy-to-use sail handling systems that can be operated by one person. In the trade winds, good average daily runs depend upon efficient downwind sail combinations for light to moderate winds. In the temperate and high latitudes, a well-rounded sail inventory allows the crew to keep an optimal amount of sail flying in the variety of conditions that will be encountered.

One of the most difficult things about putting together your sail inventory will be finding a good sailmaker, but getting good sails depends upon it. Most sailmakers build sails for coastal boats, sails that get used for a few weeks of every year and that never have to deal with more than 30 knots of wind. These sails will not be up to what you will put them through. A good sailmaker not only understands the details that set offshore sails apart from coastal, but has also built those details into dozens of sails.

A good sailmaker will want to know more than just the P, J, and E measurements on your boat. The loft should ask you about your itinerary, the sail combinations you intend to use, when you reef, and whether or not you sail with the jib furled. Any sailmaker who does not ask these questions and a dozen others will not build the sails you need for your voyage.

In our experience, the best sailmakers for high-performance offshore cruising boats are those who have dealt with offshore racers, and particularly with the Vendée Globe and Volvo round-the-world boats. They understand what it takes for a sail to hold together over tens of thousands of ocean miles, and they know the most modern materials and techniques and whether or not they failed during the last race. Many lofts work on these sails, and the same designers and sailmakers will work on yours if you are willing to seek them out and pay a bit of a price premium.

If your boat is more traditional, look for a sailmaker who specializes in offshore cruising sails and has a track record. Talk to people who have used sails from that loft, and ask them what failed and when. Try to see a set of sails that have been used for 10,000 miles or more. We have found highly qualified sailmakers in most boating centers. If you take the time, you will find someone who can build a fine offshore suit of sails for you.

Table 5-2 summarizes the sail inventories we have assembled aboard both *Silk* and *Hawk*. They offer an overview of the types of sails a traditional ketch and a more modern sloop need to carry to meet the range of conditions that will be encountered on a circumnavigation. The following sections describe the specific sail combinations and sail handling we used in the tropics and in higher latitudes. The choices we made, and the logic behind those choices, will help you as you build an offshore sail inventory and design sail handling systems suitable to your boat, crew, and voyage.

Temperate and High-Latitude Passagemaking: Managing Variability

Above 30° latitude, no combination of wind angle and wind speed dominates (see Figure 5-3). Sailors experience much greater variability in wind speeds and wind angles in the temperate and high latitudes than in the tropics, including stronger winds on occasion. To sail efficiently, a boat must carry not only a sail inventory to cover this broad array of conditions, but also the

TABLE 5–2. SAIL INVENTORIES FOR *SILK* AND *HAWK*

Sail Types	*Silk* (37-foot centerboard ketch)	*Hawk* (47-foot fin-keel sloop)
Working	**Mainsail** • 9.0 oz. woven Dacron • Crosscut construction • Full battens/lazyjacks • Internal track/Battslides • Two reef points/slab reefing **Mizzen** • 7.5 oz. woven Dacron • Crosscut construction • Two reef points/slab reefing **Working headsail** • 7.5 oz. woven Dacron, roller furling 135% genoa • Crosscut construction	**Mainsail** • Spectra laminate • Radial construction, loose-footed roach overlaps backstay by 18 in. • Full battens/lazyjacks • External track/ball-bearing cars • Two reef points/double-line reefing **Working headsail** • North 3DL laminate with Vectran fibers, roller furling 105% blade jib • Radial construction, vertical battens
Light air	**Spinnaker** • 700 sq. ft., 1.5 oz. nylon asymmetrical spinnaker • Dousing sock	**Spinnaker** •1,500 sq. ft., 1.5 oz. nylon asymmetrical spinnaker • Dousing sock **Code Zero** • 1,000 sq. ft. (~155%), 5 oz. woven Dacron furling reaching sail with Vectran luff • Removable furler
Downwind	**Running sail** • 9 oz. woven Dacron 110% hank-on genoa	**Running sail** • ~105% 2.2 oz. nylon furling "blast reacher" with Vectran luff • Removable furler
Heavy air and storm	**Heavy-air jib** • High-cut, 10 oz. woven Dacron, 88% hank-on Yankee **Storm jib** • 10 oz., 50% hank-on staysail with club	**Storm trysail** • ORC[1]-sized, 12 oz. storm trysail • Separate trysail track **Heavy-air jib** • 60% Spectra laminate hank-on "genoa staysail" **Storm jib** • 12 oz., ORC[1]-sized, 40% hank-on staysail **"Hurricane" jib** • 10 oz., 20% hank-on staysail

[1]As stipulated in the "Complete ISAF Offshore Special Regulations," also known as the ORC Special Regulations.

gear to make sail changes fast and easy for one person working alone.

Working Sails and Sail Handling

Above 30° latitude, we rarely manage to go more than one watch without a major sail change. On many occasions, we have put in and shaken out reefs in the main or furled and unfurled the headsail half a dozen times in a single watch period. Simple, bulletproof sail handling gear enables a shorthanded crew to put in a reef or douse a sail quickly. Such equipment is not a luxury: It is an absolute requirement for safety.

Primary headsail. In the last decade, headsail furling systems have become accepted as standard offshore equipment and can now be considered virtually bulletproof if properly sized, installed, inspected, and maintained. Today it is rare to see a cruising boat longer than 30 feet without furling for the primary headsail. All the major manufacturers make excellent and reliable furlers. When sizing a furler for your boat, go with the larger size if your boat length falls on the border between two units. On 47-foot *Hawk*, we installed a furling unit designed for boats from 45 to 60 feet, which has given us an extra margin of safety in sudden squalls or high gusts.

The prevalence of light winds would seem to argue for a large headsail, but in a big sea a large sail (over 135 percent of foretriangle area) will not be stable enough to hold the wind. The furling headsail should be sized so that it will get the boat moving in anything over 8 knots of apparent wind and cut so that crewmembers can see underneath it from the cockpit. On most cutters, this translates into a bit over 100 percent. On a sloop- or ketch-rigged boat, it might be as much as 135 percent. Sized this way, the sail will be usable in up to 30 knots of wind without being more than a third furled, the point at which even a well-designed sail starts to lose efficiency to windward. Fractionally rigged boats like *Hawk* and most catamarans have headsail sheeting positions inside the stays and carry *blade jibs* (jibs sized so they just fill the fractional foretriangle) as their primary headsails. Such boats need a larger headsail for light upwind conditions, as discussed in more detail in the Upwind Sail Combinations and Sail Handling section below.

High-quality woven Dacron remains the most durable and least expensive material for headsails on most cruising boats. Only a small percentage of larger, high-performance boats will realize enough performance improvement to justify the higher price and reduced longevity of laminate materials (see the Modern Sail Materials and Their Uses sidebar below).

If the sail isn't full hoist, use a tack pendant at the bottom of the sail to raise the halyard swivel to the prescribed height to prevent halyard wrap. The sail should be equipped with a padded luff to maintain sail shape when partially furled, foot and leech lines that can be reached from the deck, and UV protection on any area exposed to the sun when the sail is fully furled, including webbing straps at the head. Acrylic materials such as Sunbrella provide much greater protection than UV-coating the sail, and the extended life more than makes up for the extra weight on the leech and foot.

Furler manufacturers all insist that a sail should be furled by hand, but most cruisers on boats over 40 feet or so lead the furling line to a secondary winch. This allows you to leave the furling line on a self-tailing winch when furled rather than cleating it off, making it easy to reduce or increase sail area as needed. When the sail is not in use, it should be furled so that the sheets wrap around it a full three or four times, and the furling line should then be secured so that the sail cannot come unwrapped in strong winds.

The furling line must have a chafe-free lead from the drum all the way to the furling winch, or it could chafe through in a gale, turning a well-reefed, under-control headsail into an unreefed, out-of-control flogging jib in seconds. A chafe-free lead requires, at a minimum, a turning block near the furling drum and a large foot block near the cockpit. Invest in oversized, low-friction hardware for these blocks.

When a headsail sheets inside the stays, its efficiency on a reach or a run will be greatly enhanced if the sheet lead can be moved outboard to the toe rail. Like most racing boats, *Hawk* uses a *short sheet*—a second sheet from the clew of the jib through a block on the toe rail and back to the primary winch (Figure 5-5). Switching from our regular sheet to the short sheet increases our boat speed by ½ to 1 knot when the apparent wind angle goes above 50 degrees.

Primary winches need to be sized so that the smallest crewmember can operate them with the sail fully loaded, and they need to be self-tailing. They should be placed so you can get your whole body over them either by standing on the cockpit seat or by straddling the coaming. There should be enough space around them to crank a long winch handle without hitting a dodger or another winch. If your winches don't meet these criteria, replace them. This is not a place to economize. These will be the most-used winches on the boat, and they will serve a variety of functions beyond headsail sheeting, including winching the boat into a dock against a wind, kedging the boat off after going aground, retrieving a kedge anchor, and even taking someone up the mast if a self-tailing halyard winch has not been fitted.

Although it is important to have large, self-tailing primaries, there are at least three reasons to avoid powered winches if you can. First, electrical or hydraulic winches

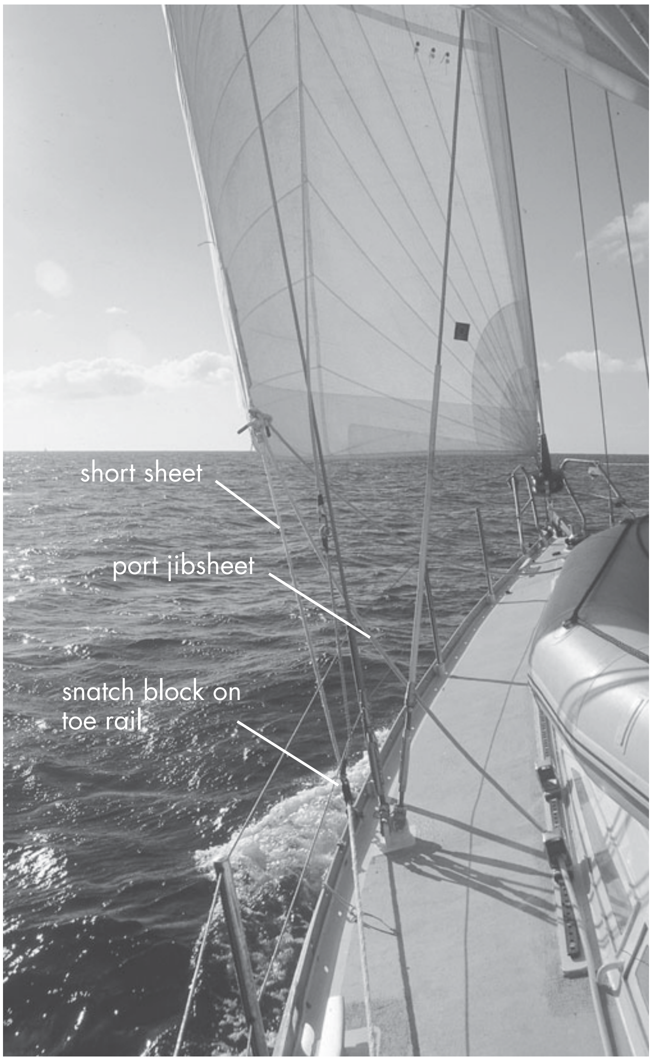


Figure 5-5.
When reaching or running, we move the jibsheet lead outboard on *Hawk* by running a short sheet through a snatch block on the toe rail.

and furling units can jam without anyone noticing, resulting in major breakage. Second, the buttons on powered winches can short out in heavy weather, powering up the winch when no one is in attendance, with potentially disastrous consequences for sails and spars. Third, they add complexity and increase the crew's dependence on mechanical aids. Powered winches should be equipped with nearby breakers so they can be disabled in an emergency, and they should be used in tandem with rope clutches so that lines do not need to be left in the winch self-tailer.

Genoa tracks may need to be lengthened to allow sheeting for the range of headsails you will carry for offshore work. Tracks should be marked with indelible ink to show the close-hauled position of the genoa cars for the primary headsail and the storm jib. Additional marks for off-the-wind sailing or other headsails will prove helpful when making sail changes. We cannot change the position of the genoa cars from the cockpit, but we have never found that to be a big issue.

Mainsails. Although headsail furling systems have proven themselves in the Southern Ocean school of hard knocks and have been embraced across the sailboat spectrum from Hobie Cats to Open 60s, mainsail furling systems remain problematic for offshore sailing. Both in-mast and in-boom systems require the boat to be turned up at least onto a reach in order to reef or douse the sail. This makes shortening sail a two-person operation on most boats, and in extreme sea conditions can make it dangerous to get the mainsail down.

Mainsail reefing systems tend to jam without careful attention to furling procedures (furling line tension, boom angle, etc). In addition, in-mast furlers add weight and windage aloft while compromising sail shape and reducing sailing performance; in-boom furlers add significant weight to the boom, increasing its tendency to slam violently back and forth in a large swell. If an in-boom furler breaks, the sail can still be dropped on deck, but if an in-mast furler breaks with the sail partially furled, it can be very difficult to get the sail down. Despite these disadvantages, there is little alternative to some type of mainsail furling on cutters and sloops over 55 feet long. Their crews operate them conservatively and set up the systems to limit their disadvantages.

Flaking systems (where the sail flakes around lazyjacks that run through grommets in the sail) and stack-pack solutions (where the sail drops into an integral sail cover supported by lazyjacks) are also not in general use aboard offshore boats. Although perfectly acceptable for coastal cruising, most flaking systems generate too much friction for one person to raise and douse the sail quickly and easily in heavy weather, and the sail cover on a stack-pack assembly won't hold up to constant sun and wind, resulting in broken zippers, frayed material, and a chafed sail. When it comes to mainsail handling, simpler is still better.

Hawk's 750-square-foot mainsail is as large as many mainsails on 60-foot boats, but we did not want to rely on a complicated furling system in the high latitudes, nor did we want to sacrifice performance. We have followed the lead of the single-handed offshore racers who control much larger mainsails than ours using full battens and lazyjacks.

Full battens offer four main advantages over a sail with partial battens or no battens:

1. **Increased sail area and aerodynamic efficiency.** Battens stabilize the leech of the sail, increasing its aerodynamic efficiency. Battens also allow extra sail area to be added in a roach that extends beyond the line drawn from the head of the sail to the clew. Full battens allow the most

roach to be added—picture a Hobie Cat sail with its almost humpbacked shape—greatly increasing the power available from the mainsail.

2. **Better sail shape.** Full battens improve sail shape at almost all wind angles and make the sail less sensitive to small changes in wind angle or speed. Full battens also allow the sail to be luffed without flogging, keeping the boat well balanced without reefing in gusts or squalls. In very light conditions, the battens hold the sail more or less rigid, so any slight breeze is not wasted in shaping the sail but gets translated into forward motion.
3. **Increased sail life.** Full battens extend sail life in a number of ways. First, they reduce flogging when reefing or dousing. Second, they help retain the sail's shape as it ages, particularly the aerodynamic efficiency of the trailing edge. Finally, in a sudden, short-lived squall, the sail can be luffed to keep from being overpowered with minimal damage to the sail material.
4. **Easier sail handling.** With the proper luff hardware and lazyjacks, a full-battened sail will drop down on the boom when reefed or doused even off the wind rather than ending up plastered against the mast and the stays. On *Hawk*, we can reef when sailing dead downwind in up to 20 knots apparent. That means that one person can reef or drop the sail without changing course. When dousing sail, we just drop the sail into the lazyjacks, tug on it a few times to straighten it, throw a few sail ties over it, and forget it.

Full-length batten systems do have downsides, expense and chafe being foremost. Both are a function of the forces the battens generate, particularly on the luff of the sail. Boats over 45 to 50 feet will need an external mast track plus luff hardware and one of the several excellent batten car solutions (from Harken and Antal, among others) to manage the batten's high compression loads while allowing the main to be hoisted and dropped easily (Figure 5-6). On boats with high booms, the sail will stack lower if you use a batten car system with short cars, making it easier to handle.

Ball-bearing batten cars (also called battcars or luff cars) offer the lowest-friction solution, but only as long as they stay clean. Batten cars using a slippery, ultra-high-molecular-weight polyethylene (known as UHMWPE) instead of ball bearings work less well when perfectly clean, but their performance changes little as the track and cars accumulate a coating of salt over a long passage. If you opt for ball-bearing cars, make sure to install ones with "captive" systems that hold the bearings in place when the car is removed from the track, and clean them with hot water and soap as often as possible at sea.

Figure 5-6.
Larger boats will need to be fitted with an external track, luff cars, and good luff hardware to handle the loads generated by full battens.

Retrofitting an external track and batten cars to an existing boat can easily cost as much as a new mainsail—

Figure 5-7.
Schaefer Marine's Battslides use a slug that runs through the existing mast track. This allowed us to install a full-battened main on *Silk* without the expense of an external track and batten cars.

an expense justified only on boats 45 feet and over with modern underbodies. On smaller boats, a system consisting of sail slugs in the existing track that are mated with fittings attached to the batten ends works almost as well (Figure 5-7). For ketches up to 45 feet and cutters up to around 40 feet, this option offers a practical, inexpensive way to attach the batten end to the mast. For slightly larger boats, UHMWPE tracks that can be inserted into the existing track are much cheaper and easier to install than the external tracks used for ball-bearing cars. In conjunction with the UHMWPE cars, they provide another alternative for retrofitting batten hardware.

Some people worry about full battens breaking, but we broke far more partial battens on *Silk* than full battens on either boat. The materials used to make full battens have become so strong and light that they are virtually indestructible. In 65,000 offshore miles, we've broken only one full batten, and that was in the Southern Ocean in light air and a 4-meter swell during a jibe.

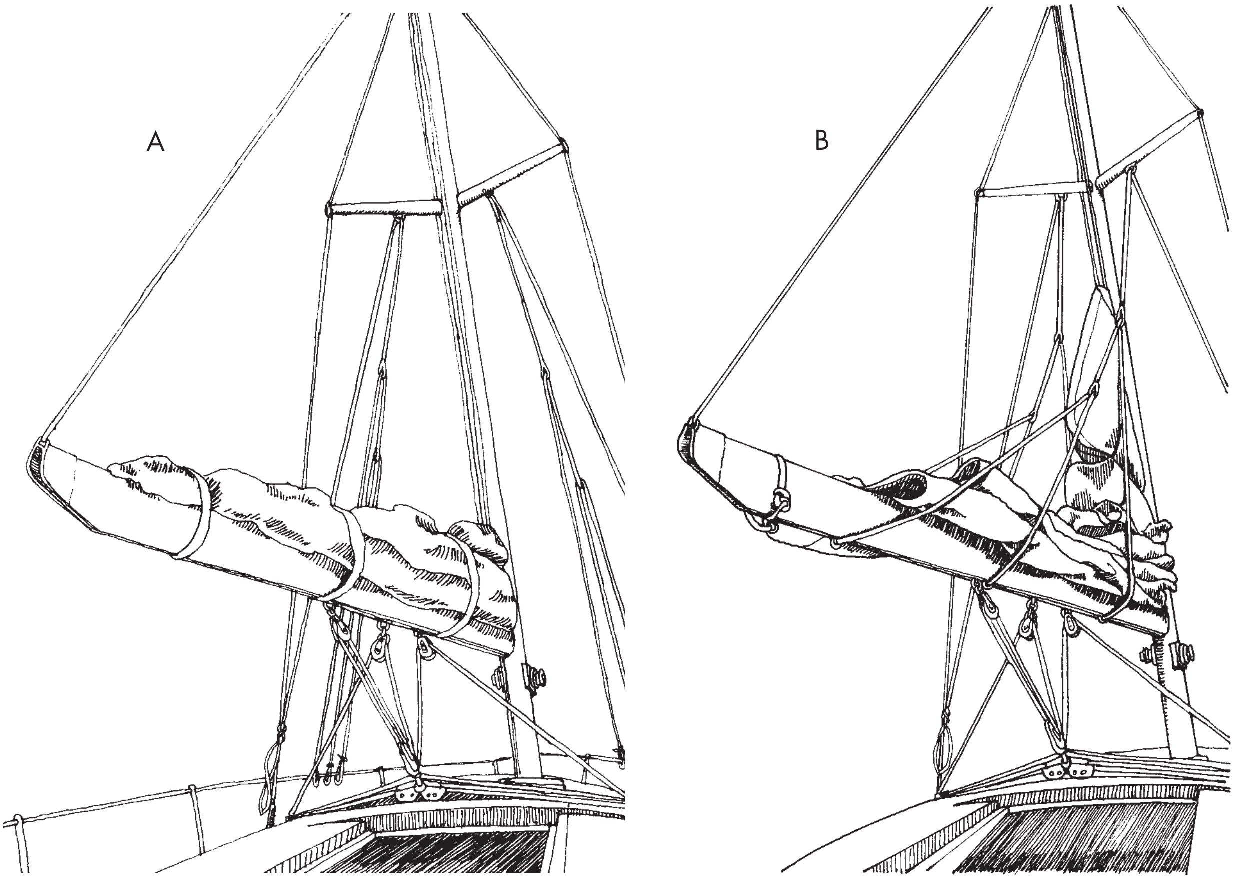
The only real issue we've had with full battens is protecting the luff ends of the battens from splitting due to high compression loads. Many battens are now constructed with an end cap made from carbon fiber. Where this is not the case, a couple of inches of aluminum tubing slipped over the end and affixed with epoxy will keep the batten from splitting.

Chafe from battens and lazyjacks can be a problem on full-battened sails. The batten "stands proud" of the surrounding sail surface, so any standing or running rigging in contact with the sail will chafe through the material covering it in short order. To prevent this, batten pockets should be covered with a sacrificial material, preferably a strip of ¾- to 1-inch-wide Spectra webbing sewn from luff to leech along both sides of each batten pocket.

Lazyjack chafe can be addressed in one of two ways: minimize the amount of time the lazyjacks are up, or construct them from a low-chafe material. We used the first method on *Silk* and the second on *Hawk*. With either method, the lazyjacks need to be stowed so they won't interfere with the sail when it's being raised.

On *Silk*, we attached the lazyjacks to the boom only when we dropped the sail; the rest of the time they were led forward and clipped to the lifelines near the shrouds (Figure 5-8). The bitter end of each lazyjack was cleated to a small cleat on the stays. When we needed to use the lazyjacks, we would unclip them from the lifelines, clip

Figure 5-8.
Silk's lazyjacks were easily removable and stowed by the stays (A) except when we were actually dropping the sail (B). (Lyanne Schuster illustrations)



them to pad eyes on the boom, tighten them, and cleat off the bitter end again at the stay. After we flaked the sail, we would store them back on the lifelines and put on the sail cover.

On *Hawk*, we leave our lazyjacks up whenever the mainsail is in use so we can hand or reef immediately if conditions change. They are permanently attached to the boom and run through a block on the first spreader and down inside the mast to a cleat at the base of the mast. We started out using Dacron for the lazyjacks but switched to 6-millimeter single-braid Spectra (uncovered) after the Dacron chafed the mainsail. Spectra single-braid is extremely strong, UV-resistant, and slippery. Once the sail has been flaked and secured, we lead the lazyjacks forward and clip them to snap shackles below the gooseneck. We raise the sail with them stowed in this position, and then put the lazyjacks up.

Even without full battens, lazyjacks help collect the main when reefing or dropping the sail and, with a few sail ties, will keep the main nicely contained even in gale-force winds. They can be used on any boat to ease mainsail handling. The exact layout of the lazyjack lines depends on the length of the boom and the shape of the sail. They need to be set up so they don't catch the ends of the battens when shaking out reefs and so that they gather the sail as it drops without letting large folds fall through the lines onto the deck. It may take several iterations before you arrive at a configuration that works for your boat (Figure 5-9).

Partial battens create their own chafe problems—a rigid plastic batten encased in flexible sailcloth spells trouble. The shorter the batten, the more the material near the leech of the sail will be worked, especially when the sail flogs. If your rig makes full battens undesirable, or you can't afford the necessary hardware, or you plan to begin your voyage with an existing partial-batten mainsail, you can greatly reduce chafe through a few simple, inexpensive preventive measures.

Tapered battens combine rigidity at the leech end of the batten with flexibility where the batten meets the sailcloth. This reduces the amount of chafe on the inner end of the batten pocket. It's not expensive to refit an existing partial-batten sail with tapered battens. To keep partial battens from chafing through their pockets, cover the end of the batten pocket with two or three layers of sail tape and tape over the batten ends before putting them in the pocket. Sew batten pockets closed to prevent losing battens when the sail flogs.

No matter what type of battens you choose, carry two spare battens of the longest length used. They can be cut down with a hacksaw to replace any that break or get lost. A hollow boom makes the best stowage place for long battens.

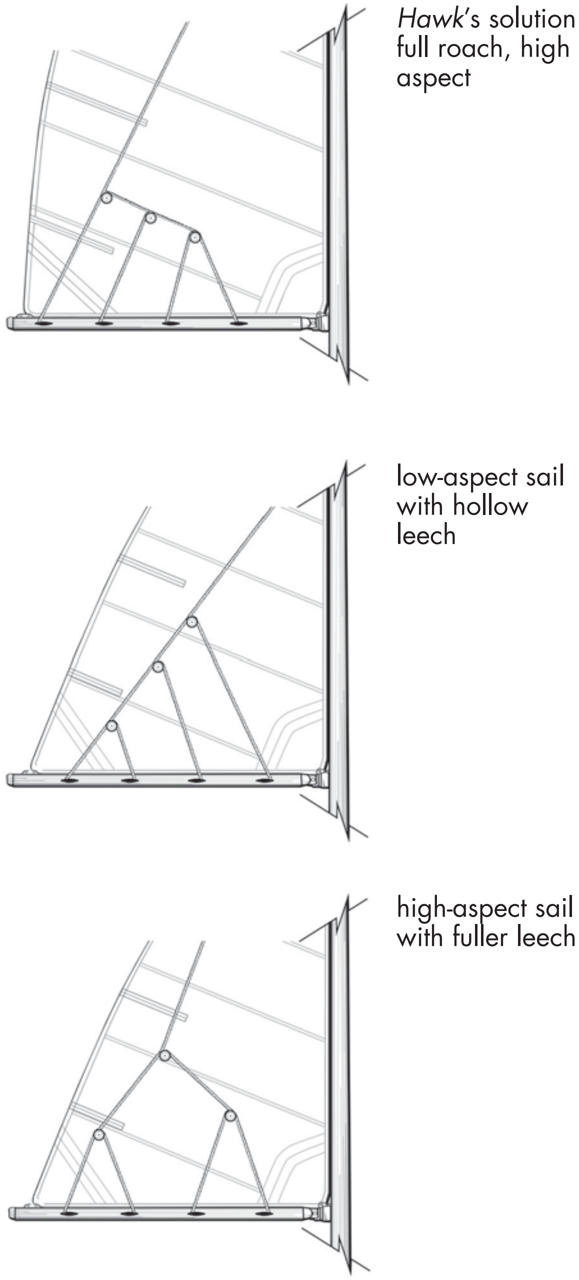


Figure 5-9.
Possible lazyjack layouts for low- and high-aspect sails. (Fritz Seegers illustrations)

When it comes to materials, very few cruising boats will benefit enough from the low-stretch and shape-holding qualities of laminates to justify their additional expense and reduced durability. A high-quality woven Dacron mainsail made by a sailmaker with extensive experience in offshore sails will be a better choice for all but the biggest, highest-performing cruising boats (see the Modern Sail Materials and Their Uses sidebar below).

When we were out on *Silk*, very few boats could be reefed from the cockpit. The available systems had too much friction for a shorthanded crew to manage them easily. We used slab reefing for the two reef points on both the main and the mizzen. After easing the halyard, we slipped the tack grommet at each reef point over reefing horns at the gooseneck, and then pulled in the relevant clew line. This system proved practically foolproof. Our first reef reduced the sail area by about 20 percent, our second by an additional 15 percent. A small, non-self-tailing winch on the boom assisted in tightening the clew line. It took two of us to reef, not only because we needed to turn the boat up into the wind, but also because we preferred to have both of us on deck when one of us was balanced precariously on the side deck trying to work the reefing winch.

Given our high-latitude agenda and the frequency with which we would be reefing, being able to reef the mainsail with one person working alone from under the hard dodger became a key design criterion for *Hawk*. This proved a challenge, as *Hawk*'s 750-square-foot mainsail has as much sail area as all of *Silk*'s working sails combined. We started out looking at single-line reefing systems, which use one line led back to the cockpit to tighten both tack and clew. But with such a large mainsail, single-line reefing generates too much friction and involves winching in a great deal of line, which almost inevitably snags somewhere.

We ended up installing a two-line reefing system led aft to the cockpit. This uses separate lines to pull in the tack and clew at each reef position. The main halyard, mainsheet, and the four reefing lines for our two reef positions are led back to rope clutches in the cockpit on either side of the companionway (Figure 5-10). The port and starboard clutches each feed to a self-tailing winch. Using this system, one of us can tuck in a reef in less than 4 minutes; two of us working together can do it in half that time.

Figure 5-10.
The two tack and two clew reefing lines on *Hawk* lead back to rope clutches on either side of the companionway.

Over the course of six years using double-line reefing on *Hawk*, we have developed the following refinements to make the system work as smoothly as possible:

- **Clean, chafe-free leads for all lines.** To minimize friction and the potential for snags, the main halyard and all reefing lines must lead cleanly and without chafing back to the cockpit (see Figure 5-10). To lead lines to the bottom of the mast and then turn them so they lead well to the cockpit requires some combination of cheek blocks, turning blocks, and line organizers. Invest in oversized blocks designed to minimize friction.
- **Set up the tack reefing line so forces pull down and forward.** To minimize friction at the tack, the reefing line should be kept on one side of the sail, and hardware needs to be positioned to create the greatest leverage. On *Hawk*, the bitter end of the tack reefing line attaches to the starboard reefing horn. The line then leads up and through a ring on a webbing strap that runs through the reefing cringle, then back down to a cheek block on the starboard side of the mast behind the gooseneck before running to the turning block at the bottom of the mast. The reef position is located midway between two battens, so that when reefed the fold of the sail brings the cringle almost to the cheek block (Figure 5-11). When we pull on the tack line, this arrangement directs all the forces down toward the deck and forward toward the mast. We use a halyard bend (Figure 5-12) positioned straight below the reefing cringle to attach the clew reef lines to the boom.
- **Use Spectra single-braid for reefing lines.** We use 10-millimeter uncovered Spectra single-braid (see the Modern Line Materials and Their Uses side-

Figure 5-11.
When reefed, the fold of the sail with the reefing cringle gets pulled down over the top of the stacked sail and cars and almost reaches the cheek block on the mast; the leech line control is located right above the reef position.

Figure 5-12.
The halyard bend we use to attach the clew reef lines to the boom.

bar below) for the reefing lines, a different color for each reef. Spectra single-braid is stronger than Dacron, allowing us to reduce friction by using smaller, slipperier line. It also stretches less, all but eliminating the motion that leads to chafe. The Spectra does tend to slip through rope clutches unless we sleeve it internally, which we do by using a fid to work a foot or so of cheap nylon or polypropylene line into the hollow core in the area where the clutch will grip.

- **Keep reef lines taut.** The biggest headache of single- or double-line reefing is the tendency of the reefing lines to get snagged around the boom, or winches, or clutches on the mast. Keeping a slight tension on lazy reefing lines minimizes this problem. After putting the first reef in, we always pull in any excess slack on the second reef lines.

Retrofitting double-line reefing need not require a major investment. If the system is set up well, only the clew lines and the main halyard need to be led through rope clutches so that they can be worked with a winch near the companionway. On a boat already equipped with a winch in this position, the main investment would be in hardware to lead all the lines aft.

Hawk has two reef positions, the first reducing the mainsail area by about 20 percent and the second by an additional 15 percent. To make reefing straightforward even in the dark or when we're tired, the mainsheet, main halyard, and clew and tack reefing lines are each a different color and marked with indelible ink where they exit the rope clutches when each reef is properly set. A light mounted under the hard dodger illuminates the reefing controls, letting us see what we're doing at night. The mast is marked with reflective tape at the proper headboard heights for the first and second reef. With a quick flash of a light at night, we can tell if a reef is set correctly.

Beyond reefing, three other sail controls are essential for managing the main and maximizing its life: the preventer, leech controls, and the traveler. The most important of these is the preventer, which not only forestalls accidental jibes but also, in the absence of a boom gallows, locks the boom in place in heavy weather (see Figure 22-5B). A good preventer is one the crew is willing to use virtually all the time. On a ketch under 40 feet or a cutter or sloop under 35 feet, a block and tackle from the boom to the toe rail or the base of a stanchion will be adequate, but the forces on larger boats demand stronger alternatives. "Boom brake" systems offer one solution to this problem, but their control lines, which cross the side deck, create a significant tripping hazard.

On *Hawk*, we spliced permanent preventer lines to tangs on each side of the aft end of the boom and led them forward along the boom to cleats near the gooseneck (Figure 5-13). Another line is stowed on either side of the boat with its working end shackled to a ring on the stay. It runs through a snatch block attached to the toe rail beneath the stay, then to a rope clutch mounted on the toe rail near the cockpit, and then through a turning block to bring its hauling end into the cockpit. When we need the preventer, we shackle the working end to the eye at the forward end of the preventer line on the boom, winch in the hauling end, and close the rope clutch (Figure 5-14), which frees the winch for other duties. Even with the boom fully eased, we can reach the preventer line to set it up.

Before jibing, we set up the new preventer line, jibe the boat, and then clean up the original preventer line. The line runs along the toe rail, well out of the way. We use a preventer whenever the wind is on the beam or aft, or at any wind angle aft of close-reaching when the wind

Figure 5-13.
Our preventer line remains cleated to the front of the boom until needed, at which point it can be reached even with the boom fully eased.

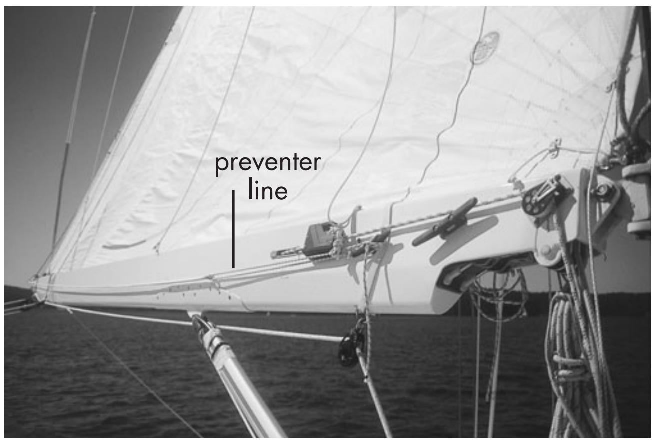


Figure 5-14.
When in use, the preventer line is shackled to another line that leads through a snatch block to a rope clutch mounted on the toe rail, from which it can be easily led to a winch.

drops below 10 knots in a big ocean swell. We also use the preventer to hold the boom in place whenever we drop the main completely.

Leech controls on the mainsail prevent leech flutter in high winds, which would greatly shorten the life of the sail material on the trailing edge of the sail. The adjustment points for the leech lines should be placed right above the reef points with a long enough length of line that they can be reached from the deck by the shortest crewmember (Figure 5-11). On mainsails over 600 square feet or so, a 3:1 block and tackle system will be necessary to get adequate purchase on the leech line.

Jibes, whether accidental or intentional, create some of the biggest and most dangerous shock loads on the boat. To cushion these loads we use nylon mountain climbing line for our traveler control (see Figure 5-27). This absorbs most of the shock even from an accidental jibe and allows us to jibe the boat without bringing the mainsail all the way to the centerline.

Upwind Sail Combinations and Sail Handling

If gentlemen never sail to weather, they must never leave the tropics. Despite our efforts to avoid headwinds, we have still spent more than a third of our time above 30° north and south latitude with the apparent wind forward of 70 degrees (Figure 5-1). On trans-equatorial passages, when we're crossing at an angle to the prevailing winds, we have had the wind forward of the beam more than 40 percent of the time. As can be seen in the comparison between *Silk* and *Hawk* in Table 3-13, windward ability depends on the hull shape and sail plan of the boat. But assuming your boat goes to windward at all, you can improve her performance with the right sails.

As a centerboard ketch, *Silk* did not sail particularly well to weather. But after getting new sails in New Zealand, she pointed 10 degrees higher and sailed a knot faster close-hauled than she had with the old sails. Several factors contributed to that improvement. We added full battens and increased the roach on the main and mizzen, which improved their efficiency. The additional sail area on the mizzen also eliminated lee helm in light headwinds, which had destroyed our light-air performance. The smaller, lighter, better-cut headsail allowed *Silk* to point higher. The improved sail shape translated more of the sails' effort into forward movement through the water, so the boat heeled less and could carry sail longer before we had to reef.

Over- or undercanvasing a boat impacts performance to windward much more significantly than it does downwind. When a boat carries too much sail to windward, the weather helm increases to the point where the rudder creates drag rather than lift. Gusts round the boat up, causing it to lose forward momentum and spill wind from the sails. Conversely, if the boat has too little canvas up, the rudder will have to be turned to windward to hold the boat up to the wind, and this lee helm will slow the boat even more than too much weather helm does. To do well upwind, a boat needs to carry the right amount of sail area, and it needs to be well balanced. Table 5-3 shows the upwind sail combinations we used at different wind speeds in moderate waves aboard *Silk* and *Hawk*.

Sailing a ketch rig to windward takes some practice. The dirty air from the main spoils mizzen efficiency when close-hauled. To sail *Silk* in apparent wind angles of 40 degrees or less, we learned to drop the mizzen completely, no matter what the wind speed. When we first discovered this, it felt like releasing a hand brake; without the drag from the mizzen, the boat picked up 2 knots of speed in moderate winds. But this left less sail area than on a comparable cutter, giving her too little canvas to point above 40 degrees in light winds. With the wind aft of 40 degrees, the mizzen adds efficient sail area and improves performance.

Offshore in over 20 knots or so, the waves built to the point where they would push *Silk* off course, and she didn't have an efficient enough keel, even with the centerboard down, to let her point higher than 40 degrees apparent. In these conditions, she sailed most efficiently under "jib and jigger"—the mizzen and our smaller headsail, the 88 percent Yankee. The sail area at the aft end of the boat helped to weathercock her into the strong winds, allowing her to sail closer than she could with the mainsail.

Hawk can sail across a much wider range of wind conditions, but to balance her properly we have to use a wider range of headsails. Her fractional blade jib does not give us enough sail area to sail efficiently to windward in light air. In winds under 12 knots, we use a 1,000-square-foot Code Zero reacher with a Vectran luff (Figure 5-17). This

MODERN SAIL MATERIALS AND THEIR USES

Evans Starzinger

In the 1950s, Dacron—DuPont's trade name for its polyester fiber and the woven fabric made from it—replaced canvas as the material of choice in sailmaking. Lighter, more durable, more UV-resistant, and less stretchy especially when wet, the new material spurred a big leap forward in the quality and longevity of sails.

But any woven fabric has two shortcomings. First, the very nature of a weave—with "warp" yarns crossing over and under "fill" yarns in a series of waves or crimps—contributes to loss of shape over time. When the sail comes under load, the longer warp yarns straighten and lose that crimp, so they stretch more than the shorter fill yarns. Further, because the load-bearing fibers run at right angles to one another, the cloth is less stable across the bias, at a 45-degree angle to the weave. Try pulling a handkerchief from corner to corner and see how much more it stretches than when pulled from edge to edge.

Second, sailmakers turn woven sail material into finished sails using a crosscut construction, which makes the sail heavier than it needs to be and orients the fibers poorly to the loads. Sailmakers calculate the highest loads the sail will need to withstand and use that to determine the weight of the sailcloth. That material then gets laid out in panels perpendicular to a straight line between the head and the clew. But the same sailcloth gets used in both high- and low-load areas, so the sail ends up weighing more than it would if material weight could be varied (Figure 5-15). Further, the loads on any sail tend to radiate toward the center of the sail from the corners—across the bias of the woven cloth, its weakest direction. The result is stretch and loss of sail shape as the sail ages, which translates into increased leeway, increased weather helm, and decreased pointing ability.

By tightening the weave, the load can be distributed more evenly with reduced stretch on the bias. By coating the sail with resins, the material can be stabilized and held in place to reduce stretch until the resin breaks down. But the essential problems of stretch and construction inherent to the woven material remain, and the sail will lose shape over time. Depending on the quality of the sailcloth and how the sails are treated, that process can take many years. A set of high-quality, woven Dacron sails should complete a five-year tropical circumnavigation, but they will have lost significant upwind performance well before the end of the voyage.

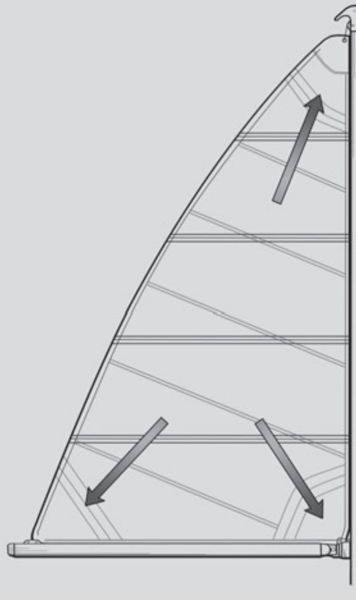


Figure 5-15.
Crosscut sails get laid out in panels using the same weight of cloth for high-load areas, such as the luff, as for low-load areas, such as the leech. The panels are oriented so that the loads from the corners cut across the bias of the sail. (Fritz Seegers illustration)

New laminate materials have been developed to address these shortcomings. Rather than weaving the fibers into a cloth, laminated sails consist of fibers affixed to one or two layers of polyester film, typically Mylar. This allows the use of high-strength, low-stretch materials that cannot be woven, such as Spectra, Vectran, and Kevlar. These fibers get laid down in an unwoven mesh, called a *scrim*, onto the Mylar. They can be distributed only where needed and can be oriented along the highest load lines, reducing weight and all but eliminating stretch while increasing strength. Further, the sails can be put together using radial instead of crosscut construction, so that panels of cloth radiate from the corners of the sail to take loads along the axis of the fibers instead of along their bias (Figure 5-16). Radial construction allows the use of different material weights in different panels, reducing weight over an equivalent crosscut sail. Each of the major sailmakers has developed a proprietary laminated

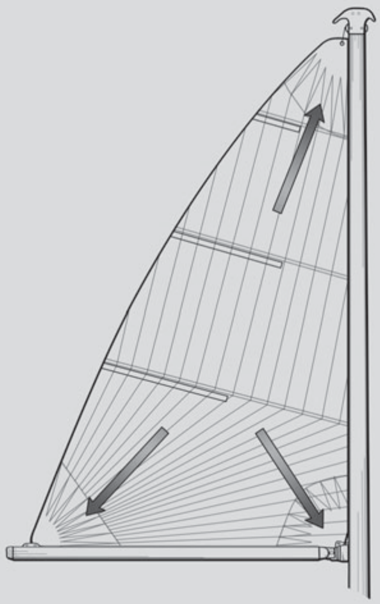


Figure 5-16.
Radial-cut sails orient the fiber to the loads, allowing for greater strength and reduced weight. (Fritz Seegers illustration)

technology. North's 3DL sails are the most sophisticated, for these do not involve panel construction at all but are molded as a single piece in a three-dimensional mold.

Laminated sails have two drawbacks over conventional woven Dacron sails. First, they're very expensive. Both the laminating process and the construction of sails from the laminated cloth are complex and labor-intensive. A suit of laminated cruising sails will cost anywhere from 30 to 50 percent more than the equivalent Dacron sails. Second, they're not as durable as woven Dacron sails. The Mylar breaks down over time, and the fibers start to break loose from the scrim. Although you can keep sailing a Dacron sail for years after it is blown out and can sew it back together as long as there's some material left to sew to, only minor repairs can be made to laminated sails, and once the fibers start to break loose from the scrim, major failure is just around the corner.

Chafe, flaking the sail, flogging, and crushing the fabric all contribute to degradation of the Mylar, and all are things that happen on cruising boats on a daily basis. To protect the Mylar, cruising laminates are covered on both sides with a woven "taffeta" of polyester or Spectra, which increases sail weight but also increases longevity.

How long will a laminated cruising sail last? We've gone through two suits of laminated sails on *Hawk;* the mainsails have lasted about 20,000 nautical miles and the headsails about 30,000. This difference in longevity between the main and jib results from differences in their use. We switch down to a staysail when the wind blows over 25 knots, while the main remains up through 40 knots of apparent wind. Our blade jib never experiences chafe, but many things can and do chafe the main.

We were willing to pay for laminated sails on *Hawk* for several reasons. First, her large mainsail area made sail weight and stretch more of an issue than on most cruising boats. We saved at least 80 pounds over a woven Dacron sail, which made the difference between being able to raise the main by hand and needing a powered winch. Second, our high-latitude itinerary meant we would be spending significantly more time pounding to windward than most cruising boats. The laminated sails held their shape throughout their life and greatly increased our upwind performance as they aged over what we would have gotten from Dacron sails. Third, we really do enjoy sailing the boat, so the better sail shape as the sails aged gave us a great deal of satisfaction.

Should you consider laminated sails for your boat? If you have a traditional, moderate- to heavy-displacement cruising boat, Dacron still offers the better value for working sails. To get the best shape possible for as long as possible, buy the highest-quality woven Dacron you can afford and find a sailmaker with extensive experience fabricating offshore cruising sails.

If you have a performance-oriented cruising boat or a multihull and can afford it, we would recommend a laminated working headsail. Durability and longevity are similar to what you would get from a Dacron sail, and the performance improvement will be noticeable. For the mainsail, the cost/durability trade-off is right on the margin. Laminates make sense only if you really value performance, have a boat that can sail well, and plan to sail to weather. But if cost and durability matter to you, Dacron will be a better choice.

TABLE 5–3. SAIL COMBINATIONS FOR WINDS FORWARD OF 60 DEGREES APPARENT			
Apparent Wind (knots)	**Apparent Wind Angle (degrees)**	***Silk* (37-foot centerboard ketch)**	***Hawk* (47-foot fin-keel sloop)**
3–12	< 40		• Full main • 105% roller furling blade jib
	40–60	• Full main • Full mizzen • 135% roller furling genoa	• Full main •155% Code Zero on removable furler
12–18	< 40	• Full main • 135% roller furling genoa	• Full main • 105% roller furling blade jib
	40–60	• Single-reefed main • Full mizzen • 135% roller furling genoa	
18–22	< 40	• Single-reefed main • 88% hank-on Yankee	• Single-reefed main • 105% roller furling blade jib
	40–60	• Double-reefed main • Full mizzen • 88% hank-on Yankee	
22–28	< 40		• Double-reefed main • 105% roller furling blade jib OR
	40–60	• Full mizzen • 88% hank-on Yankee	• Single-reefed main • Genoa staysail
28–34	< 40		• Double-reefed main • Genoa staysail
	40–60	• Forereach	
35+	< 40		• Forereach
	40–60	• Forereach or heave-to	• Forereach

Figure 5-17.

Our Code Zero reacher flies on its own Vectran luff with a removable furler and functions like a 155 percent genoa on a sloop or cutter.

masthead sail is about the size of a 155 percent light-air jib, but with a deeper cut. It will fly efficiently in apparent wind angles from 40 to 120 degrees, though we have used it at even deeper angles. On a catamaran, the sail can be flown off a pulley system that allows the tack to be positioned anywhere between the two pontoons, increasing the useful wind angles. On many cruising cats, masthead reachers have all but replaced spinnakers, serving as the primary light-air headsail across most wind angles.

We control the sail using a furling system referred to as a Code Zero furler, a gennaker furler, or a removable furler. This consists of a swivel that attaches to the head of the sail (see Figure 5-24), and a compact continuous-line furling unit that attaches to the tack (Figure 5-18). The rope luff makes the sail flexible enough to stow furled in a bag when not in use. We keep ours in a floor-to-ceiling mesh bag that clips to the bottom of our sail locker hatch (Figure 5-19). When we want to raise the sail, we open the hatch, attach the halyard to the swivel, and raise the furled sail (Figure 5-20). When we reach the foot of the sail, one of us attaches the furling unit to a pendant anchored to a strong point on our bow roller (Figure

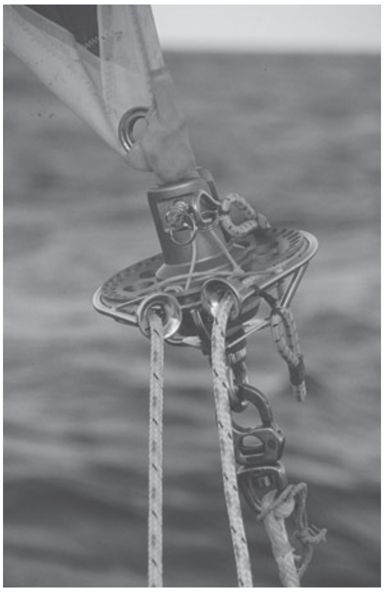


Figure 5-18.
Our Facnor continuous-line Code Zero furler—a removable furler for handling large sails.

Figure 5-19.
We stow the furled Code Zero in a mesh bag that clips to the sail locker hatch.

Figure 5-20.
After attaching the halyard, I raise the sail out of the bag while Evans keeps it from getting caught on the rig. (John Neal photo)

Figure 5-21.
Evans attaches the furling unit to the bow roller using a low-stretch, high-strength Spectra pendant. (John Neal photo)

Figure 5-22.
Evans is at the mast tensioning the halyard to tighten the luff as I unfurl the sail from the cockpit. (John Neal photo)

5-21). Then we raise the sail the rest of the way, tension it using the winch, and unfurl it in the normal fashion (Figure 5-22).

When properly set up, the sail will furl as easily as a normal roller furling headsail in up to 15 knots. Once up, one person can furl and unfurl the sail. The sail can be left furled in front of the jib with the jib in use. If a squall blows up, we furl the Code Zero reacher and unfurl the blade jib, then switch back when the squall goes by.

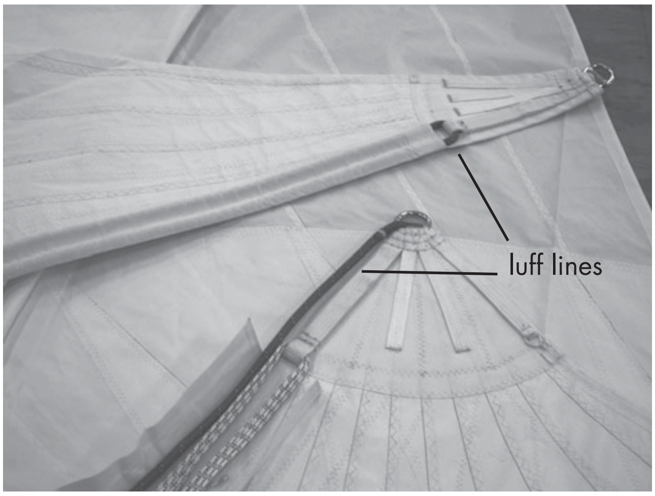
The removable furling system and high-tech rope luff can be used to fill gaps in the headsail inventory on any boat. Many of the Vendée Globe boats don't even bother to use conventional furlers anymore; they use removable furlers for their entire sail inventory. On cruising boats, we have seen these systems used for storm jibs and for running and reaching sails, but we have also seen people struggling to make these systems work properly. The success of the system depends upon three key elements:

1. **Properly constructed luff lines.** The luff needs to be large enough so that the sail furls around it and rigid enough so that it doesn't twist with the furler. We've seen two ways to accomplish this. One is to use a very-large-diameter line; the other is to use two smaller-diameter lines held rigidly apart (Figure 5-23). In either case, the line must be very high strength and low stretch. Vectran and Spectra are used most frequently.
2. **Properly sized continuous-line furler.** Continuous-line furlers never run out of line or get jammed, as can happen with a removable furler that uses a drum (like conventional furlers), and they have significantly less friction than drum furlers. They cost more than drum furlers, but unless you're using the furler on a relatively small sail, they will be much more reliable. The furler shown in Figure 5-18 is manufactured by Facnor (see the resources for this chapter in Appendix 1).
3. **Luff tension.** For the sail to furl well, the luff needs to be under significant tension. Dacron halyards are too stretchy on boats over 40 feet or so and will need to be replaced with a low-stretch, high-strength Spectra or Vectran line (see the Modern Line Materials and Their Uses sidebar below). For large reaching sails, it may also be necessary to install a 2:1 halyard to increase leverage. To accomplish this, dead-end the halyard at a pad eye on the top of the mast, run it through a block above the shackle that attaches the halyard to the sail (Figure 5-24), then take it back up to the sheave at the top of the mast before bringing it down the mast to the winch.

We have also learned four lessons about handling this sail. First, the sail shape improves and we avoid leech flutter when we move the sheet lead aggressively forward and outboard as we bear off on a reach. Second, the sail

Figure 5-24.
On the 2:1 halyard for our Code Zero sail, the halyard runs through a block that we attach to the furling swivel at the head of the furled sail.

Figure 5-23.
The Vectran luff line at the head and foot of our Code Zero furler.



furls more smoothly if we keep some wind pressure on it. If the mainsail blankets it, the furl will be sloppy and uneven. Third, we adhere to a strict "whitecap rule" and take the sail down when we start seeing regular whitecaps on the sea's surface. Though the sail is rated for wind speeds up to Force 5, this means we take it down while the wind is still Force 4, avoiding problems with the furling unit or sail. Finally, unlike normal furling sails, Code Zeros are not meant to be left up for an entire passage. These sails have too much windage and insufficient UV protection for this extended use. We drop the Code Zero into a large bag in our sail locker whenever it looks like a light-air spell has ended.

Sailing upwind into apparent winds between 22 and 28 knots on *Hawk*, we can either put the second reef in the main and use the full jib or leave the first reef in the main and switch down to a smaller headsail. If we're trying to make progress into large waves, we furl the blade jib and fly a genoa staysail hanked to the inner forestay (Figure 5-25). This sail just fills the inner foretriangle. We prefer this sail in large waves because the blade jib causes the bow to bury more frequently, slowing progress. The smaller sail set farther aft helps the bow ride up and over the waves, keeping the boat moving at a better average speed.

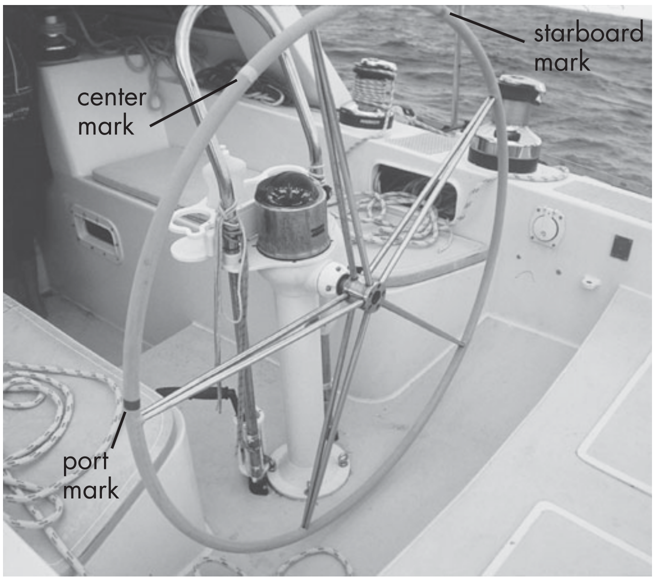
Figure 5-25.
Hawk charges to windward in 25 knots under double-reefed main and genoa staysail. (Walker Vought photo)

Carrying too much mainsail increases heeling and leeway and decreases forward progress, so getting the reef in as soon as it's needed optimizes speed. But knowing exactly when to reef isn't obvious on many boats. We now rely on two objective measures to tell us when it's time to reef.

The first is an *inclinometer*, a small device that measures heel angle. We have one mounted in the navigation station, next to our sea berths, and one on the watertight door in the cockpit (refer back to Figure 4-5). The manufacturer of your boat should be able to tell you at what heel angle your boat loses efficiency. Otherwise, try reefing in different wind speeds and see what happens to your average speed. Most boats need to be reefed somewhere between 20 and 30 degrees of heel. Once the exact figure has been established, the inclinometer can arbitrate any crew disputes over whether or not it's time to shorten sail.

The second indicator that it's time to reef is when we have too much weather helm. We have marked our wheel at the centerline and at 8 degrees of rudder angle (as shown on our autopilot control), the point where the efficiency of our rudder begins to decrease (Figure 5-26). If the helm is consistently beyond the 8-degree mark, the rudder will create drag and reduce our boat speed. These

Figure 5-26.
In this photo we're carrying a comfortable amount of weather helm. It will be time to reef when the mark on the starboard side of the wheel moves to the top of the wheel and maintains an average position around the centerline of the boat.



two measures almost always are in agreement, making a compelling argument for reefing and helping us keep the boat moving efficiently as wind speed changes.

To facilitate tacking on *Hawk*, we have a pelican hook on the staysail stay so we can easily remove it. We also have a manual backstay adjuster, which we use to flatten the mainsail to windward and to increase tension on the headstay. This has proven worthwhile with *Hawk*'s fractional rig and would also make a difference on a boat with a carbon fiber spar, but it won't make much difference on a stiff aluminum masthead rig.

Hawk sails to weather far better than we do. She would be quite happy to continue pounding to weather in more than 35 knots of wind, but we are both prone to seasickness upwind in over 30 knots apparent. So unless we're trying to outrun even worse weather, we prefer to slow the boat down and wait for more favorable conditions. On both *Silk* and *Hawk*, we could do that by forereaching—reducing sail and feathering the boat up so she jogs slowly to weather. This allows us to make progress to windward while keeping the boat from making much leeway. This tactic is discussed in more detail in Chapter 22.

MODERN LINE MATERIALS AND THEIR USES

Evans Starzinger

Dacron used to be the only choice for almost all running rigging applications aboard a cruising boat. In the last two decades, however, a wealth of new fibers has been incorporated into a host of new lines for use in different applications.

Table 5-4 outlines the physical properties of the most common line fibers. UHMWPE (branded as Spectra by Honeywell Specialty Materials, Dyneema by DSM Performance Materials, and Amsteel by Samson Rope Technologies), Kevlar (trademark of DuPont), Technora (trademark of Teijin), and Vectran (trademark of Kuraray Company) are high-strength, low-stretch, relatively expensive materials. Nylon is highly elastic (high-stretch). Polypropylene is relatively light and inexpensive, and Dacron (trademark of Invista) is general purpose. Other fibers are constantly being developed. One of the newer fibers, PBO, is even stronger and less prone to stretch than Kevlar, but it has limited UV resistance and is not as durable as Spectra or Vectran, though much more expensive.

These fibers are combined in five basic types of line construction:

1. **Balanced double-braid.** A braided cover over a braided core, both made of the same fiber and each carrying about half the line load.
2. **Parallel-core.** A braided cover over a core of fibers bundled parallel to the axis of the line. This construction reduces stretch with minimal increase in cost.

TABLE 5–4. PROPERTIES OF VARIOUS TYPES OF FIBERS

Property	Nylon	Dacron	Polypropylene	Spectra[7]	Technora	Vectran
Strength[1]	1.0	1.0	0.6	2.8	2.9	2.9
Stretch[2]	1.0	0.6	0.8	0.1	0.1	0.06
Weight[3]	1.14	1.40	0.91	0.97	1.40	1.40
Friction[4]	0.12	0.15	0.22	0.08	0.15	0.15
Creep[5]	Negligible	Negligible	Yes	Yes	Negligible	Negligible
Cost[6]	$0.13	$0.28	$0.10	$0.69	$0.46	$0.60

[1]Breaking strength per circumference squared, indexed to nylon.
[2]Elastic elongation at working load, indexed to nylon.
[3]Specific gravity, indexed to water.
[4]Coefficient of friction.
[5]Amount of elongation when exposed to steady high loads.
[6]Dollars per ton of breaking strength for ½-inch line.
[7]Also Dyneema, Amsteel.
Source: Adapted from the Samson catalog.

3. **Core-loaded double-braid.** A Dacron (usually) braided cover over a braided core made from low-stretch fibers. Here the core carries virtually all the load, and the cover is there to protect the core from chafe and UV. This is the most common construction for the new "high-tech" lines.
4. **Single-braid.** This consists of eight to twelve strands of fiber braided together with no separate cover. The same strength and stretch can be achieved at a much lower weight than with core-loaded line, but without the protection from chafe and UV.
5. **Three-strand.** Three strands of fiber twisted into a line. This traditional construction results in the highest stretch and is common for nylon anchor rodes and docklines—where stretch is desirable—as well as for "hemp-like" line on classic yachts.

So which of these fibers and lines should be used for which applications?

- **Halyards.** Halyards need to be light and resistant to stretch. On cruising boats up to about 45 feet with crosscut Dacron sails, Dacron double-braid line works just fine. On larger or higher-performance boats, parallel-core Dacron braid for Dacron crosscut sails or core-loaded double-braid with one of the high-tech cores for laminated sails will reduce weight aloft and make the halyards easier to handle. Vectran is generally judged to be the best core material for the main and jib halyards, as it stretches least and does not creep; Technora is slightly less expensive but also slightly less durable. Spectra is generally judged the best core material for spinnaker halyards, as it is the lightest of the low-stretch fibers, and its slight creep under load is not critical to spinnaker trim. A core-loaded double-braid halyard made with one of the high-tech cores is strong enough to serve as a temporary stay in the event of a failure.
- **Checkstays and runners.** These have traditionally been made from wire, but Spectra and Vectran single-braid offer the same strength while reducing weight aloft and minimizing mainsail chafe. At the very-high-performance end, there are lines made especially for checkstays and runners with parallel Vectran, Kevlar, or PBO fibers inside a plastic cover.
- **Reefing lines.** Reefing lines are usually shorter than halyards and thus less prone to stretch, and their weight, being closer to the deck, matters less. They are, however, prone to chafe from the many sharp turns and flogging they must endure. They are typically made from Dacron double-braid, but we prefer single-braid Spectra to minimize friction and chafe.
- **Jibsheets and guys.** These are easy to adjust, need to be durable since they experience chafe and flogging, but don't need to be especially light since they are low in the boat. Dacron double-braid works well until the boat gets so big that Dacron sheets with the necessary working strength become uncomfortable in the hand. Five-eighths- to 3/4-inch sheets are about as large as can easily be managed. From there, it's best to move up in material sophistication and expense to find a line with the required breaking strength in a manageable size. When cost is not a factor, double-braid Vectran is preferred for the jib; Spectra core with the cover stripped off is judged best for light-air sheets, where weight does matter.
- **Mainsheet.** Two of the biggest shock loads on the boat—the accidental crash jibe and the mast pumping while pounding to weather—both affect the mainsheet. Some stretch cushions these loads and saves hardware from blowing up. As with jibsheets, therefore, Dacron double-braid is preferable until it becomes too big to handle. Be careful not to select a line with too little stretch for this application. Switching from a Dacron double-braid to a Vectran mainsheet will increase shock loading by 480 percent (Table 5-5) and almost certainly result in broken hardware somewhere along the line.
- **Furling line.** If you regularly fly your furling jib partially furled, you'll want a relatively low-stretch furling line. For boats under about 40 feet, Dacron double-braid is appropriate; for boats of 40 to 50 feet, a Dacron parallel-core is appropriate, and for boats over 50 feet a Spectra or Vectran cored double-braid is appropriate.

(continued on next page)

even more elasticity to the traveler by going to nylon parallel-core line (climbing line). This adds a big cushioning factor to protect the hardware during shock loads, while not introducing too much stretch under normal working loads (Figure 5-27).

TABLE 5–5. THE INCREASE IN SHOCK LOAD THAT RESULTS FROM SWITCHING FROM A DACRON DOUBLE-BRAID MAINSHEET TO OTHER TYPES

Rope Type	Percent Stretch[1]	Percent Load[2]
Three-strand nylon	20.0	15.0
Double-braid nylon	8.1	37.0
Parallel-core nylon	5.5	55.0
Double-braid Dacron	3.0	100.0
Parallel-core Dacron	2.0	150.0
Spectra	1.0	300.0
Technora	1.0	300.0
Vectran	0.6	480.0

[1]At 15% of breaking strength.
[2]Relative to Dacron double-braid, with equal breaking strength for all lines.

- **Other lines.** The vang, cruising spinnaker tack line, and traveler control lines can likewise be Dacron double-braid until size gets prohibitive. These three applications are exposed to shock loads and don't demand particularly low stretch, so it makes sense to leave some stretch in them. Conventional wisdom holds that nylon is too stretchy for any running rigging application, but on *Hawk* we have added even more elasticity to the traveler by going to nylon parallel-core line (climbing line). This adds a big cushioning factor to protect the hardware during shock loads, while not introducing too much stretch under normal working loads (Figure 5-27).

All of this can be summarized with a few big generalizations. Correctly sized Dacron double-braid is the appropriate and economical solution for all running rigging, except halyards, on the vast majority of cruising boats. Dacron double-braid or Dacron parallel-core is appropriate for halyards on cruising boats up to 50 feet long with Dacron crosscut sails, and Spectra or Vectran line is appropriate for halyards on bigger boats or those with laminated radial sails.

Beyond these generalizations, investing in high-tech line is a matter of preference. On *Hawk*, we have done so for lines that have experienced chafe (lazyjacks and reefing lines), where we wanted to minimize shock loads (traveler control lines), and where stretch was obviously affecting sail shape (main and jib halyards and jib furling line).

Two final observations with respect to high-tech line: Some lines with high-tech cores will lose up to 50 percent of their strength if knotted or improperly spliced. Check with the manufacturer before splicing to determine the proper technique. After being coiled, many high-tech lines kink and hockle up and will not run free. To prevent this, flake the line in a figure eight, then fold the figure eight in half at the crossover point and finish it with a loop through the center. When you uncoil the line, undo the loop, and the line should run free out of the figure eight.

Figure 5-27.

Parallel-core nylon climbing line provides extra elasticity for a high-shock-load application like our traveler, which uses a line driver and is mounted atop our hard dodger. (Tom Linskey photo)

Heavy-Weather Sails and Sail Handling

Prudent sailors see very little heavy weather, but almost every offshore sailor sees some, so the boat has to be prepared to deal with it. That means carrying appropriate storm sails and setting them at least once before you depart. If the trysail cannot be raised without removing the lazyjacks, it's better to find out in a calm anchorage than on a storm-tossed deck at sea.

Heavy-weather headsails. To handle heavy weather, a staysail stay and a storm jib are preferable to running a furling sail reefed to the size of a handkerchief. On a cutter or sloop, dropping to the staysail moves the center of effort toward the mast, complementing the reefed main. Working inboard is safer for crew in heavy weather. The smaller sail and the lower attachment point of an inner stay put less force on the mast. If a headstay ever parts, the staysail stay offers essential backup. All in all, your first experience with heavy weather will be less traumatic if you fit an inner stay before you depart.

When structural issues preclude installing a staysail stay on a sloop, a removable furler (like the one we use on *Hawk* with our Code Zero) could be used in conjunction with a storm jib constructed with a Vectran or Spectra luff. The attachment points on the deck and at the mast have to be just as strong as with a wire stay, however, and it may be necessary to use a 2:1 halyard in conjunction with some sort of tensioning device on the tack to get sufficient tension on the luff.

It is becoming more and more common to see boats equipped with a staysail on a separate furler. Their crews can switch down to the storm sail and reef it without leaving the cockpit, keeping them off the deck in the worst weather. The sail can be furled to any size, so the appropriate amount of canvas can be carried at all times.

As attractive as it is to put our staysail on a furler, we have not yet done so, though we revisit that decision about once a year. In the high latitudes, we go to weather enough that the extra weight and windage aloft would adversely affect our performance. Not being able to remove the headstay would greatly reduce the enjoyment we take in short-tacking the boat when coastal cruising. We use our staysail genoa a great deal, but we would not want to run the staysail reefed in heavy weather. So we would give up a useful sail for one we would rarely use but have to have. We question our decision every time we find ourselves on the foredeck switching headsails in heavy weather, but so far we have judged that the drawbacks of a furling staysail outweigh the benefits for the kind of sailing we do.

To limit our time on the foredeck, we've set up the staysail to make it as easy to handle as possible. On passage, our genoa staysail is hanked to the staysail stay and bagged (see Figure 5-31). If we're expecting bad weather, the staysail sheets are run from the cockpit through their

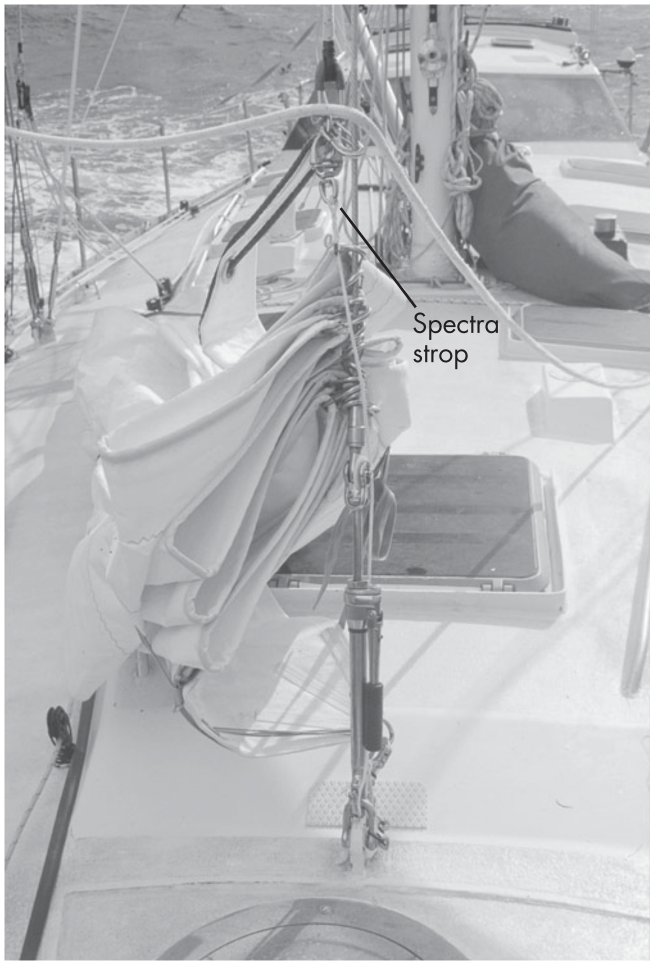


Figure 5-28.
We keep the staysail halyard attached to the head of the sail, tensioned against a Spectra strop; to raise the sail we release the strop and haul on the halyard.

blocks and tied off to the bag, and the bag is tied to the handgrip on the deck. The staysail halyard is attached to the head of the stay and tightened against a strop running from a shackle at the bottom of the stay to the head of the sail (Figure 5-28). When we need to raise the sail, we unzip the bag, tie the sheets to the clew, unsnap the strop, and step back to the mast to pull up the sail.

In addition to the genoa staysail, we carry two smaller storm jibs. One is the ORC-recommended size for our boat, and one is about half that size—we refer to it as our "hurricane jib." We've never had to use the smaller sail but carry it as insurance after the report on the 1998 Sydney-to-Hobart Race concluded that the ORC-sized storm sails were too large for the conditions the race boats encountered (see the 1998 Sydney-to-Hobart Race: A Postmortem sidebar in Chapter 22). Our storm jib has a large international orange stripe on it to make us more visible in heavy weather and to aid in locating us during a search and rescue. Both sails are flown off 3-foot-long pendants to keep them above breaking water sweeping across the decks.

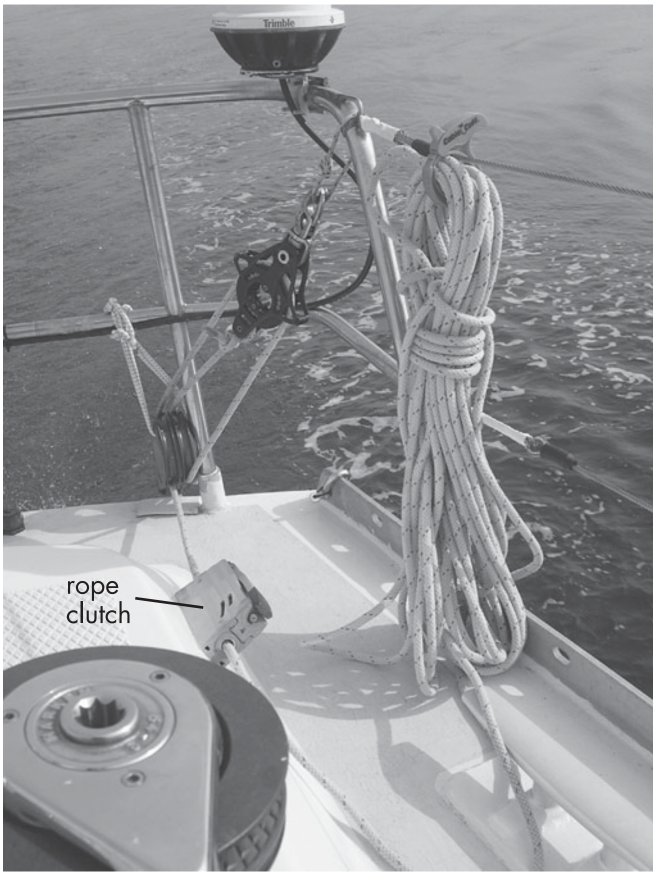


Figure 5-29.
A block and tackle is shackled to a chainplate on each stern quarter for use with our checkstays; the line can be locked off in the rope clutch mounted on the side of the coaming after we have tightened the checkstay using the secondary winch.

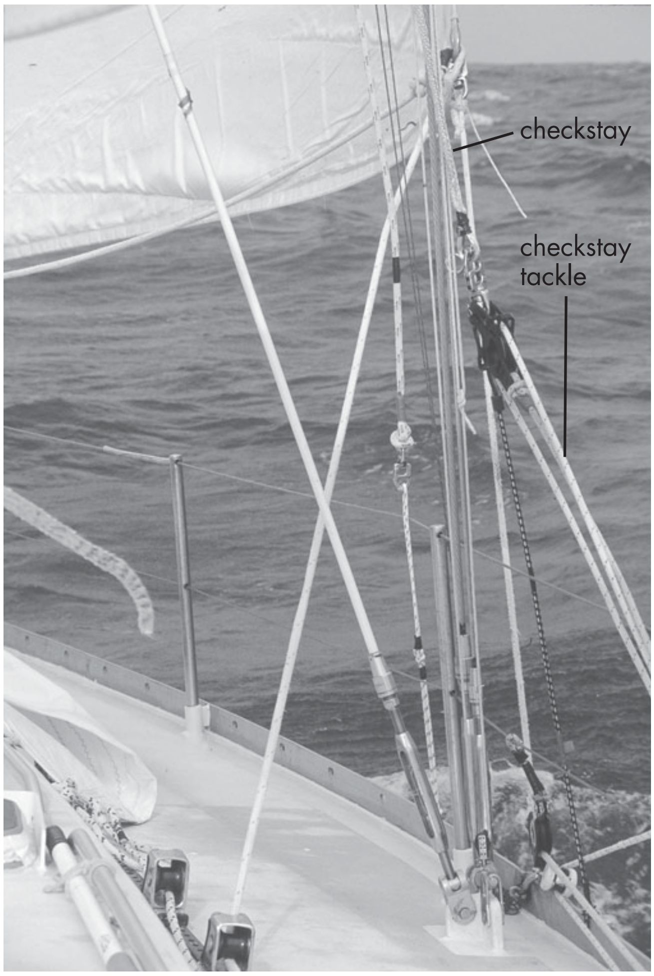


Figure 5-30.
The lines on the block and tackle portion of the checkstays are long enough that the whole thing can be stowed along the side deck when on passage.

Cutters and sloops will need to use checkstays whenever they fly the staysail. These run from the mast at the level of the inner-forestay hounds to the stern quarters to offset the pull exerted on the mast by the staysail. They prevent the mast from *pumping*—flexing forward and back at the inner-forestay hounds as the boat goes over waves. Checkstays used to be constructed from wire, which made them heavy and hard to stow without damaging sails and rigging, but the new high-strength, low-stretch lines are every bit as strong as wire and are much lighter and easier to stow (see the Modern Line Materials and Their Uses sidebar above). We use single-braid Spectra for our checkstays and stow them along a permanent stay when not in use (see Figure 5-31). The block and tackles we attach to the checkstays are stowed on each stern quarter, shackled to a chainplate (Figure 5-29). When we need a checkstay, we shackle the block and tackle through the eye at the bitter end of the checkstay. The block and tackle is long enough that the checkstay can be pulled forward and stowed along the side deck when we're on passage and using them frequently (Figure 5-30). Rope clutches on our coamings hold the checkstays after we've tightened them on the secondary winch (Figure 5-29).

Heavy-weather mainsails. Experienced sailors disagree as to whether a storm trysail or a third reef in the mainsail is better in heavy weather. Much of the logic for storm trysails comes from an age when booms were heavy and hard to control, and mainsails were made from materials that couldn't handle storm-force winds. Today's sail materials and sail handling mean that the boom can be controlled, and the mainsail can take heavy weather without damaging the sail or the track. The biggest argument in favor of a third reef is convenience—putting in a third reef is a simple operation on most boats, which makes it much more likely the crew will do it in a timely fashion rather than leaving it until they can't do anything at all. All too often, storm trysails never leave the sail locker, and that's where they sit through the storm they were designed for.

On the other hand, the storm trysail and its separate track provide redundancy in the event the mainsail gets blown out or its track becomes damaged. The storm trysail is flown free, allowing the boom to be securely stowed in the worst weather and eliminating one source of danger to the crew. The sail can be set high off the deck to keep it out of breaking waves. If the mainsail blows out, the mast track rips off the mast, or the top of the mast comes down, the trysail can still be used to get the boat into port.

On *Silk*, we neatly avoided this issue; our mizzen was our primary storm sail in gale-force winds. On *Hawk*, we felt the redundancy of the separate track was important given our high-latitude agenda, though we have also carried a deep third reef in the main for much of our voyage. We haven't used either solution enough to be definitive about our preference. That's one of the best and worst things about heavy weather—few people have spent enough time in gale or storm conditions to really experiment and compare alternatives.

But we have been grateful to have the trysail and separate track twice in the 50,000 nautical miles we have sailed aboard *Hawk*. In the Southern Ocean, the end cap came off one of our batten cars, spilling the ball bearings. When we tried to reef, the car twisted and chewed up a section of track midway up the mast, putting the mainsail out of operation. The trysail gave us enough horsepower to keep making miles and would have allowed us to go to windward had we needed to. The second time, our mainsail blew out while we were close-reaching in 30 knots. The trysail kept us moving even when the wind dropped. The trysail and separate track have provided useful redundancy for the high-latitude sailing we have done on *Hawk*.

But the trysail will do no good if it can't be raised and flown easily by one person, and it takes a bit of effort to ensure that on most boats. The trysail track should run all the way down to the deck so the sail can be loaded onto the track from a seated position and can be left hanked to the track and stowed in a bag (Figure 5-31). This often takes additional sections of track and some careful routing around winches and other equipment. There must be enough room between the track and the mainsail that the trysail will go up without getting caught on the furled main. The track must go high enough that the trysail can be raised above the stowed mainsail. A sufficiently long pendant will need to be fitted between the tack of the sail and a cleat at the base of the mast.

No lines can cross the trysail track. To accomplish that may mean reorganizing reefing lines and setting up lazyjacks so that they can be pulled forward of the mast when stowed. The trysail sheets need to lead as far aft as possible, right to the stern quarters of the boat, and then pass through turning blocks that lead them back to the primary winches on either side (Figure 5-32). This may mean removing a bimini or finding a way to lead the sheets through a radar arch. The clew of the sail must be high enough not to chafe on the boom, and the boom must be locked in a position that won't interfere with the sheets.

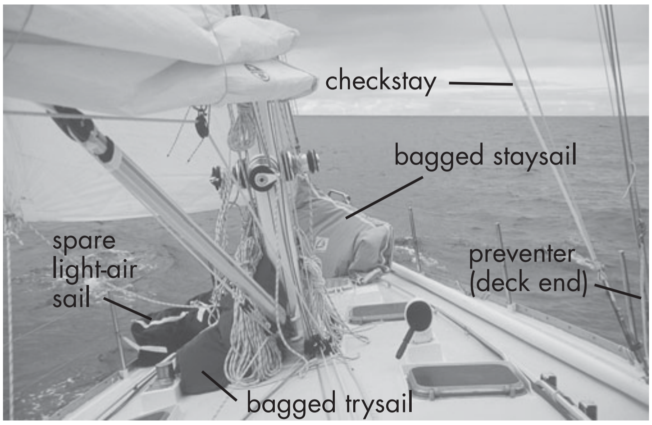


Figure 5-31.
Typical passage arrangements: the bagged trysail is hanked to its track, which runs right to the deck; the staysail is hanked to the inner forestay and bagged; the Spectra checkstay (white line), not in use, is stowed on its bungee cord along the stay; the starboard preventer line, also not in use, is shackled to the ring on the starboard stay. We drop the light-air sail into the sail locker when we start to see whitecaps.

If you have a trysail and want to be in a position to use it, you need to do three things. First, pick a nice, calm day in a beautiful anchorage, and go through the exercise of setting the trysail. Don't be surprised if it takes a couple of hours to get everything right. Take photos of the setup and put them in your navigation table so you can show them to crew or remind yourself how the lines are led. Second, when leaving on passage, hank the sail to its track and bag it so it's ready to run. Third, switch down to the trysail early. It takes a good deal more work to set

Figure 5-32.
The trysail sheets must be led to the stern quarters of the boat and then turned through turning blocks to the primary winches.

the trysail than to tuck in a reef, even on a boat that has been well organized. It's a lot easier to do it in 30 knots than 40. If we think we're going to need the trysail, we try to set it before the wind reaches gale force.

Both the trysail and the storm jib should be made from heavy Dacron (at least 8 to 10 ounces) and triple-stitched to ensure that they hold together in storm conditions. The corners should be reinforced with large patches, particularly the clew. Both sails should be cut very flat, and the storm jib should be fitted with oversized, hand-sewn stainless steel snap hooks (bronze barrel bolts corrode over time and can't be opened when you need them). The trysail should be about 30 percent of the mainsail area excluding roach. The head of the storm jib should reach about halfway up the mast, and the clew should be high, at least 6 feet off the deck.

Trade Wind Passagemaking: Maximizing Downwind Performance

Even though all voyagers can remember times when the trade winds refused to cooperate, the trades do live up to their downwind reputation. Passagemaking in the trade winds means sailing with the wind aft of 110 degrees the vast majority of the time (see Figure 5-1). Downwind sail combinations will be in use day after day in the tropics. To be effective, they must meet three requirements:

1. **Minimize chafe.** Preventing chafe is a challenge on any ocean passage, but downwind passages are particularly problematic. In apparent wind angles of 120 degrees and more, the ocean swell creates a constant roll. Sheets and sails collapse and fill from time to time in all but the strongest winds, and this causes chafe in running rigging, sails, and even hardware. The best downwind sail combinations stabilize the boat to reduce motion while eliminating as many opportunities for chafe as possible.
2. **Maintain helm balance.** Boats for shorthanded crews must be equipped with reliable, redundant self-steering systems that can steer the boat efficiently almost all the time. That means the boat must be balanced so that it tracks well with minimal steering effort even in gusty or rolly conditions. Good downwind sail combinations accomplish this in all but the most extreme weather.
3. **Minimize the risk of jibes.** Uncontrolled jibes can injure or kill crewmembers or dismast a boat, and they need to be avoided at all costs. While preventers should be used anytime the wind is behind the beam, mechanical prevention can fail, with serious consequences for the crew and the boat. Downwind sail combinations that prevent jibes or minimize their consequences work better than preventers to increase safety on board.

Finally, jibing the boat is the major sail handling task in the trade winds, and jibes can be dangerous if not done properly. The best downwind sail combinations minimize the effort required to jibe the boat or eliminate jibes all together.

Coastal sailors usually sail downwind *wing and wing*, with the main prevented to leeward and the jib poled out to windward. But this means easing the main to the spreaders and shrouds, which will significantly increase chafe and shorten the sail's life. A slight increase in wind speed or apparent wind angle will tend to round the boat up, making self-steering difficult, and an uncontrolled jibe of the main can easily damage the rig or injure crew. Even bringing the main across the boat in a controlled jibe offers plenty of opportunity for things to go wrong in strong winds or a big sea.

For these reasons, headsail-only combinations continue to be many voyagers' preferred choice for trade wind conditions. Unlike downwind sail combinations using the main, headsail-only solutions meet the offshore requirements outlined above. Headsails are not in contact with any part of the boat, minimizing chafe. Twin headsails balance a boat downwind, allowing the self-steering to maintain control. Uncontrolled jibes rarely occur, and when they do, damage tends to be limited to the spinnaker pole or its fittings. Controlled jibes do not involve bringing the main across the boat, greatly reducing the possibility of problems.

Table 5-6 shows our preferred downwind sail combinations on both *Silk* and *Hawk*. All but one of these rely on headsails only and meet the criteria outlined above for trouble-free downwind passagemaking. The following sections will take a closer look at these sail combinations and discuss both the sail inventory and the sail handling requirements for efficient and comfortable downwind passagemaking.

Light-Air Sail Combinations and Sail Handling

As the data at the beginning of this chapter show, boats on a tropical circumnavigation will spend up to a quarter of their time trying to make progress downwind in 10 knots or less of apparent wind. To get the most out of a cruising boat downwind on a light-air passage without resorting to the motor, the boat must be equipped with a large, light-air headsail of some type. This will hold enough air to keep a boat moving even in a heavy ocean swell when other sail combinations will be slatting uselessly. On most monohulls, a cruising spinnaker offers the best solution.

TABLE 5–6. SAIL COMBINATIONS FOR WINDS 120 DEGREES APPARENT AND AFT			
Apparent Wind (knots)	**Sail Carried To:**	***Silk***	***Hawk***
3–8	Leeward	Asymmetrical spinnaker	Tack downwind at ~135° apparent under full main *and* asymmetrical spinnaker
	Windward		
9–14	Leeward	135% roller furling genoa	Vectran luff blast reacher on removable furler
	Windward	Poled-out 110% hank-on genoa	Poled-out 105% roller furling jib
15–20	Leeward	135% roller furling genoa	Vectran luff blast reacher on removable furler
	Windward	Poled-out 88% hank-on Yankee	Poled-out 105% roller furling jib
21–25	Leeward	Genoa furled to 100%	Genoa staysail
	Windward	Poled-out 88% hank-on Yankee	Poled-out 105% roller furling jib
26–30	Leeward	88% hank-on Yankee	105% roller furling jib

But a light-air headsail will not improve passage times if it stays in the sail locker, and that's exactly what will happen if it is too large or too difficult to handle. Like many coastal sailors, we were intimidated by managing a chute at sea. *Silk* came with a midweight (0.75-ounce nylon) asymmetrical spinnaker slightly oversized for round-the-buoys racing. The light material couldn't stand up to much wind or any mistakes in sail handling, so we were very cautious about flying it. The light weight and cut of the sail meant any swell rolled the air right out of it. Its size kept us from using it at night and caused us to douse it whenever a squall approached. When we got to New Zealand, we replaced this sail with one that was cut fuller, three-quarters of the size, and twice the material weight (1.5-ounce nylon) of the recommended coastal spinnaker for *Silk*.

The fuller shape and heavier material increased the stability of the sail in light winds even with a big swell. The smaller size allowed us to douse the sail without fuss, even after the wind had picked up, and we felt safe leaving the chute up overnight even in the puffy, doldrums-like conditions of tropical ocean light air. The spinnaker became our preferred downwind sail aboard *Silk* whenever the wind dropped below about 8 knots apparent. We have followed the same strategy aboard *Hawk;* we carry a 1.5-ounce nylon asymmetrical spinnaker of about 1,500 square feet, a third smaller than the recommended size on her sail plan.

We prefer the asymmetrical (or cruising) spinnaker for its ease of handling, because it can be flown without a pole across a wide range of wind angles. If you have experience with a symmetrical spinnaker and like how it works on your boat, then you will probably not want to switch. But if you haven't flown spinnakers much before, an asymmetrical spinnaker will be friendlier as you learn to use it.

On a multihull, symmetrical chutes can be rigged with one tack on each bow, making a jibe trivial. Asymmetrical chutes can be set using two tack lines, one to each bow. The lines can be used to position the chute from side to side and to change the height of the tack. This allows the sail to be set at the optimal angle to the prevailing wind.

To handle a spinnaker with fewer than three people, it will need to be fitted with a snuffer or sock. Socks like the ATN Spinnaker Sleeve (see the resources for this chapter in Appendix 1), with a hard fiberglass scoop at the bottom, work best. The control lines should run through separate channels to keep them from tangling each other and the sail. The following procedures will take the drama out of setting and dousing the chute.

To fly a symmetrical spinnaker, start by setting up the pole. The pole jaw needs to be a comfortable reach from the bow, which means 3 or 4 feet above the deck and 2 to 3 feet to windward of the headstay. The guy should be in the pole fitting, but not attached to the sail. The pole should be held firmly in place by its afterguy, foreguy, and topping lift.

Asymmetrical spinnakers need to be flown from a pendant attached to a strong point on the stemhead or a tack downhaul that runs through a turning block on the stemhead and then aft to a cleat. Whichever is used, it must be long enough so that the bottom of the sail sets

Figure 5-33.
Trigger shackles can be released under load and allow for easy dousing of asymmetrical spinnakers.

above the bow pulpit, and it should terminate in a *trigger shackle* (a shackle that can be released under load, using a fid—Figure 5-33) for attaching it to the clew of the sail. Set up the pendant or downhaul so it is ready to use, but don't attach the sail to it.

Set the self-steering to steer an apparent wind angle of about 120 degrees. Tie the ends of the sock control lines to a cleat. With the tack and clew free, attach the halyard to the head and hoist the sail in its sock. When the head is close to the proper hoist, free the tack and clew from the bottom of the sock and spin the sail around within the sock until the control lines are running straight up the inboard side of the sock and not kinked around the sail.

Next, pull the tack around the headstay and attach it to the trigger shackle on the tack pendant or downhaul or, on a symmetrical spinnaker, attach the guy to the windward clew. Attach the sheet to the leeward clew (the clew on an asymmetrical spinnaker). While one crewmember raises the sock using the control lines, the other pulls in the sheet. Once the sail fills, set the pole for a symmetrical spinnaker and use the guy/tack downhaul or the halyard to get the proper tension on the luff, and then trim the sheet.

Racers would be trimming and easing the chute all the time, but shorthanded crews need to set it and leave it. That means overtrimming to be sure it doesn't collapse. To do this, make sure your boat is on the heading you want, then trim the sheet until the luff is stable. Ease it a bit until the luff just starts to flutter or curl—this is where a racer would keep it at all times. Then sheet it in another few inches, until the luff stops fluttering except in the biggest swells. Cleat it there and make sure the sail stays full for several minutes before leaving it.

When dousing the sail, you cannot pull the sock down as long as the sail is still full. Brute force does not help. Many people release the sheet to collapse the chute, but all too often the wind stays in the sail, or the sail streams out in front of the boat or wraps itself around the headstay. To take the drama out of the takedown, release the tack or guy, not the sheet.

To douse a chute with a sock easily in strong winds, return the boat to the 120-degree wind angle and set the self-steering. For a symmetrical spinnaker, return the pole to the setup position and trip the jaws to release the guy. For an asymmetrical spinnaker, use a fid to trigger the shackle on the pendant or downhaul and release the tack. The chute will collapse and flop around until the sock is pulled down.

On *Hawk*, we store our asymmetrical spinnaker in a large mesh bag like the one we use for the Code Zero reacher (Figure 5-19). We raise the sail in its sock right out of this bag. After dousing it using the sock, we drop it right back into the bag. This eliminates the need to drag sailbags up and down the deck, and the sail can be doused and stowed within a couple of minutes. When flying the spinnaker, we adhere to the same whitecap rule we use with the Code Zero. By being conservative we eliminate most of the tension associated with flying a chute.

In the lightest winds, we use a lightweight Spectra sheet attached with a bowline to the clew to keep the sail from drooping. In rolly conditions, we run the spinnaker sheet through a plastic hose tied to the end of the fully eased main boom (see Figure 5-36). This arrangement "poles out" the clew without causing chafe to the sheet or the flaked mainsail.

On multihulls, spinnakers may not be the best solution for light wind work. Multihulls bring the apparent wind farther forward than do monohulls, and they sail best jibing downwind instead of running dead downwind. A Code Zero sail like the one described in the Upwind Sail Combinations and Sail Handling section above will be more useful than a spinnaker most of the time. This should hoist all the way to the masthead and be equipped with a Vectran or Spectra luff and removable furler so it can be taken down when not in use. A spinnaker can still be useful and should be aboard if the crew can afford it, but if budget constraints mean choosing between these two sails, multihull sailors will do better to buy the Code Zero.

Medium-Air Sail Combinations

More than half our time in the tropics was spent with the apparent wind behind the beam at Force 4 to 5 (see

Figure 5-2). Some monohull cruisers sail wing and wing in these conditions, but we prefer using double headsails for the reasons already described. Many people assume that double headsails result in a rolly downwind ride. Indeed, Eric Hiscock described *Wanderer III*'s "fast and furious rolling" under twin headsails, but he attributed this motion to the boat's narrow beam and low initial stability—uncommon design features in today's offshore voyagers. Aboard both *Silk* and *Hawk*, we've been most comfortable downwind under double headsails.

On both boats, we have relied on double headsails going downwind in anything from 9 to 25 knots of apparent wind, or from Force 4 through Force 7 (see Table 5-6). On passages we've spent more than two-thirds of our time in the tropics and about half of our time overall under double headsails. It has therefore been very worthwhile to invest in dedicated downwind sail combinations for these wind speeds.

To fly double headsails, a boat needs a way to set a second headsail and a pole for the windward sail. Some older boats are equipped with double headstays either side by side or with one forward of the other. *Silk* had side-by-side headstays, one equipped with a furling sail, which made it easy to put up two sails. Another relatively common solution is to carry two sails on furlers at the bow, one behind the other (Figure 5-34). The forward sail is a large genoa, 130 to 150 percent. The second stay holds a blade jib that just fills the inner foretriangle. Downwind, the smaller sail is flown to windward on a pole, or both sails are flown on poles. For boats without a double headstay arrangement, a sail with a Vectran or Spectra luff fitted with a removable furler, as described in the Upwind Sail Combinations and Sail Handling section above, makes it possible to set a second headsail.

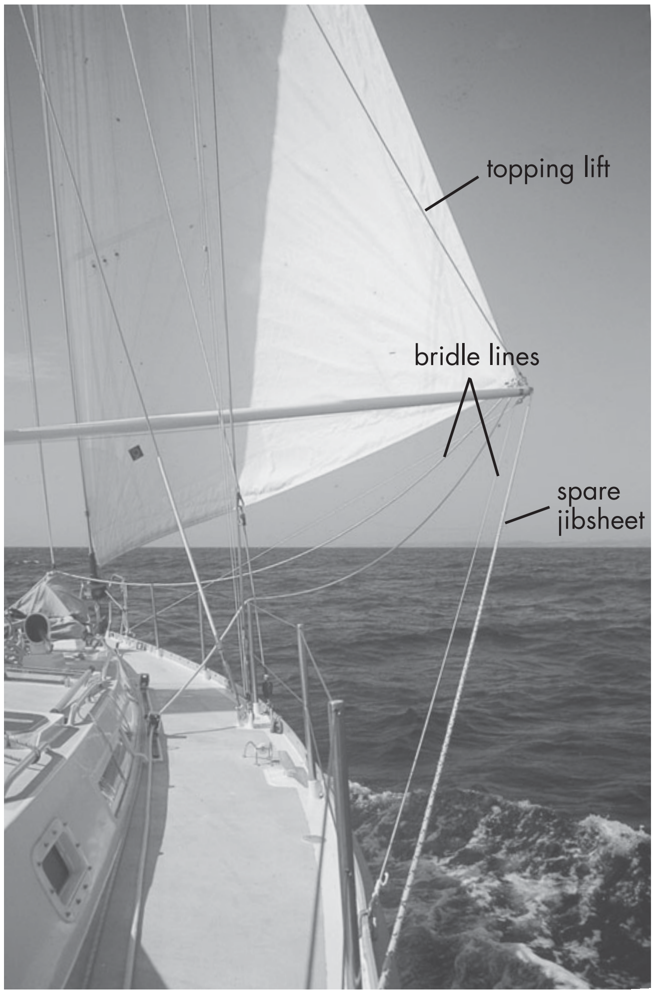
Figure 5-34.
This Passoa 50 by Garcia carries three sails on furlers: a large genoa on the forwardmost furler, a blade jib on the solent stay, and a staysail on the inner forestay for storm conditions.

The windward sail needs to be flown from a pole, which should be strong enough to handle an accidental jibe, sized to the boat's J measurement, and fitted at both ends with releasable fittings. Carbon fiber poles do not cost significantly more than aluminum ones, and their lighter weight makes them much safer to handle. If your boat does not have a pole, invest in a carbon fiber one.

The bridle system we use to hold our pole in place offers three big advantages over the usual guy system. First, the pole is fixed and set independent of the headsail, so in the event of a potential collision or other hazard, the sail can be jibed without doing anything to the pole. Second, because it requires no adjustments, the bridle can be set up quickly and accurately even by a tired or inexperienced crewmember. Third, it allows the pole to be set and dropped by a single crewmember in all but the rolliest conditions.

The bridle consists of a 10-meter length of ¼-inch Spectra line with three Wichard 4-inch stainless steel snap hooks, one on either end of the line and one about

Figure 5-35.
When set, these bridle lines hold the pole in position independent of the sheet.



in the middle. To set up the pole, we clip a topping lift to the top outer end of the pole and lift it about a foot off the deck. We run a spare sheet from a primary winch through the pole jaw and attach it to the clew of the jib. Next, we clip one end of the bridle to the toe rail near the bow. The middle snap hook snaps to the bottom of the outer end of the pole, and the final snap hook snaps to the toe rail a bit aft of amidships. Once all these lines are in place, we swing the inner end of the pole up to the mast socket and then haul up the topping lift until the pole is fixed in place by the topping lift and the two bridle lines (Figure 5-35). At our leisure, we can then sheet in the spare sheet to bring the jib clew to the end of the pole.

Crews with long experience in the trades often fit their boats with two poles, with one or both stowed on the mast. This arrangement means the boat never has to be jibed, thereby eliminating one of the few big sail handling chores in the tropics. We have never carried a second pole because of the cost, windage, and stowage issues. But if we were outfitting for a tropical circumnavigation again, we would set up the boat with twin downwind poles.

Ninety percent of the time the leeward sail needs no support, but in extremely rolly conditions we use the main boom to pole out the clew of the leeward sail. To do this, as mentioned, we run the genoa sheet through a length of plastic hose tied to the end of the fully eased boom (Figure 5-36).

On *Silk*, we flew the 135 percent furling headsail to leeward and poled out a 110 percent sail to windward in winds from 10 to 15 knots apparent (Figure 5-37). When the wind went over Force 5 apparent or the wind angle went forward of 135 degrees, we switched down to our 88 percent, 9-ounce Yankee for the windward sail. The smaller sail to windward allowed us to fly double headsails to 120 degrees apparent in moderate seas. As the wind increased toward Force 6 apparent, we reefed the roller furling genoa until we were running with a 100 percent sail to leeward and the 88 percent sail to windward. We marked the foot of the furling headsail with reflective tape at 100 percent and 88 percent to facilitate reefing at night.

Despite *Hawk*'s fractional rig and modern underbody, she is most balanced and most easily controlled running downwind under double headsails. We use our roller furling headsail in conjunction with a 650-square-foot running sail that we call a "blast reacher" (Figure 5-38). Midway between what sailmakers call a blast reacher and a blooper, this nylon sail is cut for deep reaching angles.

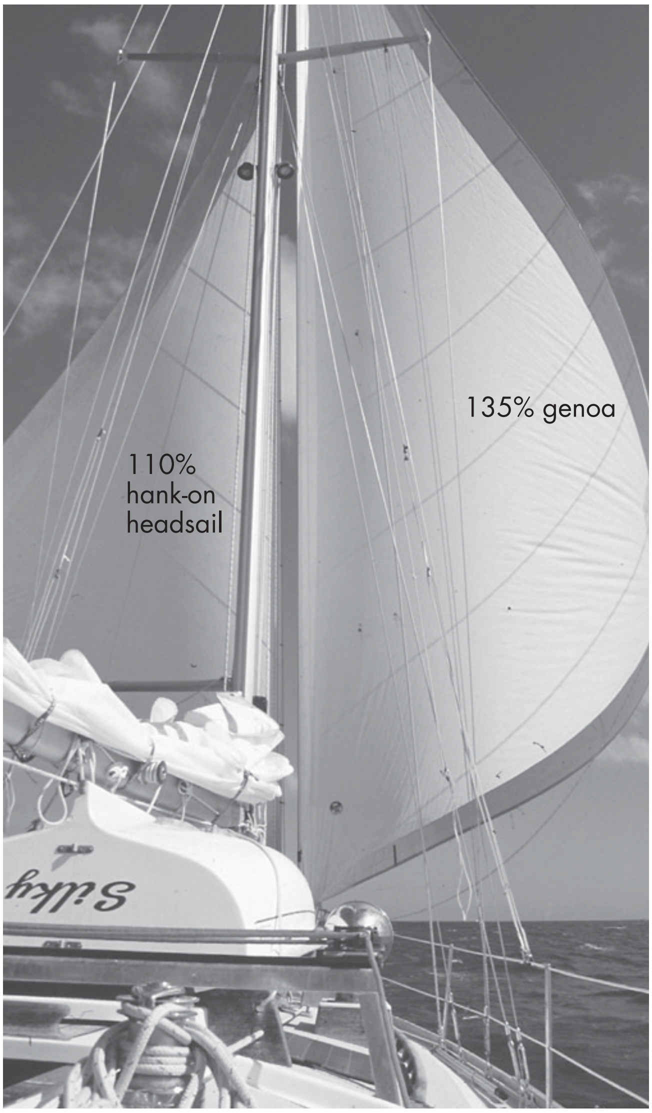
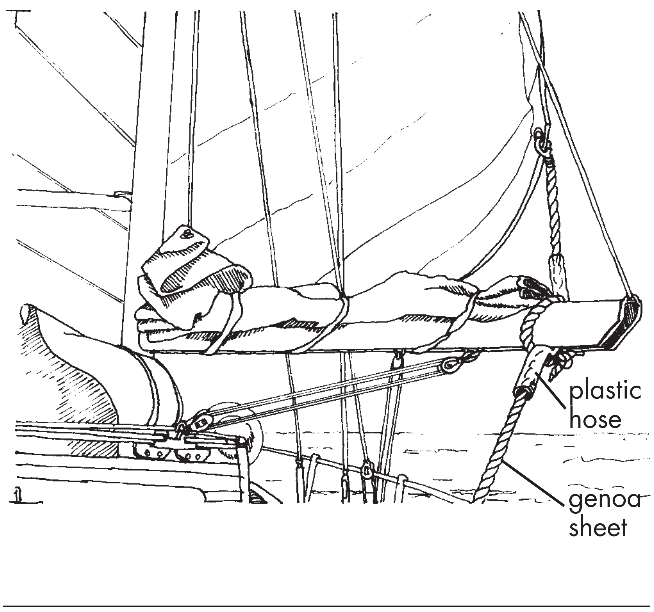


Figure 5-37.
Silk's primary downwind sail combination: a 135 percent genoa on the roller furler to leeward and a 110 percent headsail hanked to the second headstay and flown from a pole to windward.

Figure 5-36.
The poor sailor's second spinnaker pole: a plastic hose attached to the end of the fully eased main boom. (Lyanne Schuster illustration)



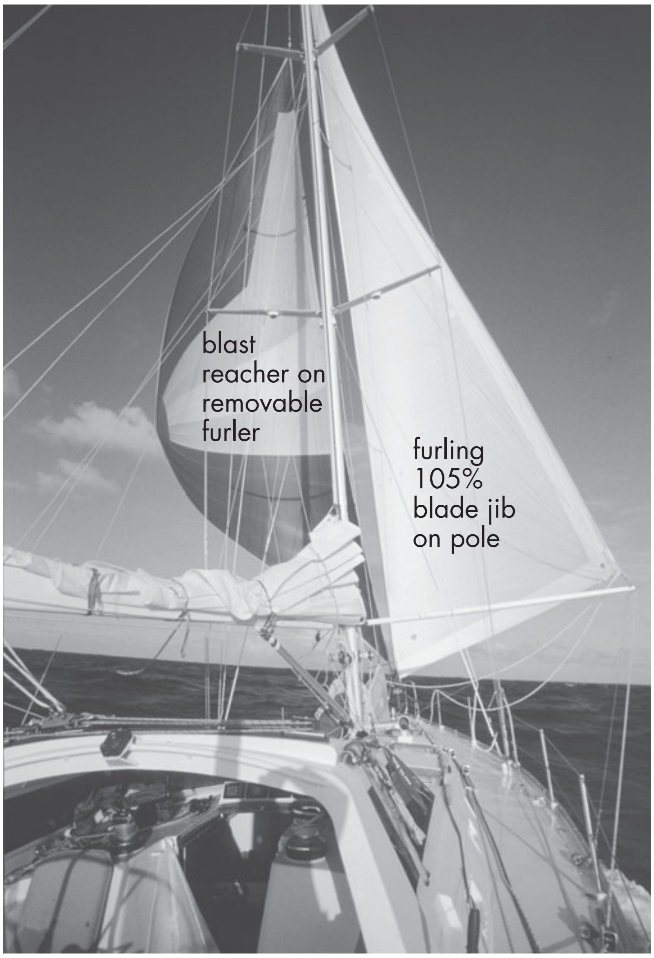


Figure 5-38.
Hawk's primary downwind sail combination: a 650-square-foot (~130 percent) blast reacher to leeward and a 105 percent blade jib on the roller furler poled out to windward.

The blast reacher has a Spectra luff and uses the same removable furling system as the Code Zero.

Though we much prefer double headsails, we have sailed downwind wing and wing on *Hawk* a significant percentage of the time. If we think the wind is not going to stay behind us for more than a watch, we'll keep the mainsail up rather than switching to the double headsails. We have also ended up wing and wing when we started with the wind on the beam or forward, and it gradually shifted aft until it went beyond 120 degrees apparent. From these experiences we have learned several lessons:

- **Hardware.** To sail wing and wing, the headsail needs to be poled out to windward, and the main prevented to leeward. The pole and preventer arrangements described above facilitate sail handling and increase safety with this sail combination.
- **Balancing the boat.** The boat will balance better if the main is similar in size to the jib. On a sloop, that means reefing the main when the entire headsail is flown, and putting a second reef in the main if the headsail has to be partially furled. The sail areas tend to be more balanced on a cutter, but if the self-steering system is having trouble, a reef in the main will almost always help.
- **Mainsail handling.** When running downwind wing and wing, it's even more essential that the crew be able to get the mainsail off in strong winds without turning up. Otherwise, reducing sail becomes a major operation—rolling in the headsail, releasing the preventer, turning up into the wind, reefing or dropping the main, securing the boom, turning back downwind, and unfurling the headsail—not something one person will be happy trying to do alone on a dark and stormy night. If you will not be carrying double headsails, invest instead in a mainsail handling system that will let you reef or drop the sail on any wind angle, and try it out thoroughly before you leave.
- **Mainsail care.** In downwind conditions, the mainsail will chafe if it is used day after day. Every time you drop it, check it for broken stitches and chafe spots, and repair them as soon as you find them. In a big swell, drop the mainsail completely when the wind falls below 6 or 8 knots. The turbulence from the main as it slats from side to side will keep the headsail from drawing, accentuate rolling, and damage the main. You'll be much better off under a spinnaker or just a jib in these conditions.

To optimize performance on a multihull, the crew should be tacking downwind on a broad reach in these conditions, not running. The mainsail in conjunction with an appropriate headsail—a Code Zero or the boat's furling jib—will make the best sail combination.

SAIL INVENTORY FOR THREE OFFSHORE VOYAGERS

Every used boat comes with an existing sail inventory that must be adapted to the demands of offshore sailing within the constraints of the crew's budget. The final sail inventory on any cruising boat will reflect that starting point, along with the crew's ideas for sailing the boat and the amount of money they are willing and able to invest in sails and sail handling. This is the case for each of our three boats, *Simplicity*, *Moderation*, and *Highlife*.

Table 5-7 summarizes the initial sail inventory and sail handling equipment each boat had aboard when purchased. The use each boat was put to in its previous life as well as its age determined what sails and equipment they each carried.

Both *Simplicity* and *Moderation* have spent their lives family cruising and racing in coastal waters, so neither has been set up to handle heavy weather or to be man-

TABLE 5–7. INITIAL SAIL INVENTORIES AND SAIL HANDLING EQUIPMENT ON THREE OFFSHORE VOYAGERS			
Sail Types	***Simplicity* (30-year-old, 33-foot cutter)**	***Moderation* (13-year-old, 40-foot catamaran)**	***Highlife* (8-year-old, 52-foot, cutter-rigged ketch)**
Working	• 15-year-old crosscut Dacron mainsail with two reef points • 6-year-old 130% hank-on Dacron genoa	• 3-year-old full-battened Spectra mainsail with three reef points, large roach, and fitted with UHMWPE luff cars • 3-year-old Spectra laminate blade jib	• 2-year-old woven Dacron furling mainsail • 2-year-old woven Dacron furling mizzen • 8-year-old 130% crosscut Dacron genoa
Working sail controls	• Slab reefing, no winch • Small, non-self-tailing main halyard winch at mast • Traveler across cockpit • Rope vang • Topping lift • Two small non-self-tailing primary winches	• Lazyjacks • Slab reefing with non-self-tailing winch at mast • Self-tailing main and jib halyard winches on mast • Rope clutches for additional halyards, sail controls • Self-tailing mainsheet winch in center of cockpit • Traveler inboard of stern in cockpit • Rigid vang • Two large self-tailing primary winches • Two self-tailing secondary winches • Roller furling on blade jib	• In-mast furling on main and mizzen • Self-tailing halyard winches on each mast; self-tailing jib halyard winch on main mast • Rope clutches for additional halyards, sail controls • Mainsheet and main furling line led aft to electric self-tailing winch next to companionway • Two large self-tailing electric primary winches • Two self-tailing secondary winches • Traveler aft of cockpit • Rigid vang • Roller furling on genoa
Storm			• 8-year-old 10 oz. ORC-sized storm jib
Storm sail controls	• Staysail stay • Checkstays[1]	• Inner forestay[1] • Running backstays[1]	• Staysail stay
Additional	• 1/2 oz. coastal-size symmetrical spinnaker	• Coastal-size 3/4 oz. symmetrical spinnaker	• 8-year-old 1.5 oz. asymmetrical spinnaker with sock
Additional sail controls	• Aluminum pole sized to boat's J		• Aluminum pole sized to boat's J mounted on the mast

[1]Added during refit—see the Upgrading Three Offshore Voyagers section in Chapter 4.

aged shorthanded. *Highlife* was originally fit out for a circumnavigation and has already completed two ocean passages, so she came equipped with a much more complete sail inventory and much more comprehensive sail handling equipment.

Simon and Susan Simplicity could afford to spend only as much as it took to get a usable set of sails and to set up the boat so it could be sailed by one person. They also lacked the stowage space to store more than one large sail beyond their working sail inventory. After looking at the cost of roller furling and converting to a full-battened main, they decided they could not afford either. But the small size of all the sails made them easy to handle without this expensive equipment.

They had no choice but to replace the 15-year-old mainsail (Table 5-8), but they could not afford the $2,000-plus price tag for a new sail. Their boat was a common one in Australia, however, and they were able to find a used, heavily built mainsail in excellent condition for $700. They had a sailmaker add a third reef point for storms and reinforce all the reef points for an additional $200. Simon made a new cover for the sail out of Sunbrella at a cost of $50 in materials.

The genoa had been purchased a year before the boat had been laid up, so it was practically new. With some minor repairs and a new suncover, their sailmaker assured them the sail would make it across a couple of oceans. The sailmaker also fitted a sock to the spinnaker and showed them how to use it, but warned them that the spinnaker material was too light and the sail too large for offshore use and that it would blow out if they left it up in a squall. After trying it out and finding they could manage it, Susan and Simon decided to use it for as long as it lasted. As predicted, they blew out the sail in the Indian Ocean and replaced it with a smaller, heavier asymmetrical spinnaker in Durban.

Simon had installed an inner forestay during the structural refit, but they needed a storm jib. After searching the used sail sites on the Internet for several weeks, they found an unused storm jib of the right size and cut made from 10-ounce material, and were able to purchase it for $300. That completed their sail inventory.

As a small, older, coastal boat, *Simplicity* had little in the way of sail handling equipment (Table 5-7). There was not a single self-tailing winch on the boat when they bought her. Friends were upgrading their self-tailing primaries to a larger size, so Susan and Simon were able to

TABLE 5–8. FINAL SAIL INVENTORIES AND SAIL HANDLING EQUIPMENT ON THREE OFFSHORE VOYAGERS

Sail Types	*Simplicity* (30-year-old, 33-foot cutter)	*Moderation* (13-year-old, 40-foot catamaran)	*Highlife* (8-year-old, 52-foot, cutter-rigged ketch)
Working	• **Used crosscut Dacron mainsail with three reef points**[1] • 6-year-old 130% hank-on Dacron genoa **repaired by sailmaker** • **New mainsail cover**	• 3-year-old full-battened Spectra mainsail with three reef points, large roach, and fitted with UHMWPE luff cars • 3-year-old Spectra laminate blade jib	• 2-year-old woven Dacron furling mainsail • 2-year-old woven Dacron furling mizzen • **New laminate radial-cut 110% roller furling jib**
Working sail controls	• Slab reefing, no winch • Small, non-self-tailing main halyard winch at mast • Traveler across cockpit • Rope vang • Topping lift • **Block and tackle to be used as a preventer** • **Used self-tailing primary winches** • **Existing primary winches set up as secondaries for spinnaker** • **New Dacron halyards-main, genoa, storm jib, spinnaker**	• Lazyjacks • Self-tailing main and jib halyard winches on mast • Rope clutches for additional halyards, sail controls • **Two-line reefing led back to cockpit** • **Boom brake system** • Self-tailing mainsheet winch in center of cockpit • Traveler inboard of stern in cockpit • Rigid vang • Two large self-tailing primary winches • Two self-tailing secondary winches • **2:1 Spectra-cored double-braid halyard for mainsail led aft to cockpit** • **Spectra-cored double-braid jib halyard** • Roller furling on blade jib	• In-mast furling on main and mizzen • Self-tailing halyard winches on each mast; self-tailing jib halyard winch on main mast • Rope clutches for additional halyards, sail controls • Mainsheet and main furling line led aft to electric self-tailing winch next to companionway • Two large self-tailing electric primary winches • Two self-tailing secondary winches • Traveler aft of cockpit • Rigid vang • **Preventer systems permanently affixed to booms** • Roller furling on genoa
Storm	• **Used 10 oz. ORC-sized storm jib**		• **10 oz. woven Dacron 60% roller furling staysail**
Storm sail controls	• Staysail stay • Checkstays[2]	• Inner forestay[2] • Running backstays[2]	• Staysail stay
Additional	• 1/2 oz. coastal-size symmetrical spinnaker **with sock**	• **Used 1.5 oz. asymmetrical spinnaker with sock** • **1,000 sq. ft. woven Dacron Code Zero reaching sail with Vectran luff**	• 8-year-old 1.5 oz. asymmetrical spinnaker with sock • **New 150% Code Zero reacher with Vectran luff** • **Three used running sails with Spectra and Vectran luffs**
Additional sail controls	• Aluminum pole sized to boat's J	• **Removable, continuous-line furler for Code Zero** • **2:1 Spectra-cored double-braid halyard for Code Zero**	• **2:1 Spectra halyard for Code Zero** • **Roller furling on staysail** • **Removable, continuous-line furler for Code Zero** • **Carbon fiber pole sized to boat's J and mounted on mast**
Costs/owner's labor-hours	• ~$3,000/40 labor-hours	• ~$8,000/40 labor-hours	• ~$20,000

[1]Changes in sails and equipment in **bold**.
[2]Added during refit—see the Upgrading Three Offshore Voyagers section in Chapter 4.

buy the old ones for half the price of new. They moved the old, non-self-tailing primaries aft to serve as secondary winches for the spinnaker and storm jib. Once they had worked out a way to lead the main halyard aft to the primaries for taking someone up the mast, they decided they could live with the non-self-tailing main halyard winch on the mast. They replaced all the halyards with new Dacron double-braid and installed checkstays made from Spectra single-braid to be used whenever they flew the storm jib. They developed a block and tackle system that they could attach to a line from the aft end of the boom to serve as a preventer. All told, they spent a bit over $3,000 and put in 40 hours of work to upgrade *Simplicity*'s sails and sail handling equipment (Table 5-8).

Running downwind, they use the spinnaker up to about 10 knots of apparent wind. They then run wing and wing with the reefed main and poled-out genoa up to about 18 knots apparent, when they drop the mainsail. They drop the genoa at 25 to 30 knots apparent, depending on the sea state, and put up the storm jib alone.

Moderation had been fitted with new working sails three years earlier, and the owner had bought Spectra sails built using radial construction. These were still in excellent shape. The name-brand roller furler worked perfectly and would, a rigger assured them, complete a circumnavigation if properly maintained.

With children aboard, Michael and Molly Moderation's first priority was to be able do as much sail handling as possible without leaving the cockpit. They did not like the trade-offs associated with a furling system for the main, and a furler and a new sail cut to be used with it would wipe out most of the money they had reserved for refitting the boat. Instead, they decided to set up a two-line reefing system led back to the cockpit. They purchased several turning blocks, line organizers, and rope clutches. It took them several tries to get the system to work smoothly, but once they had it figured out, the children could reef the boat without any help.

Moderation came with a coastal-sized, ¾-ounce symmetrical spinnaker that had been used half a dozen times and was in excellent shape. A sailmaker suggested they sell that through one of the used sail outlets and replace it with an asymmetrical spinnaker two-thirds the size made from 1.5-ounce nylon and fitted with a good sock. They were able to find an asymmetrical spinnaker that had been used half a dozen times. The new sail proved much more mannerly than the old one and ended up costing only a little bit more than putting a sock on the original spinnaker.

When they took the boat out for a two-week summer sail along the south coast of England, they found they had a gap in their sail inventory. When trying to sail on a beam reach or higher in light air, their small blade jib did not give them the power they needed. Their sailmaker recommended they add a Code Zero sail on a removable furler. Though it was a significant investment, they knew they would need good light-air sail combinations. They went ahead and had the sailmaker build a 1,000-square-foot, Vectran-luff, masthead-reaching sail for use between 40 and 120 degrees apparent. That and the removable furling equipment to handle it cost close to $5,500.

The blade jib was small enough that they didn't feel the need for a storm jib. The deep third reef in the main reduced the mainsail area to about 80 percent of the ORC-recommended size for storm conditions. During their initial refit they had already added Spectra single-braid running backstays, which they would use in heavy weather when they were flying the blade jib.

The boat was fairly well equipped for sail handling with self-tailing winches throughout that were well positioned for their uses. For a preventer, they bought one of the commercial boom brake systems. They replaced all the halyards with Spectra-cored double-braid, installing 2:1 halyards for the mainsail and the Code Zero. It cost over $9,000 to upgrade the sail inventory and sail handling equipment aboard *Moderation*, with that amount about equally divided between sails and hardware. Michael and Molly also spent 40 hours figuring out the two-line reefing system and installing the 2:1 halyards.

Downwind in winds under 10 knots apparent, the Moderations sail with the asymmetrical spinnaker and the full mainsail above 120 degrees apparent or the Code Zero and the full mainsail for closer angles. In stronger winds, they switch to the blade jib and then reef the mainsail as needed. When the wind reaches 25 knots apparent, they drop the mainsail and sail under the blade jib alone.

Highlife had already crossed a couple of oceans and been cruising full-time for five years. Her last owners had invested in new woven Dacron main and mizzen sails before their dream fell apart, and Hugh and Hilary were satisfied with these. The boat was already well set up for shorthanded sailing with in-mast furling on the main and mizzen, powered electric primary winches, and roller furling on the genoa, but they wanted some additional sail handling equipment to make managing such a large boat easier for an older, shorthanded crew.

The 130 percent furling genoa was the only original working sail left on the boat. They replaced that with a Spectra laminate sail of the same size but cut with a higher clew so it was easier to see under. The asymmetrical spinnaker had seen very little use; the previous owners had been too intimidated to fly it because it was so big. Hugh and Hilary decided to keep it, but they also wanted a light-air sail they'd be more comfortable using. After consulting their sailmaker, they had a 150 percent Code Zero with a Vectran luff built and purchased a removable, continuous-line furler to use with it. With this sail they could jibe downwind in light air at 120 degrees apparent, or they could close-reach up to 50 degrees apparent. They installed a 2:1 Spectra halyard and a special fitting on the stemhead to be used for flying this sail. They also purchased three running sails with Spectra and Vectran luffs that could be used with the removable continuous-line furler. When flown with the poled-out jib, these gave them several different double-headsail options for running downwind in the trade winds.

The boat came with an ORC-sized storm jib that hanked to the inner forestay. It made no sense to Hugh and Hilary to have to leave the cockpit when the weather was at its worst, so they installed a roller furler on the staysail stay a size smaller than the one on the headstay. They had the sail loft build them a staysail genoa that just filled the inner foretriangle, which they put on this furler. This new staysail and the mizzen would be their primary storm sails.

The previous owners had jury-rigged a preventer solution on long downwind passages, but the Highlifes wanted a permanent solution. They installed a preventer line that ran aft along the boom and could be led forward to a snatch block and then aft to the cockpit through a rope clutch. They replaced the aluminum spinnaker pole that had come with the boat with a lighter carbon fiber one, and they replaced all the halyards on the boat with low-stretch Spectra-cored double-braid. They invested nearly $20,000 in sails and sail handling equipment, about half of it in the new laminate Code Zero and the removable furler.

Downwind, the Highlifes sail with the jib poled out to windward and whichever reaching sail is appropriate for the wind speed. They use the mizzen in light winds but drop it when the wind gets to 15 knots or so. Somewhere between 25 and 30 knots apparent, they switch down to the furling staysail.

All three boats ended up with workable sail inventories for the range of wind conditions they would experience on a trade wind voyage. Although each crew might have chosen different sail combinations if they had been able to start from scratch, they were all satisfied with the compromises they had made.

ADDITIONAL PRETRIP PREPARATIONS

- **A way to get up the mast shorthanded.** While everyone hopes it will never happen, offshore crews need to be prepared to go up the mast at sea. The various ways to do this are examined in the Going Aloft at Sea sidebar in Chapter 23. Figure out what you plan to do, buy the necessary equipment, and practice at least once before you go.
- **Safety lines.** A mainsheet block that fails can leave the boom swinging uncontrollably across the boat; the failure of a turning block at the base of the mast can rip a rope clutch out of the deck. The blocks themselves turn into metal projectiles with enough force to do serious damage to anyone in their way. To contain the forces and keep hardware from getting launched across the deck, we have followed the lead of the Vendée Globe racers and threaded a Spectra single-braid line through a strong point and through the block (Figure 5-39). This would hold the line and hardware in place long enough to let us get things under control.
- **Halyard accessibility.** On many larger boats, especially those with hard dodgers and full-battened systems, the headboard may be 8 feet or more above the deck. Install mast steps to a height that will allow the shortest crewmember to easily reach the headboard. Because of all the fittings and lines around the base of the mast, folding mast steps like those made by ABI are best for this purpose.
- **Spinnaker halyards.** For spinnaker halyards, your boat should have either a single sheave at the top of the masthead crane on the boat's centerline or two bails on either side of the masthead crane to support blocks for port and starboard halyards. Do not plan on flying a spinnaker from the sheave for a jib halyard. These sheaves are not designed for the lateral pull of a spinnaker and will chafe the halyard through in very short order.

Figure 5-39.
The Spectra single-braid line threaded through the mainsheet block and the shackle holding it in place would contain the damage if either blew up.

(continued on next page)

- **Spare halyards.** Every mast must have a spare halyard in case a sail jams or a halyard chafes through and is lost up the mast. If you want to avoid weight and windage aloft, use a Spectra messenger line rigged so it cannot chafe.
- **Tack pendants.** Check every sail at full hoist to see if it chafes at or near the tack. Many Yankees and cruising chutes need to be set up with a wire or Spectra pendant so that they clear the bow pulpit (see Figure 13-1). Some roller furling genoas will need the same treatment.
- **Tacks on roller furling sails.** Roller furling sails are particularly vulnerable to ripping near the tack grommet where the sail exits the foil. Lashing the grommet to the roller furling foil reduces the movement that causes this chafe (Figure 5-40). Do not lash it too tightly, however, or you may damage the foil.
- **Shackles.** You need to be able to operate most shackles without seeing them. The type that requires you to line up a pin and screw it into threads is almost impossible to operate in bad conditions. Trigger shackles (see Figure 5-33) and snap shackles work best for most situations. Except where they could be accidentally tripped, snap shackles should be fitted with a lanyard that makes them releasable with one hand. All shackles should be oversized. Bowlines instead of shackles on sheets save money, weight, and aggravation.
- **Sail covers.** Good sail covers protect your canvas from the devastating effects of UV radiation. But most materials stop screening the sun's rays long before they start looking worn out. If your covers are more than four years old, replace them before you leave. Any sail that might be stowed on deck, like trysails or hank-on headsails, should have a bag that can be put on while the sail is hanked to the stay (see Figure 5-31). These bags should have mesh on the bottom to allow water to drain out.

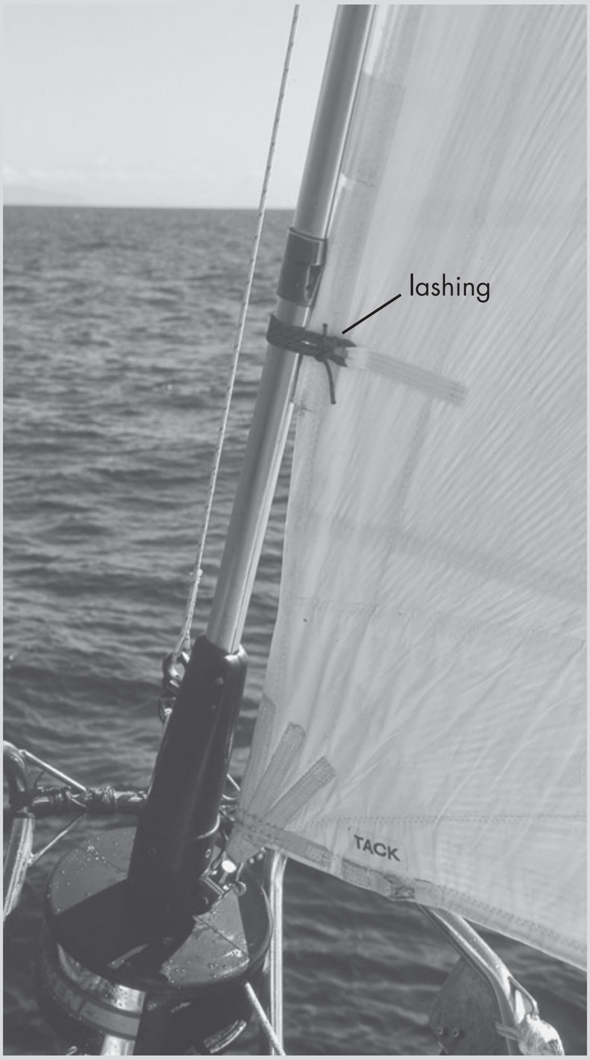


Figure 5-40.
The lashing holds the tack of the jib to the roller furling foil and prevents chafe or wear at the tack.

- **Thread.** Thread that will be exposed to the sun needs to be UV-resistant, or it will deteriorate in a matter of months. The W. L. Gore company's PTFE synthetic fiber thread, trademarked Tenara, provides complete UV resistance with strength and water resistance. The thread is guaranteed for the life of the fabric in which it is used against damage from sunlight, weather, or water for all marine applications except sails.

CHAPTER 6
Anchors, Anchoring, and Mooring

UNLIKE WEEKEND SAILORS, offshore voyagers seldom enter marinas but spend the vast majority of their time at anchor. Most coastal crews carry a variety of fenders and lines aboard their boats and have a reasonable amount of experience docking; many are comfortable picking up mooring buoys. Yet these same cruisers all too often view their anchor with a mixture of suspicion and awe. Many seem to believe that some sort of magic is involved in getting the anchor to hold in strong winds, difficult bottoms, or tidal currents. That may be why discussions of the "best" anchor and the "best" anchoring system prove a perennial favorite for sailing magazines and online sailing forums.

Yet in the real world, among the many topics experienced voyagers discuss in the cockpit over cocktails, anchors and anchoring rarely even get a mention. Anchoring is so central to voyaging that it's one thing people figure out in a hurry. They learn that successful anchoring starts with the right equipment and ends with good technique. That recipe guarantees a good night's sleep at least 90 percent of the time. For the rest of the time there are a few tricks and techniques that will guarantee stress-free nights even when the wind is howling in the rigging. This chapter considers both the basic equipment and the techniques for successful anchoring and mooring.

ANCHORING BASICS

Despite the long-standing debate about the relative merits of different anchors and rodes, everyone agrees on certain basic principles: heavier rodes and more scope are always desirable; chain is more chafe resistant than nylon; the weight of chain and anchors stowed near the bow negatively affects sailing performance; and other things being equal, holding power increases with the anchor's weight and surface area. Beyond these conclusions, the arguments degenerate into discussions of complex catenary curves, obscure trigonometric functions, and unrealistic test conditions. One expert's estimate of the force exerted on an anchor in a given wind speed can differ by an order of magnitude from another's.

Luckily, getting a good night's sleep doesn't depend upon knowing how much force the anchor can withstand. Voyagers need only select the right gear for the job, drop the anchor in the right spot with the proper scope, set it, and add sufficient elasticity to keep it set. Every cruiser we've met who has been out cruising for more than a few months has mastered the technique.

Ground Tackle for the Bluewater Voyager

Once you leave your home waters, you will spend most nights at anchor. In all likelihood, you will experience far more gale- and even storm-force winds at anchor than at sea. At some point, your boat's safety—and your well-being—will depend upon your ground tackle. Good ground tackle costs a fraction of what a new watermaker or generator costs. So if your boat came with an undersized anchor, a short length of chain, and no windlass, don't hesitate to upgrade your anchoring arrangements to offshore standards. The money could not be better spent.

Carry the Appropriate Anchors

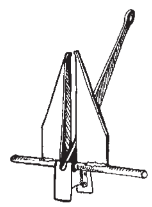
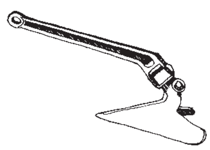
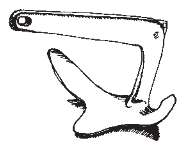
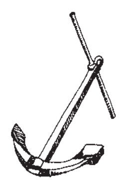
Anchors have come a long way since the days when every boat carried a fisherman anchor. Modern engineering has created a series of anchors with much greater holding power for their weight and much more efficient designs that are difficult to trip and that reset easily if tripped. This profusion of anchors increases every year as additional models come onto the market.

All these anchors can be divided into four categories. As shown in Table 6-1, each has its strengths and shortcomings. Fluke-type anchors offer the best holding power for their weight in sand and soft mud, but they generally will not reset if tripped. Plow anchors need to be heavier to achieve the same holding power as their fluke equivalents, but they hold well in a variety of bottoms. Claw-type anchors hold in an even wider range of conditions, but they can be fouled by large pieces of rock or coral that get jammed in the claw. Fisherman anchors rely on weight rather than engineering for their holding power and can hold in virtually anything, but they are difficult to stow, awkward to handle, significantly less efficient than more modern anchors, and no longer find their way onto many cruising boats.

There are bottoms in which no anchor will hold. The most difficult bottom we have ever encountered was in Princess Royal Harbour, the large bay serving the town of Albany on the southwest corner of Australia. There we found a thin layer of grass over a thin layer of sand over a hard, flat surface, either rock or cement-like sand. This is the only place we've ever been where we could not get any anchor to hold once the wind went over 30 knots, nor could the other two boats there when we were. Between us we tried every type of anchor shown in Table 6-1 and even the tandem anchor solution discussed in the Tandem Anchoring section below, and nothing held. Everybody we have met who has spent any time in this anchorage remembers it as having the worst holding they have ever encountered.

A harbor like that is, fortunately, a rare exception, and everywhere else we've been able to get an anchor to set and hold 99 percent of the time on the first try. Today's plow and claw anchors and some of the new anchors that combine the features of both work well across a huge variety of bottoms. In 85,000 nautical miles, we have anchored on everything from pebbles to rocks, soft mud to hard-packed sand, kelp-covered boulders to coral rubble using our primary anchor, an oversized Bruce (44 pounds on *Silk* and 110 pounds on *Hawk*). Of 100 cruising boats whose crews completed surveys in New Zealand in 2004, plow anchors—specifically the CQR and Delta—turned

TABLE 6-1. ATTRIBUTES OF DIFFERENT ANCHOR TYPES

Anchor Type	 Fluke	 Plow	 Claw	 Fisherman
Examples	Danforth, Fortress	CQR, Delta, Spade	Bruce	Luke
Holding-to-weight ratio	Excellent	Moderate	Moderate	Poor
Recommended size for 40-foot coastal boat (lb.)	25–35	35–45	40–45	70
Performs best in	Sand, soft mud	Weeds, grass, hard-packed sand	Sand, mud, coral, rock	Rock, coral, kelp, weed
Performs poorly in	Rock, coral, grass, clay	Soft mud, fine sand, heavy kelp	Hard-packed sand	Soft mud
Key advantage	Easy to handle	Point penetrates bottoms that other anchors skate over	Resets itself in two shank lengths if tripped	Often holds when nothing else will through sheer weight
Key disadvantage	Does not reset itself when tripped	Point pulls through soft mud or fine sand	Large piece of coral can foul claw	Difficult to stow and to handle

(Lyanne Schuster illustrations)

out to be the most common primary anchors, and their crews used them 98 percent of the time.

Though we use our primary anchor 100 percent of the time, we carry several additional anchors, as did all the crews surveyed in New Zealand. Secondary anchors ran the gamut of the types listed in Table 6-1. Every boat carried at least two types; most carried three. At the time of the survey, the light, high-holding-power Fortress anchors had almost completely replaced the clumsy, heavy fisherman-type anchors for use as storm anchors on the majority of boats.

Though these secondary anchors get used less than 2 percent of the time, they serve a variety of functions. They act as stern anchors to hold the bow into a swell; as kedge anchors to hold the boat off a dock while fueling or to kedge the boat off when it's gone aground; as a tandem anchor in front of the primary anchor to prevent it from dragging; and as a second anchor in anchorages with limited swinging room to keep the boat from fouling its neighbors. In the first two situations, the anchor is deployed from a dinghy, not from the boat. In the third situation, it is deployed by hand in front of the primary anchor. In the fourth situation, it can be deployed from the bow, but it can just as easily be deployed from a dinghy. An anchor for these purposes, then, needs to be easy to handle, with good holding power for its weight, and be easily retrievable without using a windlass. We use our 40-pound Danforth-type anchor in all these situations; 85 percent of the cruisers surveyed carried either a Danforth or a Fortress and used them in a similar manner.

Arguably, offshore voyagers could get away with carrying only two anchors: a properly sized plow or claw-type anchor as their primary, and an appropriately sized Danforth or Fortress for the uses described above. But most cruisers carry additional anchors as insurance against the unforeseen—in case they have to cast off their primary anchor and rode in an emergency or sit out an out-of-season tropical storm. That means having at least one extra anchor large enough to serve as the primary anchor. We carry a 55-pound Delta for that purpose; all the cruisers surveyed carried an appropriately sized plow or claw that could be used in place of their primary anchor if the need arose.

Maximize the Holding Power of Your Rode

All-chain rode is widely considered optimal for a bluewater boat. Chain resists the chafe and abrasion that occur as it is dragged over coral or rock. The weight of the chain keeps the pull on the anchor parallel to the bottom, making it more difficult for the forces of wind and tide to trip the anchor. A third advantage of an all-chain rode is less obvious: on a rock or coral bottom, chain friction significantly increases holding power.

Compare how hard it is to drag a length of chain over a rocky beach versus dragging a length of rope. The chain dissipates force every time it takes a slight bend around a rock, while the rope glides over the top. Chain friction can also increase holding in deep, thick mud.

Most offshore voyagers find this combination of chafe resistance, weight, and increased friction irresistible. The traditional rode for bluewater boats consists of 300 feet of chain. But an all-chain rode lacks elasticity. To be drag-proof, a monohull will need to add a good elastic snubber, and a multihull will need to use a long bridle to prevent shock loads from yanking the anchor out of the bottom and to protect the windlass and cleats from unnecessary strain. As the wind comes up and the forces on the anchor double and double again, the snubber or bridle becomes the most critical element in the anchoring system. Without a proper snubber in conditions like those shown in Figure 6-1, cleats can pull from the deck, bow rollers can break, windlasses can get damaged—and crewmembers who try to intervene can be seriously injured.

What is a proper size for a snubber on a monohull? When the boat is tied to a dock, the load is spread across three or more strong and elastic docklines. At anchor this load is concentrated on one line, which should be as strong as and more elastic than your docklines. That means a relatively long nylon snubber about the same diameter as that recommended for the boat's docklines. The snubber should be long enough that if you pay out more scope, you can let out more snubber without disconnecting it from the chain. Thirty feet of ½-inch nylon is not unreasonable for a 40-foot boat.

The snubber needs to be attached to the rode using something that won't come off the chain but that can be slipped off quickly and easily when raising the anchor.

Figure 6-1.
With an all-chain rode, snubbers provide vital elasticity and prevent breakages in conditions such as these.

Figure 6-2.
Our storm snubber—a chain grabber with two 50-foot nylon lines for creating a bridle. Note the wire ties used to seize the shackles so they can't come undone.

Figure 6-3.
Our storm snubber in use in the same conditions as shown in Figure 6-1. Note that we are also using our normal snubber (white line running to chain) and rags for chafe protection after the hoses on the storm snubber slipped (just visible above the water).

Trying to unscrew a shackle or untie a rolling hitch when the chain is under tension in an emergency will be stressful at the least and impossible at the worst. It's not sufficient to cut it away. The chain has to go through the windlass before the anchor can be picked up, and it won't do that with a shackle or knot on it. A snubber that cannot be removed in an emergency will render the windlass useless.

The usual solution is a chain hook sized for the chain. The chain hook can be flipped off the chain before it reaches the bow roller, preventing the snubber from getting fouled in the roller or wrapped around the chain. These stay on even in calm conditions as long as some extra chain forms a loop to hold weight on the hook. A *chain grabber*, a flat steel plate that slides between two links to attach a bridle to the chain (Figure 6-2), offers another good solution. In storm conditions, we use a chain grabber with an oversized, extra-long bridle (Figure 6-3) in addition to our normal snubber. We used a double snubber for the first time when sitting out Hurricane Lenny in Antigua in 1999. One snubber did chafe through and could have caused a serious problem except that we had a second snubber already in place.

On a multihull, a bridle is the key to anchoring securely. Anchoring from a single point will cause a cat to sail around instead of lying bow-to the wind. This motion will create side loads on the anchor that can cause even a properly sized anchor to pull free. The bridle should be constructed from elastic line the diameter of the boat's docklines, attached to either side of a chain grabber. Bridle lengths should be at least equal to half the beam of the boat (Figure 6-4). Once the bridle has been set, a loop of extra chain should be let out so the strain is on the two lines running from the chain to the bows. Just as with a snubber on a monohull, this provides elasticity and prevents shock loads from dislodging the anchor. In crosswave conditions, one side of the bridle can be shortened to bring the boat into a more comfortable alignment with the waves.

Figure 6-4.
To keep a multihull from surging around at anchor and pulling the anchor out, use a bridle with arms at least equal to half the beam of the boat. (Karl Matzke photo)

Figure 6-5.
A riding sail holds a cutter into the wind and helps prevent shock loading on the anchor.

In windy conditions, some monohulls will benefit from a riding sail to keep the boat weathercocked into the wind and prevent surging around the anchor. On a ketch, the mizzen sail reefed in flat on the centerline works well; on a cutter or a sloop, a sail will need to be raised up the backstay and a way found to sheet it on the centerline (Figure 6-5).

An oversized, all-chain rode with a long, elastic snubber or bridle maximizes holding power. Unfortunately, the weight of the chain, which serves the boat so well when anchored, becomes a hindrance under sail. Carrying one 300-foot rode of ⅜-inch BBB chain in the bow is equivalent to having two halfbacks standing on your foredeck at all times; two 300-foot rodes mean carrying four halfbacks around. Even moderate- and heavy-displacement offshore boats over 40 feet will be adversely affected by that much weight so far forward. On smaller or lighter boats, pitching will increase, and the boat will plow through waves instead of lifting over them.

For these smaller or lighter boats, carrying 300 feet of all-chain rode just won't be an option. Three alternatives exist for these boats: moving the weight down and aft, reducing the chain size of the all-chain rode, or switching to a mixed rope-and-chain rode. Using an *angel*, a weight that slides down the rode to keep the pull on the anchor parallel to the bottom, offers a fourth option. However, setting and retrieving the angel complicates the anchoring process, and someone must remember to deploy the angel even in calm conditions when it seems as if it won't be needed. It's far better for the boat's normal anchoring system to be set up to handle all conditions in as simple and straightforward a manner as possible.

Moving the weight of the chain down and aft can be accomplished by installing a PVC chain pipe running aft from the windlass to a chain box under the V-berth or the cabin sole. We have seen a few specially designed boats where this arrangement worked well; on most boats it proves more of a problem than a solution. When retrieving large amounts of chain, it tends to mound up and jam under the chain pipe unless the locker is particularly deep and well designed. On passage the mounded chain often shifts, falling over on itself, and when the anchor is dropped it won't run out freely. In either situation, someone has to access the chain locker to reorganize the chain. If the chain is stowed far from the windlass in a locker that can be reached only by opening up the bilge or the forepeak bunk, dropping and retrieving the chain will become a complex two-person operation. Switching to a lighter rode is one way to avoid redesigning the chain stowage arrangements.

In choosing between a smaller all-chain rode and a mixed rode to reduce rode weight, consider a simple engineering fact. For two rodes with the same total weight and length (assuming a frictionless bottom), the one with its weight concentrated in a shorter length of heavier chain followed by nylon will hold better than a longer all-chain rode of lighter chain. Concentrating the weight of the rode near the anchor reduces the leverage on the anchor as wind and wave forces try to lift or drag it. You are therefore better off using a mixed rope-and-chain rode with heavier chain. The mixed rode will be stronger and have greater holding power than an all-chain rode of smaller diameter. That's the theory.

On an actual bottom where friction is a real component, the shorter-and-heavier approach can be taken only so far. The benefits of concentrating the weight near the anchor have to be weighed against the loss of chain friction and chafe protection. The optimal mixed rode concentrates as much of the weight of the chain near the anchor as possible but includes a long enough length of chain to

TABLE 6-2. THE WEIGHTS OF FIVE ALTERNATIVE ANCHOR RODE CONFIGURATIONS

Type	Rode Configuration	Chain Weight per Foot (lb.)	Line Weight per Foot (lb.)	Total Weight (lb.)	Percent of All-Chain Rode Weight	Breaking Strength (lb.)
Traditional configuration	300 ft. of 3/8 in. BBB chain	1.70		510		11,000
Downsized chain	300 ft. of 5/16 in. BBB chain	1.20		360	71	7,600
Smaller high-test chain	300 ft. of 5/16 in. high-test chain	1.09		327	64	11,600
Mixed rode with BBB chain	100 ft. of 3/8 in. BBB chain and 200 ft. of 5/8 in. three-strand line	1.70	0.13	196	38	11,000
Mixed rode with high-test chain	100 ft. of 3/8 in. high-test chain and 200 ft. of 5/8 in. three-strand line	1.50	0.13	176	35	12,200[1]

[1]In this case, the line determines the breaking strength; the breaking strength of the chain is 16,200 lb.

generate friction along the bottom and keep the rope rode away from rocks or coral heads. For most anchorages, this translates into a minimum of 40 feet of oversized chain in a mixed rode. Since cruising boats most often anchor in water depths between 15 and 25 feet, increasing the chain length to 100 feet will allow the boat to be anchored on all chain with a 4:1 scope in most anchorages while significantly reducing the weight in the bow.

As Table 6-2 shows, a downsized chain rode weighs about 70 percent of the original all-chain rode and is not as strong, whereas a mixed rode with 100 feet of chain weighs less than 40 percent of the original configuration without giving up any strength. Substituting high-test chain for BBB in a mixed rode results in a 65 percent weight savings and a slight increase in strength over the original all-chain rode.

Although a 300-foot all-chain rode is the offshore standard, most of that chain will get used very rarely—a few times in French Polynesia on a tropical circumnavigation; occasionally in deep fjords in Chile or New Zealand on a high-latitude voyage. But carrying it in the bow will affect sailing performance all the time. Using a mixed rode with 100 or 150 feet of chain most of the time and adding a second section of chain for the few areas in the world where 300 feet of chain may be necessary will enhance sailing performance on most boats and will not compromise anchoring performance. To handle the mixed rode, the boat will need to be equipped with a windlass that can haul both line and chain.

Size All Ground Tackle for Shock Loads

The forces from steady winds, even if quite strong, represent a static load that is an order of magnitude smaller than the maximum loads to which the ground tackle will be subjected. The highest loads come when the boat fetches up hard on the anchor in a gust, or when the bow pitches against the rode in a nasty chop. In these situations, the ground tackle receives shock loads of thousands of pounds. Every piece of ground tackle and every part of the anchoring platform must be able to withstand such loads—not just the anchor and rode, but also the snubber, shackles, bow rollers, cleats, and even the bowsprit.

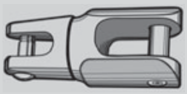
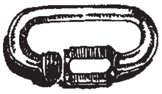
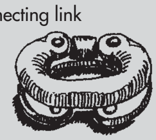
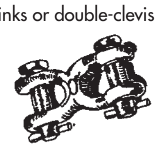
Withstanding these shock loads takes much more holding power than is required for normal anchoring. Weight is important to every dimension of holding power. Weight helps the anchor penetrate weed or kelp, allowing it to get through to the bottom where it can dig in. Weight, surface area, and the design of the anchor all contribute to preventing the anchor from tripping if the boat veers. As fisherman-type anchors illustrate, sheer weight does as much as engineering to increase holding power on the most difficult bottoms. For these reasons, most cruisers rely on an oversized primary anchor.

This can be seen in the survey of offshore voyagers in New Zealand. The 35-pound CQR is rated for use on boats from 26 to 45 feet long, whereas the 45-pound CQR is meant for boats from 32 to 58 feet long. The crews on a Fuji 35, a Hallberg-Rassy 38, and an Island Packet 38, among others, could have chosen either anchor according to the manufacturer's recommendations. All of them selected the larger CQR, adding 10 pounds of weight but significantly increasing holding power. Almost every crew surveyed relied on a primary anchor rated for a vessel 10 to 20 feet longer than the actual boat size.

A similar rule should be applied to the rode. An all-chain rode wrapped around a rock or coral head with the bow pitching in a steep chop causes huge shock loads. In this situation in Pacific coral waters, we've seen a 40-foot boat break 5/16-inch high-test chain and another stretch 3/8-inch BBB chain. In waters where your chain could snag on rock or coral, you need a minimum breaking strength somewhere between one-half and three-quarters of your boat's displacement. For most boats, that works out to one size larger than recommended. Replacing BBB chain sized for coastal use with high-test chain of the same size will increase the strength sufficiently without necessitating a new windlass gypsy.

To put this in perspective, a standard rule of thumb for sizing anchor line calls for 1/8 inch of diameter for each 9 feet of boat length; BBB chain should be half the line diameter. This would mean we should carry 5/8-inch anchor line and 3/8-inch BBB chain on *Hawk*. In fact, we carry

TABLE 6-3. COMPARISON OF WAYS TO CONNECT RODE COMPONENTS

Type of Connector	Description	Strength Compared to Equivalent BBB Chain	Comments	Recommended Use
Swivel connector 	Stainless or galvanized steel back-to-back connectors separated by a swivel	About the same	Slides easily over anchor roller; prevents chain from twisting	To connect chain to anchor
Quick link 	Stainless steel oval closed by a barrel bolt	About 80%	Will not go through windlass; must close barrel bolt with wrench	To connect chain to anchor
Screw-pin anchor shackle 	Stainless or galvanized steel shackle closed by pin and seizing wire	About 80%	Galvanized type will rust over time; will not go through windlass	To connect anchor to chain or rope to chain
Rope-to-chain splice 	Splice that connects the line to the chain in a mixed rode	About the same[1]	Will go through windlass	To connect line to chain in a mixed rode
Connecting link 	Link of chain held closed by two rivets	The same	Will go through windlass	To connect a length of chain to a chain rode
Mid-links or double-clevis links 	Galvanized steel back-to-back U's with screw pins	Higher	Will not go through windlass; not corrosion resistant	Temporary link between two chains
Lap link 	Open link of galvanized steel closed by pressing edges together with a wrench	About half	Cold-forged from rolled steel—lacks strength; no protective connection to hold closed	None

[1]The breaking strength of three-strand nylon is slightly reduced by a proper splice, but the line breaking strength is generally slightly higher than the BBB chain with which it is used. Cored line can lose up to half of its strength when spliced. Check with line manufacturers before using cored line spliced in your anchor rode.
(Top illustration Fritz Seegers; other illustrations Lyanne Schuster)

¾-inch three-strand nylon for our line rode and ⅜-inch high-test chain.

Oversized rodes and anchors mean nothing if the connections between components are not sized for the same loads as the rest of the equipment. Table 6-3 summarizes the ways to connect anchors to rodes, chain to chain, and chain to line. In most rodes, one of these connectors will be the proverbial weak link.

In selecting connectors, your first concern should be strength. If the connection needs to go through the windlass, your second concern should be whether or not it will do so. Connecting links and rope-to-chain splices offer the greatest strength and should be your first choice for connecting your rode. Note that shackles should always be one size larger than chain. If the chain is connected to the anchor using quick links or screw-pin anchor shackles, open and lubricate them regularly to prevent corrosion.

Seize all shackles connecting anchor, chain, and line with Monel seizing wire or plastic wire ties to prevent them coming undone. We prefer plastic wire ties, which are quickly and easily applied and can be removed with one slash of a knife. For extra security, a short length of ¼- or 5⁄16-inch single-braid Spectra line should be used across chain links that are joined by a connecting link. If the connecting link fails, the Spectra line should have the breaking strength to keep the anchor attached to the boat. Spectra line can also be used to back up the connection between the anchor and the chain rode.

From a safety perspective, when it comes to anchors, rodes, and the connections between them, bigger is better. Offshore boats should carry the largest anchor and rode that can reasonably be handled by the crew and safely carried by the boat.

Reset the Anchor as Necessary

One key to anchoring well is to be willing to pick the anchor back up if the boat ends up too close to something; the anchor doesn't set properly; the wind shifts, putting the boat on a lee shore; or for any other reason that might make the anchorage unsafe. But properly sized ground tackle weighs hundreds of pounds. The crew will be reluctant to reset the anchor unless the boat is properly equipped to make the task easy.

That starts with improving the bow platform as described in the Improve the Anchoring Arrangements section in Chapter 4. In addition, if your boat is over 35 feet or you are over 35 years of age, you will want a windlass of some type. We used a manual windlass aboard *Silk*, which proved workable and durable. But it wouldn't have been up to the task of handling *Hawk*'s 110-pound main anchor and 150 feet of ⅜-inch chain. If the boat is over 45 feet or you are over 45 years of age, an electric (or hydraulic, if the boat has hydraulics installed for other purposes) windlass is advisable. If you or your partner has back problems, you should buy the best powered windlass you can afford no matter what size your boat is.

The windlass should have both rope and chain gypsies so it can be used to retrieve a mixed rode as well as to take someone up the mast. Powered windlasses must be equipped with a manual override system that generates sufficient power to retrieve the boat's normal ground tackle. Electric windlasses may draw up to 135 amps, so they should be wired with heavy-duty battery cable and an in-line circuit breaker installed near the battery.

Putting It All Together: Alternative Solutions

Table 6-4 illustrates the ground tackle that four different boats might carry. Every boat is equipped with an electric windlass sized appropriately for the ground tackle aboard.

The **traditional** alternative represents the conservative approach and puts a great deal of weight in the bow of the boat. A decade ago, many boats carried two anchors on the bow and two all-chain rodes in the anchor locker. While some large, heavy boats still do so today, the majority carry a single oversized anchor on the bow, as shown in the **contemporary** alternative. The secondary anchor, while still carried, is stowed and rarely used. Two rodes may still be kept in the anchor locker, but only one will be all-chain. The other will generally be a mixed rode with 75 to 100 feet of chain. On some boats the second rode is stored in the bilge rather than carried in the bow, further reducing the weight forward.

The **lightweight** alternative has been used with success by people we have met sailing ultralight boats. These crews never leave the primary anchor on the bow roller when passagemaking, and the more serious sailors even take the anchor off the bow when day sailing. The primary anchor's light weight makes it possible to move it around by hand, so it can be removed easily.

Note that a backup steel anchor is carried in the bilge. This is essential for three reasons. First, it may not be possible to get either of the lighter anchors to set in a situation where weight really matters, as when trying to cut through thick kelp to reach the bottom. Putting the Spade and Fortress in tandem should result in enough weight to hold the boat, but it may not. Second, aluminum anchors are less robust than steel and can be bent relatively easily. Third, Fortress anchors do not hold well in coral or rock, so they can't be relied on as a secondary anchor if the primary is lost. The heavier steel anchor provides a high-holding-power alternative in all three of these situations; it would be used with the additional 75-foot length of chain also stowed in the bilge.

The **high-latitude** alternative shows what we carry aboard *Hawk*. Like most boats that have spent several

TABLE 6-4. COMPARISON OF GROUND TACKLE CARRIED BY FOUR DIFFERENT BOATS

	Traditional	Contemporary	Lightweight	High Latitude
Example boat	45 ft., heavy-displacement cutter on tropical circumnavigation	45 ft., medium-displacement cutter on tropical circumnavigation	45 ft., ultralight sloop on 5-year tropical voyage	45 ft., medium-displacement cutter on high-latitude voyage
Primary anchor/rode	60 lb. CQR on bow roller; 300 ft. of 3/8 in. high-test chain in anchor locker	66 lb. Bruce on bow roller; 300 ft. of 3/8 in. high-test chain in anchor locker	33 lb. aluminum Spade on bow roller; 75 ft. of 1/4 in. high-test chain and 200 ft. of 5/8 in. three-strand nylon line in anchor locker	110 lb. Bruce on bow roller; 150 ft. of 3/8 in. high-test chain and 250 ft. of 5/8 in. three-strand nylon line in anchor locker
Additional rode for primary anchor	None	None	75 ft. of 1/4 in. high-test chain stowed in bilge	150 ft. of 3/8 in. high-test chain stowed in bilge
Secondary anchor/rode[1]	66 lb. Bruce on bow roller; 300 ft. of 3/8 in. high-test chain in anchor locker	66 lb. steel Spade stowed in bilge; 100 ft. of 3/8 in. high-test chain and 200 ft. of 5/8 in. three-strand nylon in anchor locker	55 lb. Delta stowed in bilge	55 lb. Delta stowed in stern locker; 25 ft. of 3/8 in. high-test chain and 300 ft. of 3/4 in. double-braid nylon line in bilge
Kedge anchor/rode	25 lb. Danforth-type high-tensile anchor affixed to stern pulpit; 12 ft. of 3/8 in. high-test chain and 150 ft. of 5/8 in. three-strand nylon stowed in stern locker	25 lb. Danforth-type high-tensile anchor in stern locker; 12 ft. of 3/8 in. high-test chain and 150 ft. of 5/8 in. three-strand nylon stowed in bilge	32 lb. aluminum Fortress stowed in bilge; 12 ft. of 1/4 in. high-test chain and 250 ft. of 5/8 in. three-strand nylon in stern locker	40 lb. Danforth-type high-tensile anchor; 12 ft. of 3/8 in. high-test chain and 300 ft. of 3/4 in. double-braid nylon line in stern locker
Additional anchors	32 lb. aluminum Fortress stowed in bilge	32 lb. aluminum Fortress stowed in bilge	None	32 lb. aluminum Fortress stowed in sail locker
Total weight (lb.)[2]	1,126	856	301	833
Weight in bow (lb.)[2]	1,020	684	115	369

[1]Could also be used to replace primary anchor if lost.
[2]Including the windlass in the weight calculations would add an additional 30 to 50 lb. on each boat.

years in the high latitudes, *Hawk*'s ground tackle is oversized even beyond what tropical boats carry. We rarely saw an anchor of less than 100 pounds on the 50-foot Antarctic and Cape Horn charter boats based in the Beagle Channel. Like most high-latitude cruisers, we prefer to carry one storm-sized anchor on our bow and rely on it all the time. On more occasions than I can name, we have gone to sleep in calm conditions and woken to find ourselves in 30 or 40 knots of wind, sometimes with a 2- to 3-knot current, with the Bruce holding just fine. If we had relied on a "normal" anchor, we would have been dragging before we could have gotten a storm anchor out of the bilge.

We have used the Bruce as a primary anchor on both *Silk* and *Hawk*, and it's only dragged once, in that infamous Australian anchorage mentioned earlier. We know many cruisers who swear by the Bruce and will consider no other primary anchor. Yet in almost every anchor test, the Bruce comes close to the bottom in terms of holding power. We know other cruisers who are equally adamant about the CQR, the Spade, and others, some of which do well in these tests and some of which don't. In the end, you either trust your primary anchor or you don't. If you do, you'll sleep well even when the wind is howling. If you don't, you'll try another anchor until you find one you do trust. When you find that anchor, you'll become a convert and will be unlikely ever to switch. That's the only anchor test that matters.

Anchoring Technique

Once you have outfitted your boat with the proper equipment, you can start to practice good technique. To set the anchor well and minimize your chances of dragging, pick your spot carefully. That means looking for adequate protection and a good bottom. You then need to set your anchor securely, even if that means resetting it several times. If you put out sufficient scope for the conditions,

BEYOND ANCHORS AND RODES: ADDITIONAL ANCHORING EQUIPMENT

A variety of additional equipment makes anchoring easier and protects your boat and ground tackle. Before you leave, make sure you have the following:

- **Anchor chocks.** Light, fluke-type anchors don't stow well in standard bow rollers. Fortunately, they can be moved much more easily than their heavy counterparts. Chocks on the coach roof or a special bracket on a stern pulpit offer a seamanlike solution for stowing these anchors (Figure 6-6).

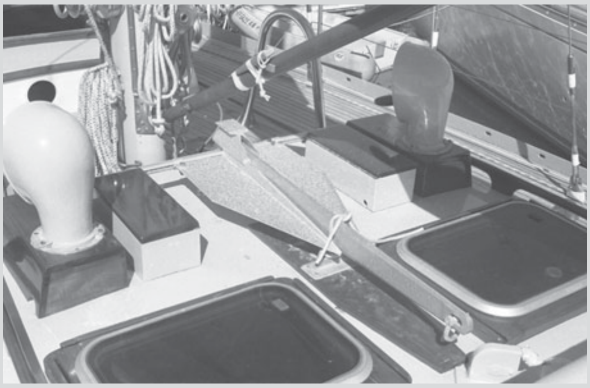


Figure 6-6.
An excellent and accessible arrangement for stowing a fluke-type anchor on the coach roof.

- **A strong point for the anchor rode.** The bitter end of the rode must be secured to something strong enough to take the shock load of the boat fetching up against it without breaking. On most boats, the rode is tied to a pad eye through-bolted to the bulkhead or a structural support in the chain locker. In the event that the snubber breaks and all the chain runs out, this would keep the rode attached to the boat. An all-chain rode should be secured to the bulkhead by a length of line so that it can be cut away in an emergency. The line should be long enough so that it runs up through the hawsepipe and out on deck, so it could be cut without having to get inside the locker.
- **Anchor rode markers.** When setting the anchor, you'll need to know how much scope you've let out. But marking the rode proved less straightforward for us than we had assumed. Paint will chip off the rode after a few weeks of daily use, and the windlass mangles the anchor rode markers available in chandleries. We have found two solutions that work fairly well and only need to be replaced every year or so. One is to use large wire ties. We wrap them around the chain link, pull them tight, and cut off most of the tail, leaving a couple of inches so it will be visible as it crosses the deck. These are cheap and easy to replace as frequently as necessary. Webbing works just as well and has the advantage of being brightly colored, making it easier to see. Pass a 3-inch length of webbing through the link and sew it closed. We use one wire tie or piece of webbing to mark 25 feet, two to mark 50, and so on. On the line rode we use colored thread sewn into the nylon and covered with epoxy to protect it from chafe. As on the chain, we use one colored band to mark 25 feet, two to mark 50 feet, etc.
- **Chafe protection.** For chafe protection on both the snubber and the nylon rode, we prefer lengths of fire hose. We thread about 3 feet of fire hose on the snubber, which protects the snubber from just in front of the cleat almost to the bow roller. The line rode has 4 feet of fire hose threaded onto it. The hose can be slid up or down to the right position on the rode. This hose extends from just in front of the windlass all the way out over the bow roller. Plastic water hose can be used as well, though its rigidity makes the snubber hard to coil and makes it more difficult to get the line rode down the hawsehole into the chain locker. It also has a tendency to slip in extreme conditions unless secured somehow.
- **Trip line.** We consider a trip line an important element of our anchoring gear (see the Raising a Fouled Anchor sidebar below) and use it whenever we have reason to believe the bottom may be foul. Our trip line, which we tie to the crown of the anchor, consists of 40 feet of ⅜-inch polypropylene line attached to a 4-inch-diameter red buoy. After the anchor has been deployed, we coil up any excess trip line and tie it off below the float to avoid having it foul someone's propeller.

- **Extra chain hooks.** If you have a windlass aboard, you need to be prepared to raise the anchor without it in case it fails. Most electric windlasses have a manual override worked with a winch handle that can be used to raise the anchor. These work well as long as the weight does not exceed 150 or 200 pounds. But if you are anchored in deep water with a heavy anchor, you may not be able to generate enough power to get the ground tackle up. In this case, or in the event of a failure of a manual windlass, the best solution is two long (20 to 25 feet) lines with chain hooks on them that can be led back to the halyard winches at either side of the mast. Using two lines with chain hooks allows you to secure one while quickly attaching the second to the chain and winching it up. We have retrieved our 110-pound anchor in 70 feet of water this way. Though painstaking, it worked, but we hope not to have to do it again.

add elasticity with a snubber, and set up the boat to minimize the peak loads on your ground tackle, you should never have to reset your anchor in the middle of the night. But skip even one step, and it may be a very long night.

In addition to good technique, practice good anchoring etiquette to minimize your impact on others in the anchorage. This is considered in detail in the Anchoring Etiquette section in Chapter 27.

Select Your Spot

When entering the anchorage, you need to decide on the general area where you will drop your anchor. To do that, evaluate the layout of the anchorage according to the following guidelines:

- **Wind protection.** Look for an area that is protected from existing and predicted wind directions. As you enter the anchorage, watch the wind patterns on the water and note where the wind lines stop and what areas remain glassy calm even when gusts come through. Select a spot in the calmest place that offers good protection from the widest number of wind directions.
- **Wave protection.** Wave protection matters more than wind protection. Although it is possible to anchor in 30- and 40-knot winds for days at a time without dragging, it is very difficult to remain anchored in 3- to 4-foot waves for more than a few hours. The pitching will put extreme shock loads on your ground tackle, and it will make life aboard unbearable. When you decide where to drop anchor, consider the fetch from all directions, particularly those of the prevailing and predicted winds. You are better off in a gale anchored 50 yards behind a reef that blocks the waves but not the wind than anchored a mile offshore in half the wind and twice the chop.
- **Escape route.** Seasoned voyagers head out to sea if conditions become dangerous. All but the most bulletproof anchorages can become untenable within a few hours of an unfavorable wind shift. As you consider your spot, plan how you would leave (at night, if necessary) if conditions deteriorate. The ideal spot will have easy access to the harbor entrance and open water.
- **Swinging room.** It takes a certain amount of practice to develop an eye for distance so that you can be sure you won't interfere with other boats after you've set the anchor. In a crowded anchorage, you'll need a gap about three boat lengths long and two wide. By dropping your anchor off the stern quarter of another boat and falling back into this gap, you should end up in a position where you won't interfere with anyone else. But don't be too concerned if you get it wrong. Lack of swinging room in a crowded anchorage is the most common reason for resetting an anchor.

Having selected the general area, you need to find the best bottom conditions within that area. Make a slow 360-degree turn through the place where you are thinking of ending up. Check the depth throughout the radius of swinging room and look for any coral or rocks in the area.

In tropical waters where you can see the bottom, you want a patch of sand large enough that the boat can swing in a complete circle without dragging the chain through coral. Having the chain grind through coral destroys the living reef and chafes and abrades the chain. We cruisers must anchor responsibly if we want to avoid having every anchorage filled with mooring buoys to protect the coral. We were able to find a coral-free spot where we could swing on one anchor just about everywhere around the world. In a few coral atolls, we had to set a second anchor to limit our swinging in order to avoid a few coral heads.

Outside the tropics, you will rarely have the luxury of seeing the bottom. The chart may include symbols for bottom type, which will give you some indication of the suitability for anchoring. Most cruising guides include information on the bottoms common to the area and note which anchorages have good holding and which may be problematic. But none of that will help you pick a specific spot within an anchorage. For the most part, you'll be dropping the anchor blind and resetting it if necessary.

Sufficient Scope

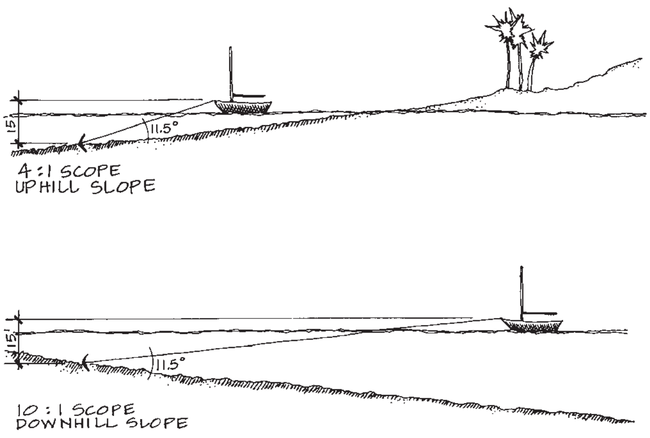
Before you drop the anchor, decide what scope you're likely to need based on available swinging room, the weather forecast, tide, fetch, and bottom conditions. First, calculate the distance from the bow roller of the boat to the bottom at the point where you plan to drop the anchor. That means adding together the water depth in the spot you have picked, any additional tidal range based on the current state of the tide, and the distance between your bow roller and the water. This gives you the initial distance for calculating total scope.

On all-chain rode, we use 4:1 scope in normal conditions. *Hawk*'s bow is 5 feet above the water. If we dropped the anchor in 12 feet of water at half tide with a total tidal range of 6 feet, the total distance from the bow to the bottom at high tide would be 12 + 3 + 5, or 20 feet. For 4:1 scope, we would need to let out 80 feet of chain.

In a crowded anchorage in settled weather, we will sometimes go as low as 3:1 scope. If we have more than ¼ mile of fetch, we'll let out additional scope and use a very long snubber—20 to 30 feet. In gale conditions, we let out as much scope as swinging room permits, trying to get at least 5:1. With an all-line rode, 7:1 scope should be considered the minimum in good conditions; 15:1 or more in a gale.

The angle of the bottom has a tremendous impact on how much scope will be necessary. It is much harder to drag an anchor uphill, far easier to drag it downhill. If you normally use 5:1 scope on a flat bottom, you would need a 10:1 scope to get the same angle of pull anchoring on a downhill slope pitched at 5.5 degrees (1 foot down for every 10 along, which is common in the Caribbean). If you were anchoring uphill, you would need only about 4:1 scope (Figure 6-7).

Figure 6-7.
The scope required to achieve the same angle of pull on different bottom slopes. (Lyanne Schuster illustrations)



Use the chart and your depth sounder or lead line to determine the steepness of the bottom. If you are on a moderate grade and pulling downhill, or if the wind might shift so that you could end up that way, put out a generous amount of extra rode—up to twice as much as normal is not excessive. But make sure you won't go aground if the wind shifts, the tide goes out, and the boat swings toward shore! Once you have determined how much scope you need, you can drop the anchor and set it.

Set Securely

Setting an anchor well is an art. It takes experience, but it also takes sensitivity to the boat's motion and the messages coming from your ground tackle. We use the following procedure.

When we approach an anchorage, we are both in the cockpit discussing where we want to anchor and how much scope we need based on the depths and bottom conditions shown on the chart, the best protection from wind and swell, and swinging room. We will often do a 360-degree turn through the most likely area. Once we are certain where we want to anchor, we agree on an initial amount of scope, and I go forward as we motor in slowly.

If necessary, I attach a trip line to the eye in the crown of the anchor and flake the line so it will run freely when I throw the float. I then put a wrap of the snubber around the base of the cleat (Figure 6-8) and cleat it off before leading the snubber through the bow pulpit. The wrap around the base of the cleat will keep the snubber from getting jammed in a blow. I hang the chain hook of the snubber on the lifeline to keep it out of the way, and then pull a foot or so of chain out on deck. I push the anchor over the bow roller until it is balanced on the chain and ready to run free when we reach our anchoring spot.

As we approach the spot we have picked, Evans puts the boat into neutral, turns up into the wind, and we coast into the area where we want to drop the anchor. If I can see the bottom, I will call or signal when we're over a good, sandy spot large enough to swing. If I cannot see the bottom, Evans will watch the depth sounder and select a spot that will give us adequate swinging room and sufficient water depth based on the bottom contours and tidal conditions.

When we reach the right place, Evans calls out the depth to me and puts the boat into dead slow astern. I release the anchor. Using the windlass or my hands, I control the

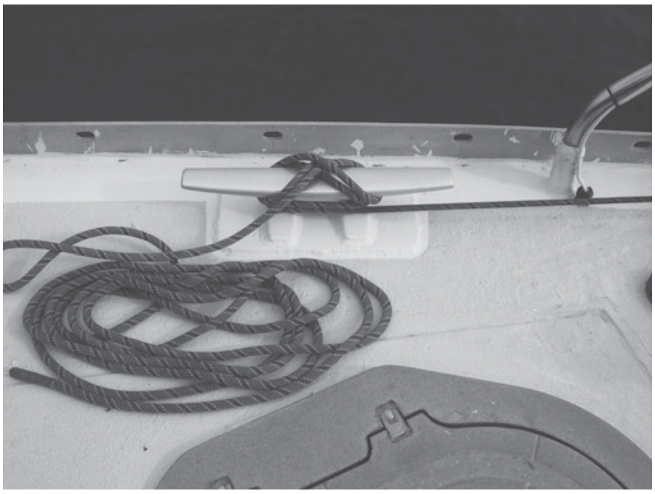


Figure 6-8.
When attaching a snubber or bridle to a cleat, put one wrap around the bottom of the cleat to prevent the line being pulled so tight in a gale that you cannot get it undone.

anchor's fall to the bottom. Though we're often still moving forward very slowly as I begin to lower the anchor, by the time the anchor reaches the bottom, we'll be stopped or moving in slow reverse. As we start to fall back, I throw the float and trip line out in front of the anchor.

The trick to getting the anchor to set is to use the boat's momentum to straighten the chain and help the anchor dig in without pulling the anchor out before it has had a chance to settle. Some people drop the anchor and chain in a heap, don't back down enough to straighten out the pile of chain, and then turn off the engine, believing the anchor is set. Other people back down so hard and fast that the anchor has no chance to set at all and hops and skips along the bottom.

To get the anchor to set well, Evans backs up at dead slow while I pay out the agreed amount of scope. Then I attach the snubber to the rode and release enough chain to bring the snubber taut and leave a loop of chain hanging from the bow. When the boat has taken up all the slack and comes up on the anchor, the bow will swing into the wind. I signal to Evans when the full force of the boat comes up on the ground tackle. At that point, the boat should no longer be moving backward.

We both take transits by lining up something close to us with something much farther away off the beam of the boat—a mast and the top of a hill, or a mooring buoy and a building ashore. If the object in the foreground does not move with respect to the object in the background, then we know the boat has come to a full stop. We leave the boat in dead slow astern for a minute or so to allow the anchor to fully settle. Then Evans gently increases reverse until we reach half throttle. If the boat still doesn't move, the anchor is set and can withstand winds of gale force.

Sometimes the anchor won't be set when we fall back on it, and we'll still be moving backward when we find our transits. In that case, Evans revs only a little, putting just a bit more force on the anchor. Usually that will set it, and he can then rev up to higher rpm. If we keep dragging, he'll try putting the boat in neutral, and we'll flake the mainsail and let the anchor settle. If after that the anchor is still not set, we'll pull it up and try again.

If either of us is dissatisfied with our position in relation to other boats or the prevailing wind and swell once the anchor is set, we reset the anchor immediately. If both of us are satisfied, Evans turns off the engine. In crowded tropical anchorages, especially where there are a lot of charter boats, Evans will sometimes dive to check how well our anchor is set—and our neighbors' anchors as well. It pays to be aware that someone near you may be coming your way if the wind shifts or increases.

If we have any concern about the holding, we take bearings on several prominent features ashore and check them every few hours. We sometimes set an anchor alarm on the GPS or use the radar to set up a Variable Range Marker and an Electronic Bearing Line so that we can check our position later. Note that these methods work only if the wind stays in the same quarter. If the wind shifts, and the boat swings through 180 degrees on 100 feet or more of rode, any of these methods will show that the boat has moved, even though it hasn't dragged.

Unlike some cruising couples, we do not have defined hand signals for anchoring. We agree on the essentials before I go forward to the bow. Anchoring is, for us, a calm and quiet procedure most of the time, with the boat moving at ½ knot or less. We've rarely been in a situation that would not allow us to meet calmly on the bow or stern and speak to one another if we needed clarification. On rare occasions, we've had to anchor in gale-force winds. In that situation, I turn to face Evans and call out the lengths of chain as they go over the bow roller—25 feet, 50 feet, 75 feet, and so on. That way, Evans knows when the anchor has reached the bottom and can use the engine to control how quickly we're being pushed backward.

Real-World Situations

Rather than discuss every possible anchoring situation, this section focuses on how we manage real situations with the ground tackle we have aboard. Eighty percent of the time, anchoring is straightforward. The other 20 percent of the time, only a few additional skills are required to keep the boat secure.

This chapter does not address how to sit out a hurricane aboard your boat. Though preparation is important, luck plays a much larger role in keeping the boat safe.

RAISING A FOULED ANCHOR

After spending an idyllic week anchored in a tropical paradise of coral reefs and sand beaches, it is time to leave. Everything is stowed, the dinghy is aboard, and you are ready to set sail. You start the engine and motor forward. Your partner goes to the bow and begins to bring in the chain. Suddenly, you hear an ugly crunch and the chain goes bar-tight against the bow roller. Your chain or your anchor is fouled on a coral boulder.

Immediately take the strain off the windlass. It is not designed to handle the shock loads that occur when chain is this tight. Snub off the chain on a bow cleat while you consider your options. If the direction of the chain shows the fouled area is still in front of the boat, put the snubber back on the chain and motor slowly forward until the angle of pull is back underneath the boat and the chain is once again tight. If the flukes of the anchor are caught under something, this should pull it out. If the chain is caught on coral, the fouled portion may pull free as the bow lifts and falls, letting you retrieve your anchor.

If not, most fouls can be freed by motoring in a small circle around the area. Dive and visually inspect the chain to see what the problem is. If it is caught on a coral head, note the direction of the wrap. Then motor the boat slowly around in the opposite direction.

If that fails, you may be able to clear the foul by hand. If you are in water less than 20 feet deep, you should be able to dive with just snorkel gear and clear the chain. If you're in a deeper anchorage (some anchorages in the Pacific are two to three times that depth), you'll need scuba gear. Some cruisers carry scuba equipment for just this situation.

If all else fails, you may have to abandon some of your ground tackle. Generally, though, all you will have to leave behind is a length of chain. If you have scuba gear, you will be able to tie a trip line to the anchor, unshackle the anchor from the chain, and pull the anchor up using the trip line. Then you may be able to get the chain back aboard. Otherwise, pull up as much chain on each side of the wrap as you can and cut it just above the water using a hacksaw or bolt cutters.

Preventing a fouled anchor is easier than retrieving one. We use a trip line (see the Beyond Anchors and Rodes sidebar above) whenever the bottom is foul or we have heard of problems in the anchorage. By pulling on the line, you can pull the anchor out, flukes first, and free it from most obstructions. If the chain is fouled, you can often free it once you have retrieved your anchor using the trip line.

Fouled anchors occur only rarely in coral waters as long as you select your spot carefully. Most of the times we've fouled an anchor have been in harbors with a lot of debris on the ocean floor. Some anchorages—for example English Harbour on Antigua—have mooring chains laid that were used by the British fleet to secure vessels in hurricanes. Many of the anchorages in British Columbia are littered with submerged logs, chains, and other debris from logging that can foul an anchor. We use our trip line in deep, coral-filled anchorages where we can not reach the anchor without scuba gear and in anchorages where local knowledge or a cruising guide warns of a foul bottom.

Even assuming your anchors hold, your boat could still get hit by one of the dozens of boats dragging around you. Like most cruisers, we have tried to avoid this situation altogether by leaving the tropics during the storm season, though we have not always been successful (see the Close Encounter with a Hurricane section in Chapter 15).

Normal Anchoring

Eighty percent of the time in the tropics and 50 percent of the time in higher latitudes, we have anchored on our primary anchor on a good bottom in 12 to 30 feet of water using an all-chain rode. On both boats, an oversized Bruce has served as our primary anchor. *Silk* had fine ends and could not carry much weight in her bow, so we stowed our 44-pound Bruce on the bow roller and kept 75 feet of ⅜-inch high-test chain in the anchor locker along with 250 feet of ⅝-inch three-strand nylon rode. On *Hawk*, we carry our 110-pound Bruce on the bow and 150 feet of ⅜-inch high-test chain in the anchor locker along with 250 feet of ⅝-inch three-strand nylon rode. On both boats, we kept a second section of chain in the bilge and attached it with a connecting link backed up by a Spectra loop to double the length of our chain rode when cruising areas with deep anchorages.

We found sand bottoms or sand over coral or rock throughout the Caribbean, in the Pacific atolls, and throughout the Indian Ocean islands. We found heavy mud and silt bottoms created by runoff from the surrounding land in parts of Fiji and New Caledonia and in river anchorages in Australia and New Zealand. Outside of the tropics, in areas such as Maine, British Columbia, Ireland, Scotland, Newfoundland, and Nova Scotia, we have found mixed rock, mud, or gravel bottoms, often with seaweed or kelp.

In all these conditions, we anchored on the Bruce and an all-chain rode with 4:1 scope in normal weather and additional scope as necessary in other conditions. We used at least 10 feet of line rode or snubber in normal conditions, and up to 30 feet in high winds or heavy chop.

In parts of French Polynesia, many of the anchorages are 50 feet or more deep, with coral heads that rise from the bottom to within a few feet of the surface. When we were there aboard *Silk*, we added our second length of chain to our primary rode, which gave us 150 feet of chain. We looked for shallow anchorages and were able to anchor with 4:1 scope on all-chain throughout French Polynesia, though not always in the most convenient place with respect to towns and villages. This was the only time during our circumnavigation on *Silk* when we would have preferred some additional chain. On *Hawk*, we have added a second length of chain for a total of 300 feet in areas with deep anchorages where we have to tie to the shore such as Chile, the South Island of New Zealand, and British Columbia. This gives us 300 feet of chain in the anchor locker, and that has always been more than enough.

Two-Anchor Solutions

Some cruisers recommend setting two anchors as a general rule. We have found that we are almost always better off with one well-set anchor. The wind and tide rarely hold the boat in one position all night, so setting two anchors means untangling two rodes in the morning. The entwined rodes can shorten the effective scope to the point where you start to drag, or one rode can trip the other anchor. One well-set anchor is less complicated and more effective in normal conditions.

There are, however, two situations where we have found two anchors to be better than one. Once in a while in the tropics, a swell working its way into an anchorage will make conditions rolly and uncomfortable. The swell may be reflected around a point that offers good wind protection, or it may result from a surge passing over a reef at high tide. Holding the boat's bow or stern into the oncoming swell greatly reduces rolling. In this situation, we set our primary anchor off the bow and our kedge anchor off the stern.

Similarly, if swinging room is minimal, a second anchor can help keep your boat out of the way of others. In this situation, many cruisers set a second anchor off the bow at 45 degrees to the first, but this only decreases the size of the circle the boat moves through. If conditions allow, we prefer to set a stern anchor. This limits our motion much more effectively and prevents rodes getting tangled or anchors getting tripped. But our solution necessarily depends on what others are doing and on how much room we have.

Tandem Anchoring

Some situations demand extra holding power, more than can be supplied by the primary anchor. This can be the case in some crowded Mediterranean anchorages, where it's not possible to put out adequate scope for the conditions. It can also be the case on a bottom with poor holding or in very high winds. In these situations, setting two anchors in tandem on the same rode provides additional holding power and will often keep the primary anchor from dragging.

The few times we have needed extra holding power on *Hawk*, we have used our primary anchor, the 110-pound Bruce, in tandem with our 40-pound Danforth. We put the Danforth in the port bow roller and hold it in place using a nylon line tied off to the port cleat. We then shackle one end of a 12- to 15-foot length of chain to the eye in the crown of the Bruce and the other end to the shank of the Danforth. We tie a retrieval line through the eye on the shank of the Danforth. We use a line about 10 feet longer than the chain between the two anchors and tie the end of it to the eye on the shank of the Bruce. If regularly anchoring with tandem anchors, a dedicated retrieval line of polypropylene with snap shackles spliced into both ends facilitates this operation.

After connecting the two anchors with both the line and chain as shown in Figure 6-9, we remove the line holding the Danforth in the port bow roller and lower it using the retrieval line until it is dangling by the chain below the Bruce. Then we use the windlass to drop both anchors over the bow, backing up slowly as we go so that the Bruce does not land on top of the Danforth. We let out as much scope as we can, and then back down and set the Bruce. If the Bruce starts to drag, it will set the Danforth, and the pull of the Danforth will stop the Bruce from dragging (Figure 6-10).

To retrieve the anchors, we pull up the Bruce as we normally would. When the shaft reaches the starboard bow roller, we reach over the port bow roller and grab the retrieval line, pulling it over the port roller and onto the rope gypsy. We use the windlass to pull the Danforth into the other bow roller, where we use the retrieval line to secure it to the port cleat. When we're finished, the chain will be dangling in front of the boat between the two anchors. We unshackle it from the shank of the Bruce and stow it with the Danforth.

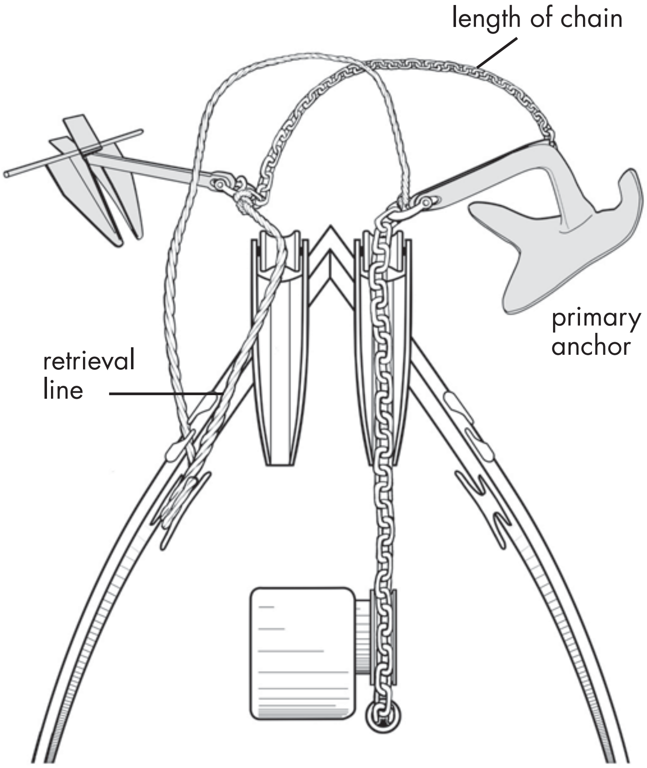


Figure 6-9.

Deploying tandem anchors. The "first down" anchor is lowered from the port bow roller using the retrieval line after being connected to the primary anchor by a length of chain. (Fritz Seegers illustration)

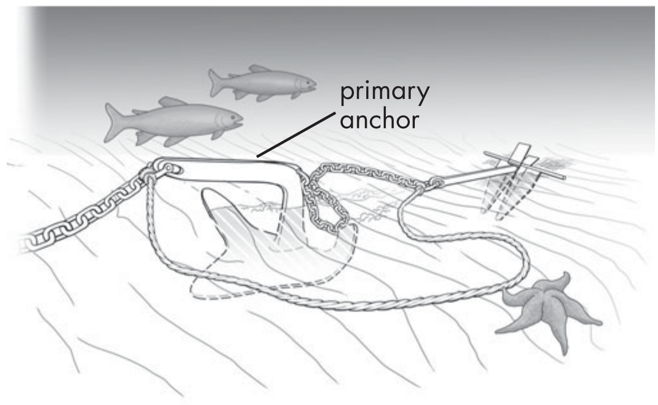


Figure 6-10.

The tandem anchor solution. If the primary anchor drags, it will set the anchor in front of it, which will stop the dragging. (Fritz Seegers illustration)

The key to tandem anchoring is making sure the two anchors don't get tangled or land on top of one another. A windlass that can lower the anchor as well as raise it will give you much more control over the anchors as they drop, while helping to manage the weight. Tandem anchors are a common solution in Chile where high winds and rocky, kelp-covered bottoms cause anchors that have worked successfully everyplace else to drag.

Med Moor/Stern Line Ashore

There are several places in the world where the preferred method of securing the boat involves dropping an anchor over the bow and tying a line ashore from the stern. This is a common practice in the Mediterranean, where it is known as *Med mooring*, and where boats end up stern-to a public wharf or marina quay. In a few tropical areas, such as Papeete in Tahiti, a line of 50 or 60 boats will be anchored just offshore with stern lines to palm trees. To avoid the fierce winds known as *williwaws* or *rachas* in Chile, boats are pulled in as close to shore as possible and secured to trees with from one to four lines.

In theory, the method used in all these situations is the same. One person works the engine controls and one handles the anchor. The boat is backed slowly toward the place where the stern line will be tied. The person on the bow starts dropping the anchor two to three boat lengths ahead of where the boat is to end up. Once the anchor hits the bottom, the direction of the boat can be controlled by letting out more chain with the engine in dead slow astern. A line is then thrown to someone ashore or taken ashore in a dinghy.

Crews proficient at Med mooring can bring the stern of the boat to within stepping distance of the wharf. But most of us throw a stern line to someone ashore when the boat is still 10 to 15 feet away. Once the line has been secured, the person at the helm leads it to a primary winch and winches the boat into the wharf.

When tying to a tree ashore, one of the two crewmembers will need to take a line ashore in the dinghy. In settled conditions, the boat can be backed in until it is several boat lengths from shore and then left in dead slow astern, pulling against the anchor. One crewmember can take a line in the dinghy while the other feeds out the line and makes sure the boat stays in position. The best line for this purpose is polypropylene because it is light, it doesn't absorb water, and it floats. That means that it's easy to pull even a long length of it if rowing a dinghy, and there's less chance of getting it caught in either the boat or dinghy propeller. Once ashore, take a round turn around the tree to limit chafe, and secure the line with a bowline. The person on board can then use a primary winch to pull the boat closer to shore.

If it's blowing hard, particularly if it's blowing on the beam or gusting from various directions, theory goes out the window in a big hurry. To avoid crashing into other boats while trying to Med moor or swinging into shore while trying to back into a small cove, we drop the anchor several boat lengths from where we want to end up and put out just enough scope to keep the anchor from dragging. Then one of us takes a light, long polypropylene line ashore in the dinghy—we have a ¼-inch line over

600 feet long that's stowed in a mesh bag for this purpose. We then put that line on a winch and pull the boat back into place, letting out more anchor rode as necessary. While not as elegant as backing up to within 2 feet of the dock and stepping off with your stern line, this solution has saved us a great deal of stress and tension over the years.

Once tied stern-to, life can get uncomfortable if the wind comes on the beam. When we were tied like this in Papeete, a line of fronts came through. Over a period of three days, we experienced 30- and 40-knot winds, at times directly on the beam. A second anchor oriented at 45 degrees to the primary anchor on the windward side of the boat helps hold the boat in place in these conditions with no risk of tangling the rodes. We also learned to leave fenders on the windward side of the boat in case our neighbor ended up snuggled against us.

MOORING AND BERTHING BASICS

Coastal cruisers have usually had plenty of experience docking at fuel docks, pulling into marina berths, and picking up mooring buoys. Offshore voyagers don't do these things very often, so these skills are much less critical to daily life than the ability to anchor well. Still, the boat needs to be set up with the appropriate equipment for tying up in a marina, rafting to other boats tied to a quay, and picking up a mooring. And the crew needs to be prepared to deal with a few special situations they probably won't have encountered while coastal cruising.

Lines, Fenders, and More

Most coastal cruisers spend enough time in marinas to have good docklines. However, these docklines tend to be too short—and sometimes too small—for the uses to which they will be put when voyaging.

For tying up in a marina, you will need a minimum of four docklines. Two of these should be two-thirds the boat's length; the other two should be between 50 and 60 feet long, 50 feet being about the farthest most people can throw with any accuracy. These longer lines can be used as doubled spring lines when docked. The shorter lines will serve as bow and stern lines but are long enough to pull the boat in to a dock sideways if it's being blown off. When entering a strange marina, it can be helpful to have bow and stern lines on each side of the boat and one spring set up on either side. This gives you more options if you didn't understand the French for "port side to" or "Slip 21 on A Dock." But that means carrying two additional 30- to 40-foot docklines, for a total of six lines in all.

Docklines need to have a good amount of stretch in them to protect the boat's hardware in chop or strong winds, and they need to be sized for shock loads. For every 9 feet of boat length, add a minimum of ⅛ inch of line diameter. Thus, a 45-foot boat should have lines of at least ⅝-inch diameter. Double-braid nylon and three-strand nylon both work well for docklines. In Europe, a braided, eight-plait nylon rope called *multi-plait* is often used. This is stronger than three-strand and more chafe resistant than double-braid; it would have been our choice for docklines if it had been available in the United States.

In addition to the primary docklines, you will need two other docklines a minimum of 60 feet long for use when rafted three or four boats out from a quay, trawler dock, or breakwater. In this situation, which is common in some of the older European harbors, etiquette and seamanship require you to take a bow and stern line ashore to keep most of your boat's weight off the raft. To prevent chafe, we secure these lines to a shackle passed through the swaged loops at the ends of a 3-foot length of 1 × 19 stainless wire rope (Figure 6-11) or to the ends of a short length of chain. We use a mooring pendant of this type whenever we think a shore line might get chafed, such as when securing it around a boulder, to a metal support, or to a wooden beam.

All our docklines are fitted with either plastic hose or fire hose to prevent chafe (Figure 6-12). Hose is inexpensive, lasts for years, and, if sized correctly, doesn't slide out of position like canvas or rubber chafe protectors do. We prefer fire hose because it can be coiled with the line. Fire hose can be obtained from chandleries that serve fishing boats or from your local fire department (with the promise of a postcard or two!). If fire hose is unavailable, heavy-duty plastic water hose also works. It should have a slightly larger internal diameter than the dockline. Cut it to a length that won't interfere too much with coiling the docklines—about 2 feet works well for us.

For rafting up five boats off a wall, docking against a fishing pier for diesel, or tying to a freighter wharf to check into customs, you will need good fenders to protect your topsides. The dainty little marina fenders most coastal boats carry won't be adequate for the job. You'll want to carry at least six fenders of various sizes, including two round fenders 18 inches or more in diameter. For high-latitude cruising, round fenders should be 24 inches or more in diameter. We have used fender boards on occasion, particularly in tidal areas when tying up to trawler wharfs where the pilings were separated by 5 or 6 feet, but we don't carry one regularly. On a tropical circumnavigation, a fender board might get used a couple of times.

For mooring to a buoy, you will need a dedicated mooring line and a good, solid boathook—or better yet, two.

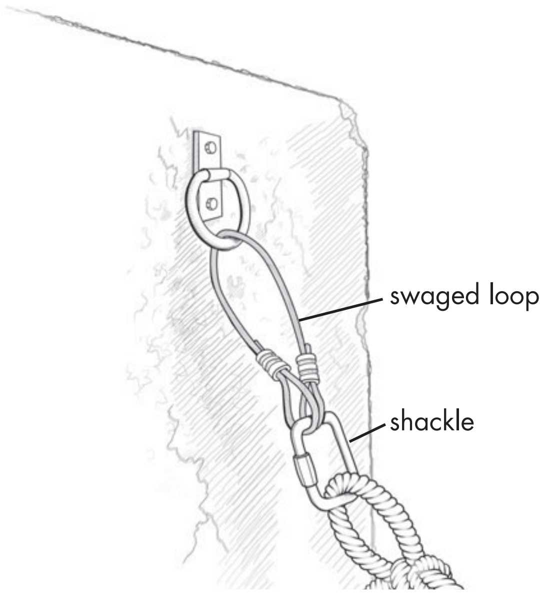


Figure 6-11.
Our mooring pendant protects mooring lines from chafe. (Fritz Seegers illustration)

Buy a sturdy boathook that can be extended to at least 6 feet in length. Designate one of your less attractive docklines as a mooring line. Use this line to keep the muddy, seaweed-covered tether attached to the mooring buoy off your boat. When mooring to a buoy, attach your line to a bow cleat, pass it over a bow roller, thread it through the eye on the mooring line, bring it back over the second bow roller, and attach it to the other bow cleat. This creates an easy-to-release bridle that will keep your boat head to wind.

If you plan to transit the Panama Canal, be aware that you will also need four 125-foot docklines of a diameter appropriate for your boat size. These lines should not be spliced or tied together. If your lines are not adequate, the pilot can refuse to allow you to transit. You can rent lines, but you may not be happy with what's available. Most cruisers manage to come up with four lines long enough using line anchor rodes or warps meant for tying ashore or towing a drogue.

Figure 6-12.
All our docklines are fitted with either fire hose or plastic water hose to prevent chafe.

Real-World Situations

Most cruisers berth in a marina slip once or twice in a cruising season. Even if you've had lots of practice berthing your boat while coastal cruising, the situation tends to be more nerve-racking when you haven't done it for six months, you're on a larger boat, and you don't know the marina. Besides marina docking, you will probably encounter a couple of other new berthing and docking situations. In Europe, you may raft up to other boats tied to a breakwall or quay. At some point, you will have to deal with getting on and off a dock in a strong beam wind.

Once berthed, there are some accepted conventions and etiquette that everyone tries to follow. These keep conflicts to a minimum and maintain harmony among neighbors, and they are just as important as the "how to" of getting berthed in the first place. These are considered in the Marina Etiquette section in Chapter 27.

Marina Docking

Marina docking is pretty much the same the world over. The only real difference is that you'll be arriving at a strange marina in a strange country with little idea of the layout and, in some cases, no certainty of communicating with anyone ashore in English. Before entering the marina, ask the marina manager where the slip is located, which side of the boat will be against the dock, how long the pontoon is, whether you'll need to get a line around a piling at the end of the slip, and whether anyone will be there to assist you. Set up lines and fenders before getting inside the marina breakwall; lines should be cleated near one end so the full length of line can be thrown if necessary.

When approaching the dock, the crew should agree on the first line that needs to be secured and in what order the remaining lines should follow, given the wind conditions. While one crewmember stays at the helm, the other should toss the first line to the person on the dock with clear instructions as to what line it's meant to be: "That's an aft spring. Take it to the cleat at the end of the pontoon." If there's another person on the dock, the crew should get another line to that person with instructions as to where it should go. Otherwise, the crewmember should get off the boat with the next line as quickly as possible. The person assisting on the dock should put one wrap around the indicated cleat but put no tension on the line until told to do so or until it looks as if the boat has reached the head of the slip. Then the line should be snubbed down, stopping the boat, and the helpers should fend off the boat if necessary. If there's no more drama, the people assisting should feel free to cleat off their lines and go about their business.

If there is no one on the dock to help, the helmsperson should stay at the helm and the second crewmember should step off the boat with a spring line as soon as possible. If the wind is pushing the boat into the slip, the spring line should be secured to the aft-most cleat on the pontoon. By powering gently against the spring, the boat can be brought to a stop against the pontoon. If the wind is coming from forward, the spring line should be secured as far forward as possible on the pontoon, and the helmsperson should use slow reverse to hold the boat against the dock. Depending on the boat's prop walk and whether an aft or forward spring is used, the bow or stern may tend to swing away from the dock and will need to be secured as soon as the spring has been cleated.

Once in the slip, the boat should be secured by at least four lines, including forward and aft springs, with enough fenders to be sure the boat can't damage the pontoon or itself. All the extra line should be brought on board the boat, leaving none on the dock. That allows the lines to be adjusted from the boat while keeping the dock and pontoon free of obstacles.

Rafting against a Breakwall

In many places around the world, it is quite common to raft up to other boats along a breakwall or a fishing wharf. Living cheek by jowl with your neighbors for an extended period of time requires a good deal of patience and courtesy. That starts when you enter the harbor and decide where to raft up.

The boat coming alongside is obligated to provide both fenders and lines. In most marinas the boat on the outside of the raft is obligated to keep the open side of the boat free of anything that might keep someone from coming alongside, including fenders over the side or lines on the cleats. As you approach the boat you want to tie up to, ask permission if the owners are aboard. This should never be refused, and the owners should offer to assist you. If no one is aboard, go ahead and tie up.

As part of getting settled, use plenty of fenders between the two boats to protect the topsides and make sure the spreaders are staggered so as not to cause damage if the boats are rolled by a wake. Pull all the extra line back onto your own boat, leaving only the bitter end on your neighbor's cleats. Always take your own lines ashore from the bow and stern. These should be tight enough to take most of your boat's weight so you're not hanging on the raft. Again, bring any extra line aboard your boat rather than leaving it on the wharf, and leave the outside of your boat free of fenders to allow the next boat to come alongside.

Getting Off a Dock against a Beam Wind

A handful of times we have had to lie against a wharf with a bad surge or strong winds on the beam. These were our scariest and potentially most dangerous anchoring and mooring situations. In a surprising number of places we have been, fuel docks are constructed beam-to the prevailing winds. In other places, we have been caught on a trawler wharf when the wind changed with an approaching front. Larger yachts can often use a large dinghy with a powerful outboard as a tugboat to push the bow through the wind, but we have never had a powerful enough outboard for this approach. We have had to learn other techniques for getting out of this situation (see the Pinned on a Fuel Dock section in Chapter 15).

To get on and off again safely, you need to know how your prop walks in reverse. Most props are right-handed and will therefore pull the stern of the boat to port in reverse. If the wind is light, we simply go in starboard side to. Then, when it's time to leave, we reverse against the forward spring. Our prop walk will pull the stern off the dock. When we are lying at about a 20-degree angle to the dock, we slip the spring line and back away, fending off from the bow if necessary until we are clear.

If the wind is strong (25 knots or more), springing will not bring the stern up into the wind enough to allow us to back off before we blow back down on the dock—as we have discovered on three occasions when we came close to seriously damaging the boat. In that case, we drop an anchor off the bow several boat lengths upwind from the dock and let the rode run as we tie up. When we want to leave, we simply winch the bow out into the wind. Once the anchor is up, we can turn through the wind using the motor.

If there's no wind, and we get on the dock only to find a large surge slamming us into the wharf, we row out a kedge anchor or tie a line to a piling off our beam and winch ourselves a few yards off the pier. We use the same technique if the wind comes up while we're fueling.

GROUND TACKLE AND MOORING EQUIPMENT FOR THREE OFFSHORE VOYAGERS

As with their sail inventories, *Simplicity*, *Moderation*, and *Highlife* all came with a set of anchors, rodes, and mooring lines, and these reflected their usage in their previous lives. Each couple made some modifications to the existing anchor inventory and mooring equipment. Their choices reflected their budgets and their previous experience with various anchors.

TABLE 6-5. ORIGINAL ANCHORING AND MOORING EQUIPMENT ON THREE OFFSHORE VOYAGERS			
	Simplicity **(30-year-old, 33-foot cutter)**	***Moderation*** **(13-year-old, 40-foot catamaran)**	***Highlife*** **(8-year-old, 52-foot ketch)**
Primary anchor/rode	• 20 lb. Danforth stowed in bilge • 150 ft. of 1/2 in. three-strand nylon line	• 35 lb. CQR on bow roller • 20 ft. of 3/8 in. BBB chain and 150 ft. of 5/8 in. three-strand nylon line in anchor locker	• 75 lb. CQR on bow roller • 300 ft. of 1/2 in. high-test chain in anchor locker
Secondary anchor/rode		• 25 lb. Danforth • 150 ft. of 5/8 in. three-strand nylon line stowed in cockpit locker	• 66 lb. Bruce stowed on bow • 150 ft. of 1/2 in. high-test chain and 250 ft. of 7/8 in. three-strand nylon in anchor locker
Kedge anchor/rode			• 32 lb. Fortress in bilge • 25 ft. of 1/2 in. high-test chain and 200 ft. of 7/8 in. three-strand nylon in cockpit locker
Additional anchors			
Windlass		• Electric windlass	• Oversized electric windlass
Docklines	• Four 20 ft., 1/2 in. docklines	• Six worn 30–40 ft. docklines	• Eight 30–60 ft., 1 in. docklines
Other	• Three small fenders	• Four small fenders	• 30 ft., 3/4 in. snubber with chain hook • Six large and two extra-large fenders

Simplicity had been sailed coastally, kept in a marina, and raced frequently. She had hardly ever spent a night at anchor. Her anchor inventory, as shown in Table 6-5, consisted of one 20-pound Danforth anchor and a line rode, and she was not fitted with a windlass when Susan and Simon bought her. She had a well-designed chain locker located in the bow, but her ends were very fine, and she would not be able to carry much weight there. Her docklines were worn and showed considerable chafe. She came with three small fenders, which when reinflated and cleaned up looked serviceable.

Susan and Simon wanted a bulletproof primary anchor, but they needed to limit how much weight *Simplicity* carried on her bow. They considered an aluminum anchor but found it would cost twice as much as steel. At a sailing swap meet, they found a used 35-pound Delta anchor, meant for boats 35 to 52 feet long, for $150. The Delta could easily be stowed in their cockpit locker on passage, unlike the hinged CQR or the oddly shaped Bruce. They purchased 75 feet of new 5⁄16-inch BBB chain rated for moderate-displacement boats up to 45 feet. This was stowed in the chain locker along with 200 feet of ½-inch three-strand nylon.

They debated adding a windlass, but the boat was under 35 feet, they were under 35 years of age, their anchor weighed only 35 pounds, and their refit budget was down to 35 percent with a great deal still to be done. On average they would be hauling up about 50 pounds of anchor and chain. They decided the exercise would do them good. With the anchor on the bow roller, *Simplicity* now carried about 120 pounds in her bow, which affected her performance only when going to windward in large waves. To reduce that weight on passage, they built special chocks in their cockpit locker for stowing the Delta.

The Danforth and its rode, with the addition of a 12-foot length of chain, became their kedge and secondary anchor and also served as a second anchor for tandem anchoring. It would have served well enough as a primary anchor for a short period of time if they had lost their main anchor. They stowed an additional 75-foot section of chain in the bilge to extend the primary rode or to replace it if it were lost. The nylon rode for the Danforth would serve as a stern line if the need arose.

They managed to scavenge some docklines and two 12-inch-diameter ball fenders someone else was throwing away. They deflated the fenders and stowed them in the bilge. They bought a chain hook and made a snubber. The Danforth rode, stowed in the cockpit locker, was set up to be deployed easily for use as a stern rode or as a shore line. Their new ground tackle and mooring equipment cost them just over $900 and 5 hours of time marking the rodes and organizing the chain locker.

Moderation had been cruised coastally and had spent some time at anchor, so, as shown in Table 6-5, she was

TABLE 6-6. FINAL ANCHORING AND MOORING EQUIPMENT ON THREE OFFSHORE VOYAGERS

	Simplicity **(30-year-old, 33-foot cutter)**	***Moderation*** **(13-year-old, 40-foot catamaran)**	***Highlife*** **(8-year-old, 52-foot ketch)**
Primary anchor/rode	• **35 lb. Delta on bow roller**[1] • **75 ft. of 5/16 in. BBB chain and 200 ft. of 1/2 in. three-strand nylon in chain locker**	• **66 lb. steel Spade stowed on bow roller** • **75 ft. of 3/8 in. high-test chain and 200 ft. of 3/4 in. three-strand nylon line in anchor locker**	• 75 lb. CQR stowed on bow roller • 300 ft. of 1/2 in. high-test chain in anchor locker
Secondary anchor/rode	• 20 lb. Danforth stowed in cockpit locker • **12 ft. of 5/16 in. BBB chain** and 150 ft. of 1/2 in. three-strand nylon line stowed in cockpit locker • **Additional 75 ft. of 5/16 in. BBB chain stowed in bilge**	• **55 lb. Delta stowed in cockpit locker** • **75 ft. of 3/8 in. high-test chain stowed in bilge**	• 66 lb. Bruce stowed on bow • 150 ft. of 1/2 in. high-test chain and 250 ft. of 7/8 in. three-strand nylon line in anchor locker
Kedge anchor/rode		• 25 lb. Danforth stowed in cockpit locker • 20 ft. of 3/8 in. BBB chain and 150 ft. of 5/8 in. three-strand nylon line stowed in cockpit locker	• **40 lb. Danforth-type stowed in stern locker** • 25 ft. of 1/2 in. high-test chain and 200 ft. of 7/8 in. three-strand nylon line in stern locker
Additional anchors		• 35 lb. CQR	• 32 lb. Fortress in bilge
Windlass		• Electric windlass	• Oversized electric windlass
Docklines	• **Six 20–40 ft., 1/2 in. docklines**	• **Eight 30–60 ft. docklines**	• Eight 30–60 ft., 1 in. docklines
Other	• **20 ft., 1/2 in. three-strand nylon snubber with chain hook** • Three small and **two large fenders**	• **30 ft., 5/8 in. three-strand nylon bridle with chain grabber** • Four small and **two large fenders**	• 30 ft., 3/4 in. three-strand nylon snubber with chain hook • **50 ft., 7/8 in. double-braid nylon storm snubber with chain grabber** • Six large and two extra-large fenders • **Two 300 ft. shore lines stowed in mesh bags in sail locker**

[1]New additions in **bold**.

better equipped than *Simplicity*. Still, her equipment was not up to offshore standards. Her 35-pound CQR was designed for boats up to 45 feet long and so was at its limit for *Moderation*. The short length of chain was also undersized for the boat. The high-quality electric windlass had been original equipment on the boat. Like many cats, she had a small anchor locker set behind the trampolines. Her docklines were worn, and her fenders were undersized for anything but civilized marina berthing.

The Moderations were concerned about minimizing the weight of the ground tackle without compromising safety. They discussed aluminum anchors, but price and durability issues put them off. They decided to buy a heavy primary anchor and minimize the weight of the rode. As shown in Table 6-6, they chose a 66-pound Spade as their primary anchor. For a rode, they purchased 75 feet of ⅜-inch high-test chain and 200 feet of ¾-inch three-strand nylon line. The anchor and rode were both rated for boats up to 65 feet long. All this was stowed in the anchor locker.

They kept the 35-pound CQR as an additional anchor, but they weren't satisfied with that as a secondary anchor. They bought a 55-pound Delta and stowed it in a cockpit locker in specially designed chocks. They carried a second 75-foot length of chain in their bilge for use as a secondary rode or for extending their primary rode. They had the windlass serviced and found that it still had lots of life left in it. Although it was a bit underpowered for the anchor they now carried, they decided they would use it until it failed. They ended up with a bit less than 200 pounds of weight on the bow including the windlass, which didn't seem to adversely affect the boat's performance.

The Danforth became their kedge and stern anchor. Its nylon rode was worn and chafed, so they discarded it. They added the 20-foot length of chain from the old primary rode to the secondary nylon rode and stowed anchor and rode in the cockpit locker. The rode was set up to easily serve as a stern line for tying ashore. A bridle, new docklines, and two large ball fenders completed their anchoring and mooring inventory. The Moderations spent just over $2,000 on these improvements and invested about 5 hours in marking rodes and stowing the ground tackle.

Highlife had been set up for offshore cruising and was well equipped with ground tackle and mooring equipment (see Table 6-5). She carried a 75-pound CQR and a 66-pound Bruce on the bow. In the anchor locker she stowed 300 feet of ½-inch high-test chain for her primary rode and 150 feet of the same chain attached to 250 feet of ⅞-inch three-strand nylon for her secondary rode. She came equipped with a beefy electric windlass with rope and chain gypsies. They considered stowing the Bruce in the cockpit locker, but realized it was too heavy to move around easily if they ever needed to deploy it. Therefore, they decided to leave it on the bow. That put over 1,200 pounds of weight in her bow, but her larger size and heavier displacement made her capable of carrying this weight, though windward performance suffered slightly. The boat was also equipped with two snubbers, good docklines, large fenders, and dedicated shore lines.

Hugh and Hilary were for the most part satisfied with the anchoring and mooring arrangements aboard *Highlife*. They found the Fortress cumbersome to assemble and awkward to deploy as a kedge anchor, so they added a 40-pound Danforth from their J/120 and stowed it in the stern locker. They had the windlass serviced, had all the chain and the CQR regalvanized, and replaced two of the docklines. They also added a storm snubber and two stern lines in mesh bags (see Table 6-6). The Highlifes spent about $300 on these improvements.

In the end, all three boats ended up with anchor inventories and anchoring and mooring equipment suitable for a tropical voyage, given their size and displacement and their ability to carry additional weight. While each crew might have chosen a slightly different arrangement if they had been fitting out the boat from scratch, their primary anchors have served them well through several years of voyaging.

CHAPTER 7
On-Deck Essentials: Dinghies, Self-Steering, and Safety Gear

HAVING BROUGHT THE boat up to standard structurally and equipped it with ground tackle and sails, you've now got a vessel capable of handling just about anything that may come its way. The crew may not find life aboard entirely safe or enjoyable without a few more essentials, however. That includes some type of tender so the crew can get ashore when the boat arrives in paradise, some sort of self-steering equipment so the crew is not too exhausted to go ashore when they get there, and some basic safety equipment so the crew and the boat arrive in one piece. All these involve choices and trade-offs, but none more so than safety equipment, which today includes a bewildering array of gear ranging from tethers and fire extinguishers to life rafts and cardiac defibrillators.

A dinghy for transportation to shore and a self-steering system that reliably steers the boat are essential. You will depend on your dinghy every day you are at anchor, and you will depend on your self-steering every day you are at sea. As with ground tackle and sails, this is equipment you cannot do without, but you will have to make some difficult choices. You will need to decide among a half-dozen different types of dinghies and between electric or wind-driven self-steering. Whatever you choose, buy the best quality you can afford. You are better off spending money on a rugged dinghy or a good self-steering system than on a refrigerator, watermaker, or generator.

Safety equipment gets even more complicated. If you were to buy everything labeled as safety equipment in the various marine chandlers' catalogs, you would spend tens of thousands of dollars. And yet it's in the very nature of this equipment that if all goes well, it will never be used. This chapter focuses on equipment used or stowed on deck that addresses three hazards specific to offshore sailing: collisions with other vessels, crew overboard, and abandoning ship. Other types of safety equipment are considered in appropriate chapters.

DINGHIES AND OUTBOARDS

The dinghy will be your packhorse or, if you prefer, your SUV. It must be able to carry your entire crew plus 100 pounds of groceries, water, or spare parts. It must be durable enough to land on beaches of sand, coral, or gravel; portable enough that one person can haul it up the beach and out of the tide's reach; stable enough to be managed in surf; and dry enough so its contents won't get wet. It must be capable of traveling through a 2-foot chop, against a 2-knot current, and into a 20-knot wind without swamping. It must stow compactly and securely, either on deck or below. Your dinghy must be deployable in minutes to kedge out an anchor if you go aground.

It should come as no surprise that the perfect dinghy has yet to be invented. Like any boat, every dinghy represents a set of compromises, and no single type suits every cruiser. The dinghy dock in any major offshore port is proof enough: you will see dainty fiberglass sailing dinghies, Avon and Zodiac inflatables, homemade wooden rowing skiffs, beefy Boston Whalers, rigid inflatable boats, and plastic kayaks. This is one of the most difficult gear decisions you will make, and you will live with your choice every day you are in port.

Choosing a Dinghy

Your budget and the amount of room you have to stow a dinghy at sea will be major constraints in working your way through the huge range of available tenders, but crew on even the smallest boat with the most limited budget will find a number of options from which to choose. In seeking the dinghy/outboard combination that will best suit your needs, ask yourself how you want to get around once you get somewhere. You can choose from the equivalent of going for a walk, riding a bicycle, or driving a car.

Dinghy Options

A hard dinghy without an outboard gives you a range similar to what walking gives you ashore. You won't want to row more than ½ mile or so regularly, especially carrying a full load of provisions or several people. You also won't be able to make much headway against gale-force winds, steep chop, or strong currents. You'll choose to anchor as close to shore as possible most of the time, and rather than traveling by water you'll go ashore and travel by land. Like walking, this can be an inexpensive option. We know people who have made their own 8-foot hard dinghies out of plywood and epoxy for less than $250. On the other hand, a brand-name 10-foot fiberglass sailing dinghy with spars and sails can cost $2,500 or more.

Putting a 3- to 5-horsepower (hp) outboard on a hard dinghy or on one of the many types of inflatables gives you a range similar to a bicycle. You will be able to get to shore and back with less effort, and you'll also be willing to explore a large lagoon or go up a river for 2 or 3 miles. Like the bicycle, if the equipment fails, you can push it home again. If the motor breaks down, you will rarely be too far from the boat to row back. With the motor, you'll be able to make headway into stronger winds, waves, and currents than when rowing a hard dinghy, but you won't want to go on long expeditions or deal with serious weather. You can buy a budget hard dinghy or inflatable and a small outboard for around $2,000. A high-quality hard dinghy or inflatable with a 3 to 5 hp outboard will cost more, on the order of $2,500 to $3,000.

An inflatable dinghy with a rigid bottom and a 15 hp outboard capable of planing gives you similar mobility to a car ashore. You can use it as your primary transportation for getting around harbors, exploring lagoons, heading miles up rivers, and running to town 5 miles away to pick up bread and milk. Instead of going ashore and walking to the next bay to go to the Internet café, you can hop in the dinghy and ride all the way there. These dinghies can handle almost anything in a sheltered harbor in the way of winds, waves, or currents, and they can manage the open sea in settled conditions. But, like a car, if the motor breaks down, you won't have much luck moving it very far. Most inflatables capable of planing are heavy and difficult to row, and impossible to row for any real distance in wind or chop. Also like a car, this is the expensive alternative. A rigid inflatable boat (RIB, which cruisers pronounce "rib") with a 15 hp outboard will cost somewhere between $4,000 and $7,000.

This overview will help you keep your bearings as you work through the comparisons of tender types that follow. The world of tenders can first be divided into inflatable dinghies that depend upon inflated air chambers for flotation and stability versus hard or rigid dinghies that do not, and both categories can be further divided into distinctive types.

We have seen hard dinghies of just about every conceivable shape, size, and material tied to the sterns of cruising boats. But most come down to variations on one of two themes: flat-bottom, scaled-down Boston Whaler–type designs or classic hulls with fine bows and flared topsides meant for sailing as well as rowing. To facilitate stowage, "nesting" versions of both types exist. These can be broken down into two or more pieces, which can then be stowed one inside the other. Hard dinghies vary greatly in price. A homemade fiberglass or plywood dinghy can cost as little as $250; a flat-bottom rowing dinghy made of polyethylene costs about $500; a foldable or nesting dinghy that takes up half the space costs $1,000 and up; brand-name fiberglass sailing dinghies can cost up to $3,000. None of these will be able to carry more than a 2 to 3 hp outboard, but all will row well.

No matter which type you choose, to be useful as a tender it needs to be rugged, at least 8 feet long, fairly stable, and capable of being stowed upside down somewhere on deck. A really serviceable hard dinghy will have two rowing positions for different conditions, three seats for carrying three or four people, and positive flotation so it cannot sink even if swamped. For towing, it should be equipped with a through-bolted eye low on the bow and a self-bailer.

Half a dozen types of inflatable dinghies have been developed in the last two decades, and these are listed in Table 7-1. The old-fashioned Avon or Zodiac with a fabric floor that moved underfoot like a waterbed hardly exists anymore. Almost every inflatable boat now available has a reinforced floor for durability and rigidity. Most have a contoured hull with a V-shaped keel to improve directional stability and increase buoyancy in the bow. This facilitates planing when used with a sufficiently powerful outboard.

The new Hypalon material used by Avon holds up better to UV radiation than the less expensive PVC-coated fabric used by Zodiac. Hypalon does not hold air as well as PVC-coated fabric, however, so a dinghy made from Hypalon will need to be reinflated more often.

TABLE 7-1. TYPES OF INFLATABLE DINGHIES				
Type	**Construction**	**Maximum HP**	**Ease of Use**	**Stowage**
Slatted-floor dinghy	• Floor consists of wooden slats over PVC-coated polyester fabric • Does not have a keel or reinforced structure in the floor, lacks rigidity, cannot plane	• 5	• Easy to inflate, deflate, and stow	• Can be rolled up into compact, fairly light bundle without removing floorboards
Roll-up sportboat	• Floor consists of interlocking wood or plastic sections over an inflatable floor made of PVC-coated polyester fabric with a shallow, V-shaped keel • Segmented floor gives more rigidity than slatted type, but not enough to plane in waves	• 8	• Easy to inflate, deflate, and stow	• Can be rolled up into compact bundle without removing floorboards, but the interlocked floor structure makes it heavy
Rigid-floor sportboat	• Floor consists of rigid wood or aluminum panels over an inflatable floor made of PVC-coated polyester fabric with a shallow, V-shaped keel • Panels give floor rigidity, making it stiff enough to plane	• 8–10 for most models, a few can carry 15	• Difficult to inflate, deflate, and stow	• Floor panels must be removed for disassembly and stowed separately; these are bulky and difficult to stow
High-pressure inflatable floor (HPIF) boat	• Floor consists of a double layer of copolymer fabric to create a chamber that can be inflated to high pressures; separate chamber creates a V-shaped keel • Rigidity similar to plywood or aluminum floors; light weight allows planing with relatively low hp	• 8–10 for most models, a few can carry 15	• Easy to inflate, deflate, and stow	• Can be rolled up into light, compact, easily stowed bundle
Rigid inflatable boat (RIB)	• An aluminum or fiberglass hull with inflation chambers attached; catamaran models available • Hull provides durability and rigidity; boat planes easily and can attain high speeds with enough hp	• 15, and up to 40 for some models	• Difficult to inflate, deflate, and stow	• Even with tubes deflated, almost as large as a hard dinghy; must be stowed on deck

Any inflatable dinghy purchased to act as a cruising tender should come equipped with towing eyes set low on either side of the bow. It should have a drain plug for getting water out of the dinghy, carry ropes along both gunwales, a set of oars that can be securely affixed to the gunwales, a seat for rowing, and a sturdy outboard bracket mounted on a solid transom.

Comparing Dinghy Options

How do these hard and inflatable dinghies stack up against one another? When evaluating a tender, a cruiser will be interested in nine criteria. Following are definitions for each of these and the range across types of dinghies:

- **Affordability.** The initial cost of the dinghy can range from a few hundred dollars for a homemade hard dinghy to close to $4,000 for a 12-foot RIB or high-pressure inflatable floor (HPIF) dinghy capable of carrying a 15 hp engine.
- **Durability.** Dinghies take all kinds of abuse. Hull materials have to resist abrasion when dragged up sand and coral beaches, punctures from metal sticking out on docks or mussel shells or rocks along the shore, and degradation from ultraviolet radiation. Hard hulls made from fiberglass, polyethylene, or wood hold up best. Inflatable fabrics hold up less well, though new materials like Hypalon have extended fabric life spans, particularly with respect to UV damage. A well-built hard dinghy can be expected to last decades. RIBs fail when the fabric in the tubes gives out; most manufacturers now give ten-year warranties. Non-rigid inflatables don't last as long—expect five years or so of hard use on a cruising boat. Roll-up and hard-bottom inflatables tend to chafe around the hard edges of the floor, leading to leaks.
- **Mobility.** Most hard dinghies and inflatables with wooden slats in the floor can carry a maximum of 5 hp in an outboard, so they will be quite limited in their range. At the other extreme, RIBs can carry 15 hp or more, allowing them to plane fully loaded and giving them a virtually unlimited range in sheltered waters. RIBs with large motors are powerful enough to tow a boat a short distance in an emergency situation or to help a boat maneuver into or away from a dock in a beam wind. The rest of the inflatables fall somewhere between RIBs and hard dinghies, with a maximum rated hp of 8 to 10, though some specially designed HPIFs and rigid-floor sportboats can carry up to 15 hp. As

a rule of thumb, light HPIF inflatables will plane carrying one person with a 3.5 to 4 hp outboard and two people with 5 hp. Heavier inflatables will need at least 8 hp to plane with two aboard, and RIBs will need 10.

- **Stowability.** When it comes time to head off on passage, the dinghy has to be stowed in a seamanlike fashion. Most inflatables can be deflated and rolled into a compact, flat bundle that can be stowed below or lashed to the deck. Hard dinghies and RIBs create a major stowage challenge, for neither can be reduced in size sufficiently to be stowed anywhere but on deck. Stern davits provide one solution for stowing these bulky tenders, but not an ideal one. In storm conditions, a large following sea can launch a 150-pound dinghy out of the davits and into the cockpit with disastrous results. Hard dinghies can usually be stowed upside down on deck, lashed to davits through-bolted to the coach roof (refer back to Figures 4-1 and 5-37). RIBs are more problematic, for they must be stowed upright on all but the largest boats (Figure 7-1). In this position, they add significant windage and, unless covered, trap water. They increase weight high in the boat and reduce stability. The outboard will need to be stowed as well, and for a large RIB that will mean finding room somewhere for a 15 hp engine that weighs over 100 pounds.
- **Portability.** Dinghy docks exist in only the most populated, highly trafficked cruising grounds. Elsewhere, the dinghy has to be landed, sometimes through surf, and pulled ashore. In areas with little tide, this will mean pulling the dinghy up 15 or 20 feet. But in tidal areas, this may mean moving the dinghy anywhere from 100 feet to 100 yards over sand, coral, rock, kelp, or mud. An inflatable needs to be lifted up and carried if there's any chance of its coming into contact with sharp rocks, mussel shells, or coral pieces. One person can manage this with difficulty if the dinghy weighs less than 100 pounds; two people can do it easily. A hard dinghy or RIB can be dragged with little regard for what it's being pulled over, but a RIB that weighs 150 pounds with an outboard that weighs another 75 pounds will prove difficult to drag more than 12 feet or so, even for two people. Dolly wheels attached to the transom of a RIB can increase its portability, but they work only on firm surfaces and will be of little use on kelp-covered rocks, mud, or soft sand.

Figure 7-1.
RIBs can be more difficult to stow than a hard dinghy, as seen on this Valiant 40.

- **Capacity.** Having a dinghy that can carry several hundred pounds of groceries in addition to two or three people means making fewer trips between the boat and shore when provisioning. When you have guests aboard, it's most convenient if all of you can go ashore at once. Hard dinghies generally have the least load-carrying ability and are often limited to 400 or 500 pounds—three adults, or two adults and a couple weeks of provisions. Inflatables have higher load limits, with most rated to carry around 800 pounds. Larger HPIFs and RIBs can carry up to 1,200 pounds.
- **Rowability.** Although most cruisers don't row, having a dinghy that will row reasonably well gives you an option if the outboard breaks down and an additional way to get exercise even if it doesn't. In secluded lagoons where you're hoping to catch a glimpse of wildlife, you'll get a lot closer with the oars than with the motor. Most hard dinghies have been designed for rowing, and they can be moved quickly and efficiently through the water using a minimum of effort. Most inflatables, on the other hand, don't row at all well. The slatted-floor type lacks rigidity; roll-ups, rigid bottoms, and RIBs are too heavy and often too wide. Due to their light weight and relative rigidity, HPIFs are the only inflatables that row decently enough to do it for pleasure.
- **Stability.** The classic hard-sailing dinghies and some homemade hard dinghies are the only ones these days that lack stability. All of the others offer a stable platform for climbing in and out and for carrying weight without worrying about capsizing. When empty, however, the light HPIFs can easily be flipped in moderate winds or a biggish swell. This is a minor annoyance unless it happens with the outboard on; then it can be an expensive headache.
- **Accessibility.** Most cruisers who dive take their dinghy to the reefs and use it as a dive platform. That

TABLE 7-2. RATINGS OF DIFFERENT TYPES OF DINGHIES

Type	Affordability	Durability	Mobility	Stowability	Portability	Capacity	Rowability	Stability	Accessibility
Flat bottom (hard)	5[1]	5	1	1	3	1	4	3	1
Sailing dinghy (hard)	5	5	1	1	3	1	5	1	1
Slatted floor (inflatable)	4	1	1	5	5	3	2	4	5
Roll up (inflatable)	4	2	3	5	3	4	2	5	5
Rigid floor (inflatable)	4	2	4	3	4	4	3	5	5
HPIF (inflatable)	3	3	4	5	4	4	4	4	5
Aluminum RIB (inflatable)	1	4	5	1	3	4	1	5	4
Fiberglass RIB (inflatable)	1	5	5	1	1	5	1	5	4

[1] 1=worst, 3=average, 5=best.

means they need to be able to get in and out of the dinghy relatively easily. Low freeboard and a broad "rail" facilitate entry from the water. Hard dinghies tend to have relatively high freeboard and a narrow rail; they can be difficult to climb into, especially if they're not stable. Any of the inflatables offers better accessibility.

One other factor should be considered when selecting a dinghy, what I'll call "stealability." Dinghies and outboards get stolen more frequently than anything else. Their attractiveness to thieves is, not too surprisingly, closely correlated to their value. The most expensive dinghies are most likely to get stolen and will need to be diligently protected from theft, while a battered rowing dinghy without an outboard will be quite safe almost anywhere in the world. Therefore, a dinghy that rates poorly on affordability will be most likely to be targeted by thieves.

Table 7-2 summarizes how the different dinghy types rate on each of these criteria. A few generalizations become apparent from this table. First, hard dinghies and RIBs lie at opposite ends of the tender spectrum. Hard dinghies are affordable and durable, but otherwise rate poorly on most of the things that really matter to cruisers. RIBs are heavy and expensive but rate well on mobility, durability, and load-carrying ability. Both share the drawback of being difficult to stow on passage.

The rest of the inflatable options represent compromises between these two extremes. Of these, HPIF inflatables have become increasingly popular because of their high rating across so many different attributes. More affordable than RIBs and almost as mobile, they are also the easiest of all tenders to stow and carry and almost as good as a hard dinghy for rowing. Their only drawback is in durability, where they don't measure up to dinghies with hard hulls. To sum up, Table 7-3 compares these three options using some specific figures.

So which option will best suit your needs? A few rules of thumb may help you choose. If you can't afford to spend more than $500 or so, a hard dinghy will be your only real option. If your boat is less than 35 feet long, stowability and weight will be key considerations. An HPIF inflatable is the best choice if you can afford it, and one of the slatted-floor inflatables or a small nesting hard dinghy is best if you can't. For "civilized" cruising in the Caribbean and Med, where dinghy docks are common and distances between ports relatively short, portability and stowability matter less, and RIBs become a very attractive alternative. If diving is central to your cruising plans, mobility will be a primary concern. One option is a RIB, assuming your boat is large enough to safely accommodate it on deck. Otherwise, the more expensive HPIF inflatables capable of carrying a 15 hp outboard will be a good choice. If you're

TABLE 7-3. COMPARISON OF 10-FOOT DINGHIES OF DIFFERENT TYPES

Type	Approximate Cost	Estimated Life	Max HP	Capacity (lb.)	Weight (lb.)	Storage Area (ft.)
Hard dinghy	$500–$1,000+	20 years+	3–5	400–500	70–100+	~10 × 4.5 × 3
HPIF	$2,200–$2,900	5–8 years	10	800–1,200	70–80	~3.5 × 2 × 1
Fiberglass RIB	$2,900–$3,300	8–10 years	15+	1,000–1,200	150	~10 × 4 × 3

planning on sailing high latitudes, you'll need to stow the dinghy below on passage and to carry it long distances to beach it in tidal areas. The HPIF inflatables will best meet your needs.

Finally, having only one dinghy means being totally dependent upon the other members of your crew for your mobility. If you have children and are buying a new dinghy, it may be worthwhile to keep the old one so the kids have something to putter around in independent of the adults. There are some other very inexpensive options that make a useful "second car." These include inflatable canoes and kayaks and the little inflatable rafts normally meant for pool use. None of these options costs more than a couple hundred dollars.

Selecting an Outboard

The decision of what outboard to buy will be constrained by the rated hp of whatever dinghy you purchase and by your stowage arrangements. A larger outboard takes up more space, and it also weighs more, which means creating some sort of block and tackle arrangement to get it on and off the dinghy. The obvious solution for stowing an outboard on most boats is to hang it from a mount on the stern pulpit. However, at sea this can interfere with trailing warps or drogues in a storm and will subject the outboard to almost continuous salt spray. Being able to stow the engine below will increase its longevity while keeping the decks clear. If you cannot store as large an outboard as you want below, you will have to weigh the benefits of a larger engine against the downside of stowing the engine on deck when at sea.

Going back to the transportation analogy, if you are looking for mobility equivalent to a car, you'll need to buy an engine sized to get whatever dinghy you have purchased planing when fully loaded. That's usually the rated maximum for the dinghy—for example, 15 hp for most 10-foot RIBs and 10 hp for most 10-foot HPIF inflatables. With 5 hp less, you will only be able to plane with two people in calm conditions, which will reduce your load-carrying ability and range. This option might be viewed as the economy car version when compared to the SUV option of maximum hp.

If you have decided on a "bicycle," you're not trying to get the dinghy to plane. A hard dinghy or an inflatable with an engine of less than 5 hp will let you make short journeys, work your way into wind or chop without exhausting yourself, and carry higher loads longer distances than you would choose to do if rowing. If a smaller outboard can meet your performance requirements, it will be a better choice. It will be lighter, easier to stow, less expensive, and more fuel efficient.

If your outboard comes with a separate steel fuel tank, you'll want to replace it with a plastic tank to prevent getting rust marks on the boat and dinghy. Never tow the dinghy with the outboard on it except in sheltered waters on calm days between anchorages. The weight of the outboard will make the dinghy flip more easily, and the engine will not benefit from getting covered with salt spray or doused by the odd wave. At the end of the day, remove or close off the fuel line and tilt up the engine so that the lower unit is clear of the water to discourage marine growth. Grease all fittings on the outboard with a grease gun and rinse and flush the engine at least annually.

Equipping Your Tender

Managing your personal transportation takes some preparation and practice. Just as your boat needs additional equipment, your dinghy also needs certain gear to make it safe and seaworthy. Drifting out of an anchorage on an offshore breeze when the engine dies may sound comical, but it can turn into a serious—or even life-threatening—situation. Treat the dinghy with the respect you accord any boat, and make sure it is equipped to get you safely home again in any conditions you might encounter.

First and foremost, always, always, always keep a pair of oars in the dinghy. These should be of the right size and strong enough to be able to make headway, even if slowly, upwind in 15 knots of breeze. Don't step into the dinghy without putting the oars in first, and don't leave the dinghy without making sure they are secured so they can't fall overboard, even if the dinghy is flipped. If you have a hard dinghy and no engine, carry a spare set of dinghy oars, oarlocks, and chafe protection somewhere aboard.

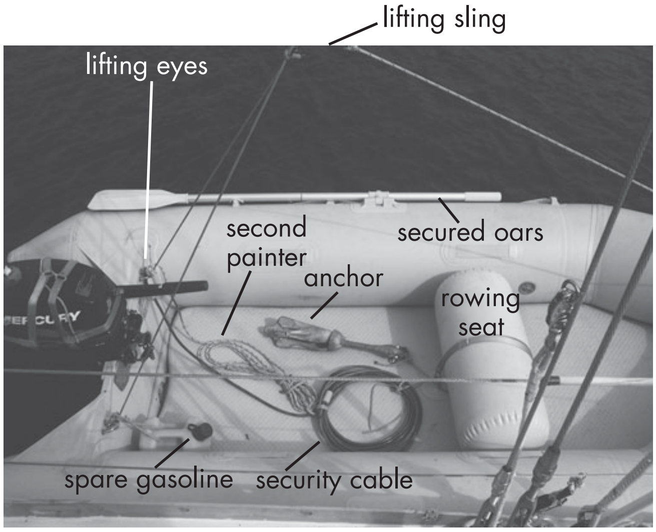


Figure 7-2.

A well-equipped dinghy has lifting eyes and a lifting sling, a security cable, a second painter, an anchor, spare gasoline, a rowing seat, and oars secured so they will remain in the dinghy even if it capsizes.

Second, if you have an outboard and you plan to motor farther than you can comfortably row back, carry a small tool kit. On a conventional two-stroke outboard, problems most often have to do with fouled spark plugs or water in the carburetor. Our kit includes spare spark plugs, a water-dispersing spray to drive water out of the electrical connections and carburetor, and a set of wrenches and screwdrivers so we can pull the drain plug off the front of the dinghy to drain the carburetor or remove the cover and drain any water out of the fuel.

If you ever find yourself having to row a heavy inflatable, there are ways to make it easier. When rowing with two people, paddle canoe-style on either side. With one person, kneel in the bow and paddle on one side and then the other. Though very inefficient compared with a good rowing dinghy, if the situation demands it, you will be able to make some headway.

Finally, if you have an inflatable dinghy, it will have come with a repair kit including fabric and adhesives. This should be stowed somewhere accessible but not carried in the dinghy unless it has a waterproof stowage compartment. If your dinghy has a high-pressure inflatable floor, add some Superglue to the kit; this is the best solution for repairing pinprick punctures in the floor. Make sure to replace the adhesives in the kit once a year or so, or they will be dried out and unusable when you actually need them.

You will need to equip a new dinghy for mooring, anchoring, and being lifted off and on the boat. You will also need to take measures to prevent it from being stolen. At a minimum, your dinghy should be equipped with the following items (Figure 7-2):

- **Dinghy painters.** The primary dinghy painter should be attached to the towing eyes in a bridle and be about 10 feet long. Any sort of nylon line with some elasticity works well for a dinghy painter. A stainless steel snap hook on the end of the painter provides a quick and easy way to secure the dinghy as well as adding redundancy when the painter is cleated. A second painter about 20 feet long should be coiled and secured somewhere in the dinghy. This will be used on crowded dinghy docks to keep your dinghy clear of others, when tying up in tidal areas where the primary painter is too short, for a dinghy anchor rode when anchoring, or for securing the stern of the dinghy to the boat when tying it alongside.
- **Lifting eyes and sling.** Your dinghy should have lifting eyes so you can easily get it aboard with a bridle and the main halyard. The best arrangement is two lifting eyes in the stern, one on each side, and a third at the bow near the centerline. If it doesn't come equipped with lifting eyes, you'll have to add them. On our inflatables, we have through-bolted U-bolts through the transom (see Figure 7-2). Our lifting sling attaches to these two points and to the grab line on the bow of the dinghy. Heavier dinghies, such as RIBs, will require a lifting eye bolted into the fiberglass of the bow as well. A stainless steel snap hook connects the bowline of the lifting bridle to a ring between the two stern lines. This allows us to drop the bridle down into the bottom of the dinghy underneath the seat when not in use.
- **Anchor.** To snorkel or dive from the dinghy, you will need a dinghy anchor. You will also need one to anchor just outside the surf line where waves or rocks prevent you from taking the dinghy ashore. A good dinghy anchor has no sharp edges to damage an inflatable. An inexpensive 5-pound mushroom anchor works well. The long dinghy painter can be used as a rode.
- **Security cable and locks.** Dinghies and outboards are theft targets and have to be protected. In major harbors or in any area where you have heard of thievery, lock your tender to the dinghy dock and to the boat at night. A 20-foot length of plastic-coated 1×19 stainless steel wire swaged to a through-bolted U-bolt in the dinghy makes a good security cable. When in use, it passes around the rail of the dock or through the pushpit of the boat and locks

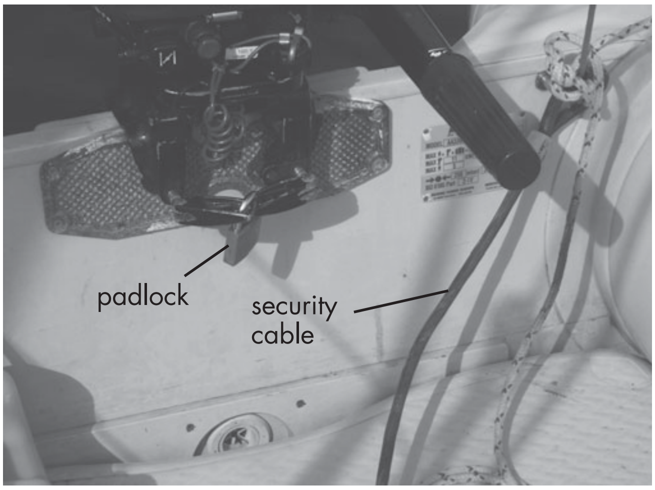


Figure 7-3.
Antitheft measures. The plastic-coated 1 x 19 security cable is swaged around a U-bolt that is through-bolted to the dinghy; the padlock will prevent the outboard from being removed easily.

to itself with a padlock. We use a padlock to lock the screw mounts on our outboard together (Figure 7-3). Although either of these measures could be overcome with the right tools, they will deter the casual thief. Leaving the dinghy on a halyard overnight as shown in Figure 7-2 will help discourage theft and prevent marine growth on both the dinghy and the outboard. The outboard should be locked at all times in areas where thefts have occurred, even when stowed aboard the boat.

If you have a hard dinghy, always keep a bailer aboard. The bottom half of a laundry detergent bottle is ideal. The best way to extend the life of an inflatable is to protect it from UV radiation by covering the tubes with canvas. You can make your own, or you can purchase a fitted cover for most dinghies.

Make sure that all the equipment carried in the dinghy, including the oars, can be attached to the dinghy in such a way that it will stay put even if the dinghy capsizes, and make sure to secure it whenever you leave the dinghy ashore or at a dock. If you leave loose articles in your dinghy, at some point your anchor will end up on the bottom or your oars will head out to sea.

To get the outboard onto the dinghy without losing it overboard, you will want some sort of tether that can be tied to the rail and used by a crewmember to lower it from the boat. If the outboard weighs more than 30 pounds, you will need some leverage to get it from the boat to the dinghy and back without straining your crewmembers' backs. On *Hawk*, we attach a small block and tackle to the radar mount located at the top of the radar pole on the boat's stern (Figure 7-4). The outboard bracket on the pushpit is located just below this. One of us can put the dinghy on or take it off alone using this block and tackle. Other cruisers we know use a block and tackle attached to their radar arch, to a small derrick arm mounted on the stern, or to the end of their boom. The block and tackle must be attached to a harness around the top of the outboard. This can be made from webbing (as in Figure 7-4).

Figure 7-4.
We use a block and tackle running from the radar mount to a webbing harness on our outboard to lower it down to the dinghy.

In areas where there are tidal currents, the dinghy needs to be secured alongside using bow and stern lines to keep it from bouncing against the hull or getting caught under the self-steering gear. We have also learned to secure our HPIF dinghy alongside to keep it from capsizing in strong winds, chop, swell, or wash from other boats. We take the outboard off the dinghy in these conditions, because its weight facilitates flipping if the bow lifts up. If winds are expected to go over 30 knots, light inflatables should be lashed to the deck.

Dinghies will grow grass and barnacles in areas where warm water combines with a nutrient-rich environment. Lifting the dinghy on a halyard until it is just out of the water will keep the bottom clean. The same technique discourages dinghy theft when used in conjunction with a stout security cable and lock.

The dinghy and the outboard both need to be stowed securely for passagemaking. Hard dinghies and RIBs should be lashed to solid davits through-bolted to the deck. Stow them upside down if at all possible. Otherwise, remove the drain plug and cover them so they don't fill with water. Store inflatables below if you can; otherwise lash them securely to strong points on the deck. Outboards will have to be stowed on the stern rail on most boats under 40 feet; on larger boats room can usually be found in an engine room or a sail locker. Gasoline needs to be stowed in a sealed locker that drains overboard. If you don't have a dedicated locker and the gasoline won't fit in the propane locker, it's safest to lash it somewhere on deck while on passage.

Regardless of the dinghy you choose, you should be comfortable with your tender and be able to handle it in a variety of conditions. You should be able to bring it alongside a boat or a dock without fuss, ride a wave into a beach, head out through surf back to your boat, and maneuver it with three people or 100 pounds of groceries aboard. Your dinghy will be your lifeline when you are at anchor, and all crewmembers should have total confidence in their ability to manage it.

Tender Choices for Three Offshore Voyagers

Our three crews ended up with three quite different tenders. *Simplicity* didn't come with a dinghy, and Susan and Simon Simplicity were running out of money when the time came to consider one. They had planned to buy an inexpensive inflatable and small outboard but found they couldn't afford the $1,500 to $2,000 they would have to spend for the least expensive option. Simon decided to build a dinghy out of plywood and epoxy that would just fit under the boom. After investing 120 hours and about $300, they ended up with a flat-bottom, reasonably stable, 7-foot-long hard dinghy. While a bit tippy, it rowed quite well and carried them both easily.

Moderation came with a well-worn, 13-year-old slatted-bottom inflatable and a 4 hp outboard. Molly and Michael decided to keep these for the kids' use for as long as they lasted and to buy an inflatable capable of carrying all four of them for everyday use. They purchased an 11-foot HPIF inflatable and a 10 hp outboard for about $4,500. This carried all of them easily and planed with up to two of them aboard even in a steep chop. They deflated the dinghy and stowed it in one engine room when on passage; they stowed the outboard in the other engine room on a special bracket.

Highlife's first owners had equipped her with a 10-foot HPIF inflatable dinghy and an 8 hp outboard. Hugh and Hilary planned to do a lot of diving and wanted a dinghy that could take them across a harbor for a nice dinner, which meant buying a more powerful outboard and faster dinghy. They kept the dinghy and outboard already aboard for the use of guests and grandkids and found room to stow them in the sail locker. For their own use, they purchased an 11-foot RIB with a 15 hp outboard for almost $6,000. They installed heavy-duty stainless steel davits on the stern for carrying the dinghy and its outboard on passage. These cost $1,500.

SELF-STEERING

Ask a dozen experienced sailors who have completed several shorthanded offshore passages about the best rig or the value of watermakers, and you're likely to get a half-dozen strongly held opinions that contradict one another. Ask these same people what the single most important piece of gear aboard is, however, and most if not all will name either their wind vane or electric autopilot. That's because shorthanded crews don't steer offshore. While self-steering is appreciated by offshore crews of four or more, it's imperative for crews of three or fewer.

Reliable self-steering has to include the notion of backup. Though hand steering can always be used as a last resort, it's best to avoid it if at all possible. If your budget permits, a second self-steering device for situations where your first does not perform well or for use in the event of failure should be one of your highest priorities. If you have chosen to rely on an electric autopilot as your primary means of self-steering, backup also includes a way to recharge your batteries if your engine dies or you run out of fuel.

Many would-be voyagers leave the decision about self-steering until the last minute; then they set about trying to find a wind vane that won't interfere with their transom-mounted swim ladder, or a below-deck autopilot that can be shoehorned into the last remaining space in the cockpit locker. Self-steering matters too much to be treated as an afterthought. It works harder than any other piece of equipment aboard. On passage it will be in use 24 hours a day, day after day, for weeks at a time. Treat your self-steering system like the uncomplaining crewmember it is, and plan for it from the very beginning.

In selecting a self-steering system for your boat, you must decide between an electric and a wind-driven system, or whether to carry both. A decade ago, a wind vane hanging from the stern was the definitive badge of a bluewater boat. The poor reliability of electric autopilots at that time meant that few crews made more than one or two passages before fitting a wind vane. But both the power and the reliability of electric autopilots have increased exponentially since then as manufacturers try to keep pace with the demands of large powerboats and single-handed offshore racers. At the same time, average cruising boat size and speed have increased, making many cruising boats more difficult for a wind vane to handle.

As a result, electric autopilots have been making inroads as the primary means of self-steering aboard offshore boats. A decade ago, 95 percent of the offshore boats we saw carried wind vanes, and their crews used them 90 percent of the time. Today about two-thirds of 100 crews surveyed in New Zealand had wind vanes on their boats; although some still use them nearly all the time, a majority reported using them less than half the time. Electric autopilots have filled the gap, with crews preferring the improved steering accuracy and additional speed they provide. This trend looks likely to continue. In the 2003 Atlantic Rally for Cruisers (ARC), only 20 percent of the boats carried wind vanes.

People fitting out cruising boats often ask us whether they should get a wind vane. For traditional designs under about 45 feet, our answer has always been and remains an unconditional "Yes!" Vanes will steer these boats at close to their hull speeds using no electricity. More than 13 percent of autopilots fail every year according to the 2005 SSCA Equipment Survey (see Table 8-8). A wind vane will be significantly more reliable and easier to fix than an electric autopilot.

For bigger and faster boats, we recommend one of two options. The first is to use only electric autopilots. To be sure of the necessary reliability for crossing oceans, the ideal solution is to carry two installed autopilots and two sources of electricity generation, each of which can power the autopilot. The second option, carrying both a wind vane and an electric autopilot, does not require the backup electrical generating capacity. This is the option we took when we outfitted *Hawk*.

We prefer this solution for three reasons. First, the wind vane allows us to dramatically cut our power consumption on long passages or when cruising remote areas away from fuel docks. Second, because our vane has a built-in auxiliary rudder, it provides an emergency backup steering system if something should happen to our primary steering. Third, and perhaps most important, it eliminates the mechanical whining in the background that always accompanies the use of an electric autopilot. When we use a wind vane, we feel in perfect harmony with the wind and the waves. At the same time, we have the option of using the electric pilot if we need greater steering accuracy or want to sail the boat faster than we can with the wind vane.

Wind Vanes

A wind vane steers the boat at a constant angle to the wind. It uses the force of the wind passing over the boat or the boat moving through the water to turn the helm and bring the boat back on course. Today's wind vanes combine rugged construction with almost frictionless gears to translate the forces of wind and water into accurate, effortless steering. Once properly installed, they work flawlessly day after day, using only the wind's energy.

Wind vanes face two limitations. First, they have to have wind to steer, which means they may not steer well when motoring or dead downwind in light air. Second, most wind vanes were designed when the average boat was less than 40 feet long and the average boat speed was less than 5 knots. On today's high-performance monohulls and on multihulls, using a wind vane may mean sacrificing some speed.

Types of Wind Vanes

Before wind vanes were developed, the earliest round-the-world shorthanded sailors experimented with a variety of ways to get their boats to steer themselves. Joshua Slocum, Robin Knox-Johnston, and others developed systems of pegging the tiller in place or of tying the sheets from double headsails to the tiller to steer the boat back downwind if it turned up. These time-honored solutions still work on tiller-steered, traditional boats with long keels that track well. But the next generation of boats with modified fin keels and wheel steering required a different solution. This came in the form of the wind vane, one of the earliest of which was developed by Blondie Hasler in the 1960s to steer his boat in the OSTAR, the single-handed Atlantic race.

A wind vane works by aligning a lightweight wing, called a *vane*, upright and edge-on to the wind direction. When the boat changes its course, the force of the wind on one side of the vane will be larger than on the other side, causing it to swing in one direction. In the simplest of wind vanes, that movement is translated through gears and pulleys into a force on the rudder that turns the boat back to its original course. As the boat returns to its original orientation to the wind, the vane returns to its original position until the boat next wanders off course.

To generate adequate force to turn the rudder using only the wind on the vane requires a sizable area. Some of the earliest vanes were several square feet in area, not a practical solution on the stern of most boats. To reduce the size of the vane while providing adequate force to turn the rudder, more complex wind vanes were developed that used the boat's motion through the water to augment the wind's force. Over the last forty years, three types of wind vanes have been developed—trim tab, servo-pendulum, and auxiliary rudder.

- **Trim tab wind vanes.** Originally developed for boats with outboard rudders, these wind vanes use a direct linkage between the vane and a trim tab on

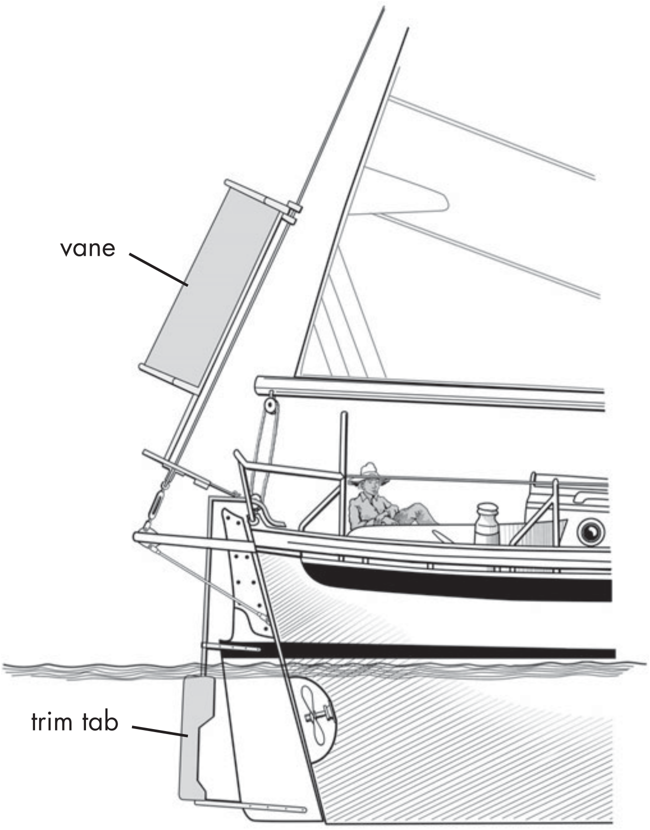


Figure 7-5.
A trim tab wind vane uses the force of the wind to change the position of a trim tab set on the aft edge of the rudder. (Fritz Seegers illustration, from material provided by Larry Pardey)

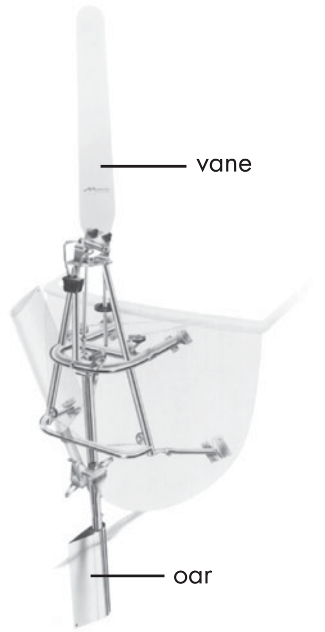


Figure 7-6.
A servo-pendulum wind vane (in this case the Monitor) consists of a vane and an oar connected by some very clever gears. (Courtesy Scanmar International)

Figure 7-7.
When the vane is forced out of the vertical by the wind, it rotates the oar, which then swings to one side in response to the differential water pressure. (Courtesy Scanmar International)

the aft edge of the rudder to steer the boat (Figure 7-5). When the boat goes off course, the wind rotates the vane, which in turn rotates the trim tab. The trim tab then acts like a rudder on the boat's rudder, bringing the rudder into alignment with it through the force of the water. The boat follows along, and the vane returns to its original position. The original trim tab wind vanes were not very efficient, but they can still be seen on some boats with outboard rudders.

- **Servo-pendulum wind vanes.** One big drawback of trim tab wind vanes was the size of the vane needed to create enough force to turn the trim tab. Servo-pendulum wind vanes use the force of the water to magnify the force generated by the wind on the vane. They consist of a small, lightweight vane set on a counterweight attached through a complex series of gears to what appears to be a rudder but is actually called an oar (Figure 7-6). With the vane oriented into the wind and the boat moving through the water, the counterweight holds the vane vertical. Without any pressure from the vane, the oar stays vertical. If the boat comes off course, the wind pressure changes on the vane. Rather than rotating in a vertical plane, the vane swings to one side. Through the gears in the midsection of the vane, this movement rotates the oar about 5 degrees in the vertical plane. The water now exerts a differential pressure on the two sides of the oar, which causes it to swing sideways with some force (Figure 7-7). A series of pulleys and lines connecting the oar to the wheel or tiller translates this movement into a force strong enough to turn the

Figure 7-8.
Hawk's Windpilot wind vane uses a servo-pendulum gear to drive an auxiliary rudder.

helm. The Aries and Monitor are the best known of the servo-pendulum vanes.

- **Auxiliary rudder wind vanes.** These systems bypass the boat's rudder altogether. The vane turns an auxiliary rudder attached to the boat's stern, either directly or using a trim tab or servo-pendulum arrangement, which in turn steers the boat. There are no lines to the tiller or wheel, and the steering system is independent of the boat's main rudder. This provides backup in case the main rudder is lost, but the second rudder also increases underbody drag. These systems are used on boats with center cockpits where lines cannot be led directly to the helm or with hydraulic or worm gear steering, which is not responsive enough for servo-pendulum wind vanes. The Hydrovanes, some of the German Windpilots (Figure 7-8), and the older Sailomat units employ an auxiliary rudder. The auxiliary rudder is smaller and less efficient than the boat's rudder, so the steering tends to be less precise than with the servo-pendulum wind vanes.

Today, most wind vanes are servo-pendulums alone or in conjunction with an auxiliary rudder. The stainless steel Monitor has come to dominate the market, though we still see quite a few of the old Aries wind vanes as well as some Hydrovanes, Sailomats, and Windpilots on cruising boats. Used Aries wind vanes sell for anywhere from a couple hundred dollars to a couple thousand. New servo-pendulum wind vanes cost from $2,500 to $4,000 including spares kits; servo-pendulum auxiliary rudder wind vanes sell for $5,000 or more.

On almost any traditional bluewater cruiser of moderate displacement from 25 feet up to 45 or 50 feet, some sort of wind vane solution can be made to work. The specific solution will depend upon the boat's deck layout, freeboard, and steering system, but for most boats a servo-pendulum gear will prove durable, effective, and efficient.

The steering requirements exceed the capabilities of most wind vanes somewhere between 50 and 60 feet of boat length or between 7 and 8 knots of boat speed. Ultralight-displacement boats (ULDBs) create special problems because of the boat's ability to "outrun" the apparent wind and because of the major shifts in apparent wind as the boat accelerates. If you want to fit wind vane steering on any boat over 45 feet or so, try to get recommendations from others with boats of similar length, displacement, steering configuration, and sailing abilities. The wind vane manufacturers are usually quite willing to put you in touch with people who have used their equipment on boats similar to yours.

Wind vanes do need wind to steer. They do not perform well when the apparent wind falls below a few knots, as when motoring or running dead downwind in light air. But on traditional boats up to about 45 feet long, they will steer the boat down to about 4 knots of apparent wind. When the apparent wind is too light to operate the vane, you will need some sort of backup. On boats under 35 feet or so, this will occur infrequently enough that hand steering as a backup to a wind vane is a real option. On larger boats, which move at faster average speeds and result in lower apparent winds, a backup will be necessary often enough that you will not want to rely on hand steering.

Wind Vane Installation

To steer well, a wind vane needs to be ruggedly built and correctly installed. Any wind vane must be constructed with solid mounting arms or brackets that can be through-bolted to the stern of the boat. Strong winds and large swells will create significant torque on the wind vane's members. Although some units like the Sailomat and

Figure 7-9.
Silk's control lines ran through a single turning block between the wind vane and the wheel.

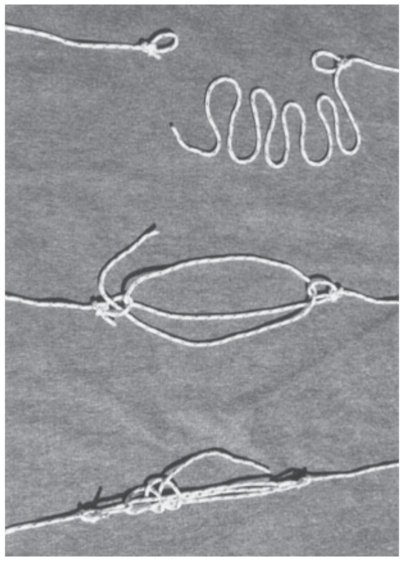


Figure 7-10.
A trucker's hitch (finished at bottom) allows the control lines to be tightened and loosened easily. (Courtesy Scanmar International)

Windpilot can rotate through 90 degrees without damage, others, like the Monitor, are limited in their range of movement and need adequate bracing made from strong metal tubes to support the large forces that will be generated.

On a servo-pendulum wind vane, control lines translate the oar's motion into a lateral pull on the helm. They run from the vane, through a series of blocks, and directly to the tiller or to a drum attached to the wheel. These lines are in almost constant motion when the wind vane is steering, so a poor installation will result in chafe problems. The best installations use only a single turning block between the vane and the helm (Figure 7-9). The control lines must exit the block exactly parallel to the attachment point on the helm and enter the drum at a right angle to that point. Otherwise, the pull on the drum will not be directly sideways, and some of the wind vane's motion will be lost.

The control lines need to be low stretch and UV-resistant. The lines also need to be kept tight enough to efficiently translate the movements of the oar to the helm, but not so tight as to create friction. Optimal tension varies with wind conditions. The lighter the wind, the looser the lines should be. In these conditions, swells cause the vane to wave around, and loose lines prevent these random movements from steering the boat off course. The heavier the wind, the tighter the lines should be. The wheel needs to respond rapidly to vane movements when the boat starts to lose her course in bad conditions. On *Silk*, we installed small turnbuckles in the two control lines between the vane and the blocks that allowed us to adjust the tension in the control lines quickly and easily without taking them off the drum. The hitch shown in Figure 7-10, which has been used successfully by offshore single-handed BOC racers, accomplishes the same end.

Auxiliary rudder wind vanes have no lines running to the tiller or wheel, which simplifies installation. The main rudder, however, must be locked securely in position to prevent its movements countering those of the auxiliary rudder and to create the necessary weather helm. Most pedestal brakes will slip when the boat is underway, so another solution needs to be found. On *Hawk*, we attach twin block and tackles to the wheel with webbing straps and clip them to the pedestal eye bolts using stainless steel snap hooks (Figure 7-11).

Getting the Most from Your Wind Vane

If the vane has been installed properly, all you need to do to get it to steer well is to balance the boat. That means having the right sail plan for the conditions and locking in the right amount of weather helm. The wind vane is not designed to make up for weather helm through steering

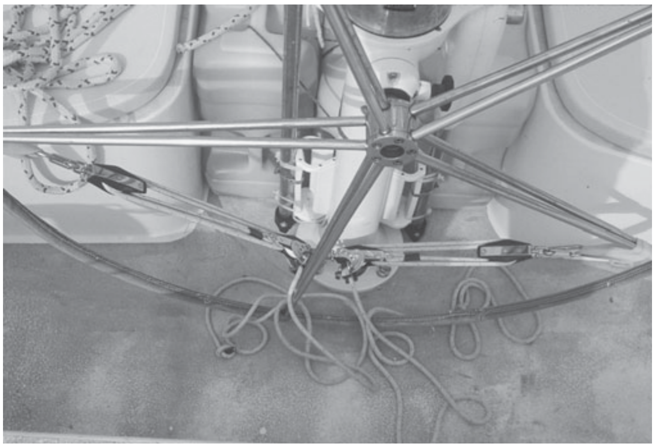


Figure 7-11.
Twin block and tackles hold *Hawk*'s wheel in place and keep the main rudder stationary when the wind vane is steering. We use the same arrangement to lash the wheel in heavy weather.

motion. The rudder must start out at the right angle for the wind speed and angle of heel.

This means that when the vane is oriented into the wind and upright, the helm will not be centered but will be turned a few degrees to weather. On a servo-pendulum unit, the control lines need to be set with that amount of weather helm in place; they will then steer around that point. Similarly, on auxiliary rudder units, the wheel will not be centered but must be locked in place with sufficient weather helm to keep the boat balanced (see Figure 7-11). In this case, the main rudder does the bulk of the work holding the boat on course, and the auxiliary rudder acts more like a trim tab. With either type of wind vane, the amount of helm in the main rudder will need to change with the wind speed. Many times, when a vane seems to be steering poorly, it is because the wind has eased or strengthened, and the boat is no longer balanced.

The key to good steering is to balance the sail plan so that the boat almost sails itself without the wind vane. When learning to use a wind vane, many people keep too much canvas up and overtrim the sails. If the vane is not steering well, try easing the sheets. Reef when the vane starts to steer sloppily (when it takes several seconds to correct). We knew it was time to reef *Silk* when she felt like she was doing a giant slalom. If we disengaged the vane and took the helm, we could confirm that she was overcanvased.

To get a well-designed wind vane like the Monitor to steer a moderate- to heavy-displacement boat with a traditional underbody up to 45 feet long takes little more than a bit of practice. But getting a wind vane to steer a larger, higher-performance boat with a fin keel and spade rudder capable of averaging over 7 knots means learning some specific techniques and may mean giving up some speed.

Properly reefed, almost all boats will steer well under a wind vane upwind, and higher-performance boats, with their fingertip-sensitive steering, actually respond slightly better than more traditional designs at such times.

Reaching is the most difficult point of sail for a wind vane on any boat. The vane can typically handle the normal working sails in a steady 15-knot breeze and minimal waves, but in lighter winds and big seas it will hunt around and tend to stall the boat. In stronger, gustier winds with bigger waves, the vane will not be able to prevent the boat from rounding up. Reaching with only headsails on *Hawk* prevents the main from overwhelming the wind vane and allows it to keep steering, but at the cost of 1 knot or more of boat speed. On more traditional boats, heavily reefing the main will help the wind vane maintain control. Even so, do not expect much precision in these conditions.

Off the wind, wind vanes steer best dead downwind in conjunction with double headsails, which hold the boat on course. But in light to moderate winds, high-performance boats maximize velocity by jibing downwind with large headsails and full mainsails, creating difficult conditions for wind vane steering. On *Hawk*, we lose the most speed using the wind vane instead of an electric autopilot in light to moderate downwind conditions. When we have limited fuel and unlimited time, we will sail dead downwind under some sort of headsail combination so the wind vane can maintain control. In strong downwind wind conditions, double headsails maximize both our speed and the wind vane's steering ability, so we lose little by using the wind vane.

On both our boats, simply throttling the boat speed back to about 7 knots has allowed the wind vane to maintain control of the helm. This was never a great sacrifice on 37-foot *Silk*, where we gave up ½ knot or so of speed, but on 47-foot *Hawk*, this may mean sacrificing 2 knots or more. Many owners of high-performance cruising boats have bought their boat because they want to go faster. These are the cruisers who are likely to rely on electric autopilots and not bother to fit wind vanes.

Electric Autopilots

Electric autopilots steer by the compass and use electricity to turn the helm. These autopilots compare the boat's actual course to the course that has been programmed into the system and adjust the helm until the two come back into alignment.

Steering a boat becomes a complicated problem when variables such as the boat's displacement, keel configuration, weather helm, and steering sensitivity, as well as changing wind and wave conditions, are considered. Electric autopilots lack the automatic feedback that a wind vane receives constantly from the wind. Early models understeered or oversteered, and even today's sophisticated models must be taken through a complex setup procedure to calibrate them for the boat's responses in various conditions.

All electric autopilots consist of a few basic components:

- **Compass.** Electric autopilots don't use the ship's compass to steer. They come with their own compass, either a fluxgate compass or the more sophisticated gyroscopic type. To be accurate, the compass must be installed near the centerline of the boat and protected from magnetic and electrical interference. It must be located well away from anything metallic, from high-powered radios, and from other sources of RF (radio frequency) interference including computers and chartplotters.
- **Control head and processing unit.** All electric autopilots need a control pad to input instructions and a brain to interpret those instructions—a central processor that compares actual course to programmed course and determines how to react. Simple autopilots combine the two into a single unit with a few buttons and an LED display. On more sophisticated units, the control head will resemble an instrument display and be located near the instruments. The processing unit will be located somewhere near the batteries and will have more computing power than first-generation laptops.
- **Drive unit.** Some type of motor provides the autopilot's muscle. The drive unit can range from an electric motor that turns a belt attached to the wheel to a hydraulic ram attached directly to the rudder.

These components can steer a boat on a single course as long as the batteries hold up and the equipment doesn't break. On more sophisticated units, you can calibrate the control head to the boat's displacement and steering characteristics to increase steering efficiency. You can install feedback loops that tell the control head how much the boat is heeling and how much rudder is being applied. The unit can also be interfaced with a GPS so that it can adjust the course for current and leeway to eliminate cross-track error and steer course changes when you reach waypoints. Interfacing the autopilot with the instrument system allows it to steer a wind angle instead of a compass course. All these components bring the autopilot's steering ability closer to that of a human's, but they also increase complexity, cost, and the likelihood of failure.

There are two main types of electric autopilots: wheel or tiller, and below-deck. An electric motor turns the helm on wheel or tiller autopilots. This motor may drive a piston arm that moves a tiller or a belt that turns a wheel. Below-deck autopilots are located near the steering quadrant, and they turn either the quadrant or the rudder shaft itself using a ram or a direct-drive motor.

The boat's electrical system must be sized to the demands an electric autopilot will place upon it. Installing a below-deck electric autopilot as your primary self-steering system will mean radically upgrading the electrical system on most boats. Although electric autopilot reliability has improved tremendously, breakdowns still occur. To keep from hand steering, many crews on large, high-performance boats without wind vanes install two below-deck autopilots in parallel.

Wheel or Tiller Pilots

Wheel or tiller pilots are designed for use on smaller boats with smaller steering loads. Compared to below-deck autopilots, cockpit-mounted autopilots cost less, use less energy, and are less reliable. They cost around $1,000 and draw between ½ and 1 amp of electricity on average, with peak loads around 3 amps. To steer with a cockpit-mounted autopilot 24 hours per day takes between 12 and 24 amp-hours (Ah) of electricity and 50 to 100 Ah of battery capacity.

Cockpit-mounted autopilots steer moderate-displacement, 30- to 40-foot boats well in light air or when motoring. They do not steer well in a following sea, with a moderate wind on the beam, in gusty conditions, or in large waves. Whenever you would have trouble hand steering, they will not be able to steer at all. Cockpit-mounted autopilots lack the strength and reliability to serve as the primary self-steering system on an offshore boat. They make good backups to either a wind vane or a below-deck autopilot.

The drive unit on older wheel-steering models was mounted to the binnacle (see our CPT unit mounted to the binnacle in Figure 7-9). Most current models have compact electric motors attached to a belt encased in plastic that hang from the wheel itself (Figure 7-12A). Tiller-steering units mount on the coaming and use a ram to push and pull the tiller (see Figure 7-13 for a tiller pilot in use steering a wind vane).

If you head offshore with a wheel-mounted autopilot, you can avoid some common problems by taking the following precautions:

- **Protect the control head.** The most delicate part of the electric autopilot is the control head. On cockpit-mounted autopilots these will contain both the autopilot controls and its computing capability. Most are described as watertight and are supposed to be installed near the wheel within easy reach of the person at the helm (Figure 7-12B), but constant

Figure 7-12A.
Most cockpit-mounted autopilots have both the electric motor and the belt encased in plastic and mounted on the wheel.

Figure 7-12B.
The control head for such units is generally mounted in an exposed position in the cockpit.

exposure to spray will short out the buttons, and direct sunlight will create condensation inside the unit. If at all possible, mount the control head in a protected position under your dodger or just inside the companionway.

- **Protect electrical connections.** Electrical connections between components can be a source of problems. Try to keep connections protected from spray. Where that is not possible, make sure they are watertight. Be careful to support wiring, particularly into the back of the control head. Some models have pins connecting the electrical wires to the control head; these will pull out under the weight of the wires.
- **Carry spares.** If the autopilot has external belts, carry at least one spare. If it has shear pins in the motor, carry a half-dozen spares. If it is a sealed unit like the one shown in Figure 7-12A, carry a second complete unit.

Electric autopilots that operate a tiller are simpler and more reliable than wheel-mounted autopilots and use much less electricity than below-deck autopilots. These can be adapted to work with a wind vane by removing the vane and attaching the ram to the counterweight on the servo-pendulum (see Figure 7-13). As the boat comes off course, the autopilot pushes the weight, which then turns the helm. This approach uses the water to magnify a small force and steer the boat just as the wind vane does.

Figure 7-13.
A tiller pilot attached to our auxiliary rudder wind vane steers *Hawk* while we're motoring.

It allows a much smaller electric autopilot than normal to effectively drive the wheel or tiller of a large boat.

Several crews we met used the wind vane as their primary self-steering and attached the tiller autopilot in light air or when motoring. When not in use, the tiller autopilot was stowed below to protect it from sun and spray. We tried this solution on *Hawk* using the Windpilot wind vane (Figure 7-13), but we found that the auxiliary rudder was too small and the tiller autopilot too sluggish to steer the boat well. The tiller autopilot/wind vane combination works best with a servo-pendulum gear that drives the main rudder on more traditional long-keel boats.

Below-Deck Autopilots

Below-deck autopilots are designed to reliably steer larger, heavier boats over a broader range of conditions than their cockpit-mounted counterparts. Depending on the size and complexity of the unit, the cost starts at about $2,500. For the most sophisticated units capable of handling boats 50 feet and over, the cost will probably exceed $5,000 and can approach $10,000. Average electrical draw runs between 2 and 6 amps at 12 volts, with peak demands between 10 and 30 amps. Insufficient voltage to meet peak demands will trip a breaker on many of these units, and they will cease to operate. To run one of these autopilots 24 hours per day can easily take 100 Ah of electricity and between 300 and 400 Ah of battery capacity. This solution necessitates a large battery bank with sophisticated charging and monitoring equipment. In return, it offers push-button, highly accurate steering in all but the most extreme conditions.

A below-deck autopilot's drive is located near the steering quadrant. On most units, an actuating arm connects the drive to the quadrant, to the steering linkage, or directly to the rudder shaft. Drive mechanisms may be electrical-mechanical, electrical-hydraulic, or purely hydraulic. The first uses an electric motor to drive a series of reduction gears that push or pull on the actuating arm. The second uses an electrically driven pump to actuate a hydraulic cylinder that moves the arm. The last can be used on boats with hydraulic steering systems and connects directly to the hydraulic steering lines. If the actuating arm attaches directly to the rudder, the autopilot will steer a wheel-driven boat even if the steering cables break.

Below-deck autopilots are much more reliable than cockpit-mounted models, but they are by no means trouble free. Whatever drive unit you have will require regular maintenance. Follow the manufacturer's instructions diligently. Install the autopilot processor in a warm, dry place, preferably close to the batteries. Protect the control head from direct sunlight and spray to greatly increase its life. On *Hawk*, we installed the control head under the hard dodger, where it is completely out of the spray and sun. In this position it has failed only once in 50,000 miles, when the LED display died. To control the autopilot from the helm, we have a handheld remote unit that we keep below and bring out on deck only when needed (Figure 7-14).

Figure 7-14.
Our main autopilot control head ("Hydra pilot" in the back) is located under the dodger, out of sun and spray; a portable control head (in front) on a long "leash" can reach all the way to the bow for use while anchoring.

One problem with getting electric autopilots to steer an accurate course is the random fluctuations in the compass course that occur as waves throw the boat around. Gyroscopic compasses and more advanced software in the processor to make use of them represent the latest innovations to improve steering performance in high-end below-deck autopilots. These help eliminate the hunting back and forth common to electric autopilots working in large seas. Gyroscopic compasses draw more power, but they reduce the power consumption of the drive unit. Friends on light-displacement boats who have installed gyroscopic compasses have seen a marked improvement in steering performance. The improvement would be less significant on heavier, more traditional boats that get thrown around less by waves.

Sophisticated autopilots can be interfaced with the GPS, allowing you to steer from waypoint to waypoint with multiple course changes. Using data from the GPS, the autopilot can also correct for current and leeway and steer right to your destination. This option can be a valuable safety feature when sailing coastwise in hazardous waters.

If you go to the trouble of installing a below-deck autopilot, select one that can be interfaced to the instrument system so you can steer to a wind angle. This greatly facilitates steering when the wind is oscillating through 15 or 20 degrees every hour. It also allows you to tack when sailing upwind and jibe when sailing downwind by pressing a single button (see the Single-Handed Jibe sidebar in Chapter 24). Steering speed can also be adjusted on more sophisticated models. Ours allows us to select normal, economy, or downwind modes. Economy cuts electrical usage by about a third in light winds and flat water, and the downwind setting works well in following seas.

If you opt for a below-deck autopilot as your primary means of self-steering, carefully consider your backup. Although these systems are more reliable than cockpit-mounted autopilots, they're not reliable enough to depend upon exclusively.

Aboard *Silk*, the mean time to failure of our electric autopilots was less than 2,000 miles, a bit worse than the 1,215 hours between breakdowns reported by the SSCA in their equipment survey in 1996 and by *Practical Sailor* in its tests during the mid-1990s. This was true of all three brands/models we carried—an Autohelm wheel-mounted unit, a CPT wheel-mounted unit, and a Robertson below-deck unit. While reliability has improved, 13.3 percent of autopilots still break down every year according to the SSCA's 2005 Equipment Survey (see Table 8-8). On *Hawk*, the mean time to failure has been just over 10,000 miles using a below-deck hybrid system with Brookes & Gatehouse electronics and a Robertson hydraulic ram. If you rely on an electric autopilot as your primary means of self-steering, be prepared to fix it every two oceans or every few years, and have some sort of backup so you won't end up hand steering when it breaks.

One option is to do as Steve Dashew does on his large cruising boats. He installs two below-deck pilots in parallel so that he can easily switch between them if one breaks. If you can't afford this option, carry a spare drive unit. We carry two drive units, and four times we have substituted one for the other in the middle of a passage on *Hawk*.

Unless you choose to install a wind vane, backup for a power-hungry below-deck autopilot should include an alternative way to generate electricity if your engine fails. Solar panels won't be up to the task. If you haven't done so already, you'll need to install a tow generator, wind generator, or diesel- or gasoline-powered generator to do the job.

Self-Steering Options and Solutions for Three Offshore Voyagers

For long-distance offshore sailing, a wind vane offers an almost bulletproof, energy-free way to steer a monohull. There are three main advantages of a wind vane over an electric autopilot. First, a wind vane uses no power. Second, the worse conditions are, the better it steers. Third, a wind vane is almost bulletproof. When sailing coastwise, however, the precision of an electric autopilot and its ability to steer by the compass instead of by the wind make it far more likely to prevent a grounding. If you plan on doing extensive coastal cruising, an electric autopilot is an excellent investment.

In practice, most bluewater boats carry one of four combinations of self-steering equipment. Table 7-4 summarizes these solutions and the characteristics of the typical boats using them.

Faced with the self-steering choices outlined in Table 7-4, the crews on *Simplicity*, *Moderation*, and *Highlife* each chose a different alternative. Susan and Simon Simplicity found a used Aries wind vane through a local chandler who sold boat bits, and they installed this with some help from a cruiser in the local yacht club who had sailed around the world with one. For about $1,500, they had a working self-steering system that they then relied on more than 95 percent of the time. When motoring or sailing in light winds, they developed a system for tying off the tiller that worked in flat water.

Moderation came with a below-deck autopilot that had been installed when the boat was first built. Molly and Michael had the autopilot serviced and were told it was in good condition. Just to be sure, they purchased a rebuilt drive unit and stowed it in the engine room as backup. They spent about $2,000 to service the old autopilot and purchase the used ram. With four crew-

TABLE 7-4. STANDARD SELF-STEERING SOLUTIONS ON OFFSHORE BOATS

Boat Length (ft.)	Displacement (lb.)	Battery Bank (Ah)	Primary Self-Steering	Backup	Approximate Cost[1]
< 35	< 15,000	100	Wind vane	Hand steer	$1,500–$4,000
30–40	10,000–20,000	200–400	Wind vane	Tiller autopilot with wind vane	$2,500–$4,000
35–45	15,000–35,000	200–400	Wind vane	Wheel or tiller pilot	$3,000–$5,000
40–50	20,000–40,000	400–600	Wind vane	Below-deck autopilot	$7,000–$10,000
50+	25,000+	800+	Below-deck autopilot	Parallel unit or extensive spares	$10,000+

[1]Equipment only; does not include installation costs.

members, hand steering would be a viable alternative if all else failed.

Highlife came equipped with a heavy-duty below-deck autopilot with a 24-volt hydraulic linear drive, which had already had five years of hard use. The previous owners had rebuilt the drive and had all the seals replaced. Hugh and Hilary decided to install a second unit in parallel with the first for use as their primary unit, and to reserve the older one for use as backup. The new unit came with the gyroscopic compass. Including labor, the new autopilot cost them over $9,000.

ON-DECK SAFETY EQUIPMENT

Most of the things that fall into the category of safety equipment—life rafts, EPIRBs, abandon-ship kits, fire extinguishers, medical kits—would better be called emergency management equipment: they are useful only when something has already gone wrong. To our way of thinking, true safety equipment prevents emergencies from happening. Waiting for a proper weather window and having accurate charts aboard save far more lives than life rafts and survival suits.

The problem with what the marine industry has come to call safety equipment is that there is always another emergency you might be able to prevent by buying one more piece of expensive gear. There is no cost-value trade-off made; no examination of the likelihood that the equipment will ever actually be needed. The result is a list of equipment that few people can afford and a list of emergencies that will keep most people from heading offshore in the first place. Most of this equipment does not make the average boat any safer or decrease the likelihood of an emergency on board.

When it comes to safety equipment, we would include all navigation and communications equipment as well as equipment meant to keep the crew from going overboard. When it comes to emergency management, offshore voyagers need to have equipment to deal with a few well-defined problems, including medical emergencies and a sinking, fire, or loss of a mast or rudder. The last four, if unresolved, could lead to abandoning ship, and the crew must be prepared for this eventuality as well. This section focuses on emergency management gear that would be used or stowed on deck on most boats: equipment meant to prevent collision, to keep crew on the boat, and to use when abandoning ship. Table 7-5 points the way to other emergency management equipment and techniques considered in this book. The 1998 Sydney-to-Hobart Race: A Postmortem sidebar in Chapter 22 also provides valuable insights into the practicalities of using safety equipment in the real world.

TABLE 7-5. LOCATION OF OTHER INFORMATION ON DEALING WITH EMERGENCIES

Equipment/Techniques For:	Considered In:
Emergency signaling/communications	Chapter 8
Navigation	Chapter 8
Fire on board	Chapter 15
Medical emergencies	Chapter 16
Collision avoidance	Chapter 21
Sinking	Chapter 23
Dismasting	Chapter 23
Rudder loss	Chapter 23

Preventing Collisions

A freighter and a sailboat on a head-on collision course will be closing the distance between them at a minimum of 25 to 30 knots. The freighter will be in visual range for less than 20 minutes during the day and only a bit longer on a clear night. Nowadays, some supertankers and larger freighters rely on radar alarms to alert them to nearby traffic, but the radar profile of a small sailboat can easily be lost in the clutter from waves or squalls. Some crews aboard freighters do not even seem to monitor VHF regularly (although our success rate in getting an answer to our hails is considerably higher if I try than if Evans does).

Luckily, collisions are rare, especially offshore. Most freighter crews are diligent and make corrections while they are still over the horizon from us. Where that is not the case, almost all collisions can be avoided simply by keeping a good watch. We have only twice been in a situation where a collision was likely (see the Close Encounters with Ships section in Chapter 15) and know of only two sailboats run down by freighters.

In addition to keeping a good watch, collision avoidance comes down to making your boat as visible as possible. This is of particular importance in heavy weather or crowded coastal conditions where a small sailboat will be lost in the clutter of waves or other vessels. Offshore tests show that radar reflectors rarely provide much of a target, and they should not be relied upon as a primary means of making a boat visible. Search-and-rescue experiences from offshore races provide better guidance on effective ways to signal and to be seen.

International orange is highly visible at sea. If you've ever seen it, you know it grabs your attention and makes you take a closer look. The Vendée Globe race committee requires entrants to paint their hulls with bright, highly visible colors. Most of us are not willing to paint our hulls orange, even to avoid getting run down by a freighter, but some color can be added without greatly impairing the boat's aesthetic appeal.

Painting the top 8 to 10 feet of your mast international orange will make the boat much more visible. International orange panels can be sewn into storm sails, or those sails can be made from orange material. Some people have small orange triangles sewn onto the heads of their mainsail and working jib. Painting a round bull's-eye about 2 feet in diameter on top of a hard dodger or pilothouse will make the boat much more visible to ships or rescue craft while leaving it unaltered to sea-level observers. Making the cloth dodger and cockpit spray cloths bright yellow, pink, or orange would also increase visibility offshore.

At night, visibility depends upon good lights. Install properly sized, high-quality lights and use them at sea. The masthead tricolor provides far more visibility than running lights low on the bow and stern. New LED masthead lights draw little power but are highly visible.

In a close encounter at night, shining a mega-candle-power handheld spotlight on the sails will dramatically increase your visibility while making it clear that you are aboard a sailing vessel. Do not shine it directly at a nearby ship's bridge, as you could destroy their lookout's night vision.

When you want to attract attention in an emergency, a strobe light will add appreciably to your visibility. You can build one into your masthead tricolor unit or buy one you hoist up a halyard when needed. Note that under the International Regulations for Prevention of Collisions at Sea (COLREGS) a strobe is used to indicate distress, and ships are obliged to investigate. So don't use a strobe to warn off a big ship: it's much more likely to come closer than to move away!

In an emergency, the chances are fair that none of these lights will be working. Flares can attract attention, need no electricity, and work both at night and in daylight, so they are well worth carrying. Yet they disperse surprisingly quickly if there is any breeze. One flare will give rescuers little more than 2 minutes to get a decent fix. Parachute and orange smoke flares provide the best visibility, but they should only be considered a last resort. Over and over, people who have been rescued describe letting off flares when ships or aircraft were in sight and getting no response.

Preventing Crew Overboard

I can think of very few things that would be worse than coming on deck at midnight for my watch and finding Evans gone. Most cruisers share the fear of losing their loved ones overboard, yet few, Evans and myself included, do nearly as much as they could to prevent it from happening. I'm not sure why this is so, though I can say that on a shorthanded boat in the middle of the ocean, pat theories have very little to do with the reality of staying on the boat or rescuing someone who has fallen off. Among the thousands of cruisers we know, most of whom are quite lax about wearing harnesses and tethers, only three have ever become separated from the boat. That suggests that most of us are adept at staying on board even if we don't take every precaution.

But that in no way mitigates the seriousness of a crew-overboard situation. Before we set out aboard *Silk*, we took a Royal Yachting Association (RYA) sailing course on the south coast of England under the instruction of a crusty old salt who had served as navigator on the Royal Yacht *Britannia*. Before starting in on the standard crew-overboard retrieval spiel, he said, "Here's the reality. If you're shorthanded in the middle of the ocean using self-steering with one person on watch and another asleep below, then this is the only man-overboard drill you will ever need"—and he waved good-bye over the stern of the boat.

Tests of crew-overboard equipment confirm how incredibly difficult it is to locate someone in the water once those on the boat have lost visual contact. For one person to retrieve an unconscious, injured, or hypothermic person in large waves and strong winds will be at least as difficult as finding the victim in the first place. For shorthanded offshore crews, then, keeping the crew on the boat—or attached to it—can literally mean the difference between life and death. This needs to be the primary focus of whatever crew-overboard equipment you buy and carry.

The safety suggestions discussed in the Sea-Safe Deck Layout section in Chapter 3 form the first line of defense for keeping crew on board. These include strong handholds within reach of every point on deck, excellent nonskid on all deck surfaces, and a high toe rail to act as a foothold. For these to work, the crew must adhere to the old saying "One hand for the boat; one hand for yourself." You and your crew must learn to move around the decks as rock climbers move across the face of a cliff. Only when you have two or three solid handholds or footholds should you reach for another one. This way of moving tends to become ingrained within a few days offshore, and this is what keeps most of us on our boats most of the time.

Harnesses, tethers, and jacklines should be viewed as the last line of defense in keeping crew aboard. Each element of the tethering system should be of the highest quality. Following are specific considerations for each:

- **Harnesses.** A high-quality harness should be made from nylon webbing with a breaking strength of 5,000 pounds or more. When properly adjusted, the tether should not be able to pull the harness over the wearer's head even when pulled straight up. While slightly bulkier, an inflatable vest/harness combination will provide flotation as well as keep you attached to the boat if you go overboard. Automatic vests have improved greatly over the years but still have a tendency to inflate when a wave submerges you while you're wrestling with a sail on the foredeck. Manually inflated vests make more sense for use on deck in heavy weather. If you choose an inflatable vest/harness combination, you'll want to use a crotch strap to keep the vest from riding up when inflated.
- **Tethers.** The ideal tether has three ends (Figure 7-15). At the chest end, a snap shackle with a lanyard connects to triple-stitched nylon webbing that splits into a double tether end. The snap shackle can be released under load, so you could get free if the boat were sinking. The tether ends consist of one 3-foot and one 6-foot length of elasticized webbing, each ending in a short length of nylon webbing triple-stitched around the eye of a Gibb snap hook, which has a double-action gate mechanism that can be worked with one hand but cannot be opened accidentally or released under load. The double ends allow you to remain clipped in at all times, and the elasticized webbing keeps the tether from trailing around your feet when not in use. The 3-foot tether is particularly good when working with both hands at the mast or the staysail, because it is not long enough to allow you to go overboard.
- **Jacklines.** Wire rope was formerly used for jacklines because of its strength and low elasticity, but it rolls underfoot, posing a serious hazard to crew moving down the side decks. Today, Dacron webbing is commonly used. This still stretches more than we think acceptable—up to 22 percent at 80 percent of breaking load, which would mean up to 10 feet if our jacklines were shock-loaded by someone going overboard. Instead, we use hollow-core webbing and thread ¼-inch Spectra line down the middle. The webbing protects the Spectra from chafe and keeps the jackline flat underfoot, while the Spectra provides much less stretch and greater strength than webbing alone. We figure-eight the jacklines onto our cleats at the bow and stern, giving us a clear run from the stern pulpit to the furling jib. While the webbing is not all that UV-resistant, we're not relying on its strength but that of the Spectra inside. We replace the webbing every couple of years just to be sure.

Figure 7-15.
The ideal tether consists of three legs, one that attaches to the harness and two ends of different lengths for attaching to the boat.

Abandoning Ship

Every time a powerful storm hits a racing or cruising fleet, stories abound of abandoned boats found floating weeks later and of crew who took to life rafts being injured or killed. These traumas include the 1979 Fastnet Race, the 1994 Queen's Birthday Storm, and, more recently, the 1998 Sydney-to-Hobart Race. In the 1979 Fastnet Race off the southern coast of Ireland, seven lives were lost in life rafts after crews abandoned boats that were later found afloat and towed back to harbor. Ever since then, the adage has been that you should only leave the boat when you have to step *up* to get into the life raft.

That doesn't mean that you shouldn't be prepared to abandon ship. No one wants to seriously consider the possibility of having to leave their boat and most of their possessions to climb into a life raft. Those people who have done it, however, have had a much greater chance of survival if they had carefully thought through abandon-ship procedures beforehand and prepared a comprehensive ditch kit to take with them.

The best advice I can give for understanding what it takes to survive in a life raft is to read Steven Callahan's *Adrift*. Steve lost his boat off the Cape Verde Islands in the southern North Atlantic and drifted in his life raft for over two months before fetching up on Bequia in the Caribbean. Don't be put off because it's a disaster story; it's also an incredible adventure yarn and an inspiring story of survival, and it's a revealing look at the skills you would need if you ever found yourself in Steve's position.

There are three pieces of equipment you will want to have aboard if you ever need to abandon ship: an EPIRB, a life raft, and an abandon-ship bag (usually called a ditch kit).

Emergency Position-Indicating Radio Beacon (EPIRB)

Emergency position-indicating radio beacons, better known as EPIRBs, are dedicated emergency signaling devices. Pushing the button on your EPIRB is no different from issuing a Mayday call on the radio. It means you are in a life-threatening situation, and you are ready to abandon your vessel. It should be used only as an ultimate last resort when you have given up all hope of saving your boat.

When activated, an EPIRB transmits a signal on internationally recognized distress frequencies monitored by satellites, aircraft, land stations, and rescue vessels. A receiving satellite computes a position for the signal that can be used by search craft to locate the distressed vessel. The satellites relay detected EPIRB signals and their estimated positions when they make contact with ground stations linked to mission control centers (MCCs). The controlling MCC tracks the signal and attempts to identify it using a database of registered EPIRBs and then passes on the relevant information to the rescue control center (RCC) responsible for the area where the incident has occurred. In the case of a U.S.-registered EPIRB going off in U.S. waters, the NOAA office in Maryland near Washington, D.C., would act as the mission control center, and the U.S. Coast Guard would execute the rescue.

Several types of EPIRBs exist. The older Class A and B EPIRBs transmit on two recognized emergency frequencies—121.5 megahertz (MHz; civilian) and 243.0 MHz (military). They lack accuracy and can go off accidentally, wasting search resources. These EPIRBs are being phased out in favor of more accurate, more informative 406 MHz EPIRBs.

The more sophisticated 406 EPIRBs transmit on 406.025 and 406.028 MHz. These signals are picked up by global weather and mapping satellites and stored until they come within range of a land station, providing worldwide coverage and notification within approximately 1 hour. The signal allows the satellite to calculate the EPIRB's position to within 2 nautical miles and carries a unique embedded code that can be matched to a database of registered EPIRBs containing useful rescue information: vessel identification, normal crew on board, and a shore-based contact who can confirm your last known location, reducing unnecessary searches.

Newer 406 EPIRBs combine the transmitter with a global positioning system (GPS) unit, which can make use of the geostationary satellites used in the GPS system. The transmitted signal includes the vessel's exact location as calculated by the GPS. Because these satellites are always available both to the boat and to the mission control centers, using them can reduce notification time from 1 hour to as little as 4 minutes. The transmitted GPS position can increase accuracy to as small an area as 0.5 nautical mile.

But getting a position can take some time as these units have to find where they are from a "cold start"—unlike your ship's GPS, which retains your last known position and uses that to obtain a fix when you turn it on again. To overcome this problem, some 406 EPIRBs come with an optical cable that can be connected to the vessel's GPS, reducing the time needed to acquire a fix. Some of today's EPIRB/GPS combined units cost less than $800 and can fit into a pocket, making them affordable for even budget-constrained crews.

Larger 406 EPIRBs can transmit for a minimum of 48 hours straight on a lithium battery that will last for six years. They also include 121.5 MHz transmitters that can be detected by ships and aircraft at a range of a couple of miles, and a powerful strobe light so rescuers can home in when in the immediate vicinity.

Although EPIRBs sound wonderful in theory, and although they have saved many lives, the system is far from foolproof. First, 406 EPIRBs must be registered with the relevant mission control center. In most cases, the MCC will not even pass on a distress signal to the search authorities unless they can verify it as registered. The U.S. Coast Guard reports that only 6 percent of EPIRB distress signals that do get passed on result from an emergency; an incredible 94 percent are false alarms. The Coast Guard resolves about 65 percent of these using registration information prior to launching search-and-rescue operations. Carefully consider whom to name as your contact in the event of a distress signal being received from your EPIRB. Make sure to pick someone who would always be familiar with your plans and could always be reached by authorities.

Second, when the distress signal originates in one country's waters but the EPIRB is registered in another country, the rescue effort depends upon communications between bureaucracies working to different protocols in different languages. The huge incidence of false signals encourages authorities to dismiss a signal if there is any question about its authenticity. There have been several alarming incidents in which the proper information did not get passed on and a search was never launched or was stopped prematurely.

The fact is that the amount of information transmitted via an EPIRB signal is extremely small, and the number of false signals almost drowns out the real ones. For this reason, many round-the-world races now require that participants carry two 406 MHz EPIRBs. Both must go off, or there must be confirmation through some other channel that a vessel is in distress, before a rescue is attempted.

Any other communications equipment can provide much more information than an EPIRB, and in an emergency should be employed first. A few minutes on the SSB or a 500-word e-mail will confirm that an EPIRB signal received later represents a real emergency, and will provide much-needed information for resolving the emergency. Having contact information for both the mission control center where your EPIRB is registered and the rescue coordination center for the area in which you are sailing will greatly facilitate the process. In considering the communications equipment discussed in the High-Seas Communications section in Chapter 8, try to create redundancy aboard that can be used to confirm an EPIRB signal and ensure a search-and-rescue effort gets launched.

Despite the downsides, it makes sense to carry an EPIRB even if you have a full complement of other communications equipment aboard. An EPIRB is compact, portable, and self-powered. It's the only long-range communications device that can be taken with you into the life raft and be expected to function. Although it makes sense to rely on other communications equipment for as long as possible, carrying at least one EPIRB stored in the life raft will greatly increase your chances of being rescued. To be sure it will work when needed, test it regularly and replace the battery according to the manufacturer's recommendations.

Life Raft

The cost of a high-quality offshore life raft starts at about $3,000 and goes up to $7,000 or more. Without proper care, a life raft may fail to inflate, or the material may deteriorate to the point of falling apart shortly after being deployed. To ensure that it works when needed, the raft must be inflated, inspected, maintained, and repacked regularly, usually on an annual basis. Inspections need to be done by the original manufacturer or a qualified representative, and servicing costs run to $250 or so annually. This is a great deal of money and effort for something that, with any luck, you will never use. About a quarter of voyagers choose not to carry a life raft at all, believing the money is better spent on reinforcing the structure of the boat, adding extra bilge pumps, and keeping up with maintenance. If you participate in an offshore race or a rally, you will be required to carry a life raft.

With the advent of EPIRBs and other worldwide communications alternatives, rescue should take a matter of days, not months. Most cruisers we talk to believe they would be rescued in a matter of hours anywhere in the world. Based on this, some have chosen to outfit their boats with coastal life rafts and little beyond an EPIRB instead of paying the high costs for offshore life rafts and putting together an extensive ditch kit. But as discussed above, rescue in less than a day is far from certain. If your EPIRB signal fails to reach the right channels or to be acted upon in the first 24 hours, and you have no other means of long-distance signaling available, you may spend a significant amount of time in your life raft.

If you invest in a life raft, it makes sense to get the best you can afford. A high-quality offshore life raft includes all the following features:

- Two independent, stacked tubes for redundant flotation and additional freeboard.
- A double-layered insulated floor to protect occupants from hypothermia.
- An inflatable, self-erecting canopy for shade and shelter in a highly visible color with a light on top.
- Large triangular or rectangular weighted ballast bags that fill with water and keep the raft from capsizing.
- An inflatable ramp for ease of boarding.
- A drogue attached by a swivel to a 50- or 60-foot tether for stability and to prevent the raft from blowing downwind faster than a person can swim.

Experiences in the 1998 Sydney-to-Hobart Race reaffirmed how frequently life rafts capsize in strong winds and high seas, even when ballasted. Drogues help keep the windward edge of the raft down and the wind out from under it, but the underside should be highly visible in case the raft gets capsized and stays that way.

Capsize becomes more likely if too large a raft is selected. Larger rafts are also bulkier to stow and harder to deploy, and it's harder to stay warm in them. Select a raft that can handle two people more than your regular crew. If your regular crew consists of more than five or six people, it's better to carry two small rafts rather than one large one.

Most life rafts are stowed on deck in a canister. If the canister is improperly designed, water will wick up the inflation cord or penetrate between the two halves of the canister, destroying the raft in as little as eighteen months. On the best-designed canisters, the top half overlaps the bottom with an O-ring seal in between. Deck-stowed life rafts can also be swept away by a wave or in a capsize. The mounts need to be through-bolted and absolutely bulletproof.

As an alternative to being stowed on deck, a life raft can be kept in a soft-sided valise and either stowed in an accessible place below or in an easily reached cockpit locker. The raft needs to be light and compact enough for one crewmember to manhandle it into the cockpit, and it should be stowed in such a way that it can be deployed within less than a minute.

For the warranty to remain valid, most life rafts need to be inspected and repacked every year. During the inspection, the raft will be inflated (using air, not the raft's CO_2 canister) and items including flares, food, and water will be replaced. The fabric will be inspected for water damage, and the cylinder will be checked to be sure it is full. The raft will then be refolded to prevent wear at the folds. Take your life raft to an authorized representative of the raft manufacturer. If you have trouble finding someone who handles yacht rafts in more remote locations, check with the airline companies. They have to have their rafts repacked regularly and should be able to recommend someone.

Try to be there when your raft is inspected. Not only will this allow you to check the condition of the raft for yourself, but it will also let you see what the raft looks like inflated, where supplies are packed in it, and exactly what items come with it.

Ditch Kit

Even high-quality offshore life rafts come with just the bare minimum of supplies. The standard inventory in many life rafts consists of little beyond materials for repairing the raft; in others it may include a flashlight, a few flares, paddles, and a bailer. In either case, the raft's emergency kit will need to be supplemented if you are to survive any length of time in the raft and have the necessary equipment to signal for rescue when help is near.

If the life raft fails before help arrives, you will die. Therefore, materials to repair and maintain the life raft should be first into the ditch kit, yet they are all too often overlooked completely. Include a generous amount of patch material and several tubes of different types of adhesives, as well as a tube or two of Superglue to repair pinprick leaks. These materials should be checked at the annual inspection and replaced if they've deteriorated or dried out. In addition, you'll need rolls of duct tape, a pump, a bailer with a lanyard, and a sponge. It's a good idea to carry paddles to retrieve anything of importance that goes overboard. If the life raft does not come with a drogue, you should purchase one separately and attach it to a rode at least 50 feet long using a swivel connection.

Humans can go for up to three weeks without food but only three days without water. A person can stay fit on 1 pint of water a day for ten to fourteen days and survive on ½ pint a day for many weeks, as evidenced by Steven Callahan's ordeal. He relied on solar stills to collect water, but reading his book will convince you not to do the same. Many cruisers stow one or two jerry jugs two-thirds filled with water near the life raft or abandon-ship bag. These would float if thrown overboard and could be retrieved from the life raft.

Another solution is to purchase a small, handheld watermaker. Models rated at a bit over 1 gallon per hour

TABLE 7-6. ADDITIONAL DITCH-KIT CONTENTS

Supply Level	Signaling Devices	Food	Shelter and Sun Protection	Medications
Minimal	• Ship's inventory of flares • 406 MHz EPIRB • Waterproof handheld VHF with spare batteries • Waterproof flashlight with spare batteries • Laser flare • Signaling mirror	• Emergency food rations • Multivitamins • Two sharp knives • Can opener • Small water bottle, plastic containers • Hurricane matches in waterproof container	• Waterproof SPF 45 sunblock and lip balm • Tube of zinc oxide • Space blanket • Sunhat • Sunglasses	• Seasickness medications • Antibiotic ointment • Painkillers • Silvadene cream for sunburn • Small first-aid kit • Prescription drugs • Spare eyeglasses
Moderate	• High-intensity strobe light • Dye marker • Smoke signal • Personal locator beacons (PLBs)	• Fishing line, hooks, lures • 20 ft. of light line • Small speargun • Drift net • Disposable lighter	• 4 × 4 ft. canvas square with grommets for blanket or sun awning	
All out	• Second 406 MHz EPIRB interfaced to a handheld GPS • Search-and-rescue radar transponder (SART)	• Hard candy	• Survival suits	• Full ship's medical kit

TABLE 7-7. MAJOR ABANDON-SHIP EQUIPMENT CARRIED BY THREE OFFSHORE VOYAGERS			
Equipment	***Simplicity***	***Moderation***	***Highlife***
Life raft	• Hard dinghy with **inflatable collar**[1]	**• Six-person offshore life raft**	• Six-person offshore life raft
For ditch kit	• Handheld VHF and spare batteries • Ship's flares	**• 406 MHz EPIRB** • Submersible handheld VHF • Ship's flares **• Manual watermaker**	• 406 MHz EPIRB **• Backup 406 EPIRB stowed in life raft** **• Submersible handheld VHF** **• Manual watermaker**

[1]Entries in **bold** were added by the crews specifically for use in abandoning ship.

could produce enough water in half an hour to keep two people well hydrated. Though more expensive, this seems more likely to do the job than the smaller models rated at 6 gallons per day. In theory these would take an hour of pumping per person to produce the minimum amount of water to keep the crew alive, and in practice it can take significantly longer. At $600 for the smaller units and $1,500 for the larger ones, these do represent a significant investment, but one that makes a certain amount of sense if you've already invested in a life raft. For a watermaker to work, the membrane must be serviced annually, and this should be considered part of your annual life raft inspection. Don't forget to put a small water bottle in your ditch kit for storing the water.

If you have an EPIRB, you should take it with you into the life raft. Note that most EPIRBs will transmit continuously for 48 hours, which won't be long enough to allow searchers to get close to you in remote areas. For that reason, you may want to carry a second EPIRB that you activate only when you see search activity. This could be one of the less expensive personal locator beacons (PLBs) instead of a full-size, full-function EPIRB.

After that, most of the contents of the ditch bag fall into four major categories as shown in Table 7-6: signaling devices, food, shelter and sun protection, and medications.

If you have room, include toothpaste, a toothbrush, and a bar of soap for physical well-being and a deck of cards for mental stability. Keep copies of your passport and essential documents in the ditch bag. You may also want to include some cash and a credit card. The ditch kit itself should be brightly colored, waterproof, and able to float. It should also have a lanyard attached that can be used to tie it into the life raft.

On-Deck Safety Solutions for Three Offshore Voyagers

Simplicity, *Moderation*, and *Highlife*'s crews have very different budgets and very different tolerances for risk. But all three agonized over the decisions they had to make with respect to life rafts and ditch kits. Susan and Simon Simplicity are young and healthy and don't yet believe in their own mortality. Michael and Molly Moderation's safety decisions were largely determined by their concern for their children. Hugh and Hilary Highlife tried to limit their expenditures to the equipment they felt would best address the risks they might face.

All three crews invested in stout jacklines, webbing harnesses, and high-quality tethers. Neither *Simplicity* nor *Moderation* came with any offshore safety equipment, as they had only been used for coastal sailing. *Highlife* came with a high-quality, six-person, offshore life raft and a 406 MHz EPIRB.

Susan and Simon Simplicity investigated purchasing a life raft, but they could not find one they could afford that they thought would be worth having. They decided instead to set up their hard dinghy for use as a lifeboat. They created an inflatable collar around the boat using neoprene tubing, and added flotation in the seats and bow so the dinghy was unsinkable. They could not afford an EPIRB, but they put together a fairly extensive ditch kit that fit into a duffel bag stowed under the companionway stairs. On passage, they put their handheld VHF and spare batteries into the kit along with the ship's flares (Table 7-7). They spent about $500 for their on-deck safety equipment.

Michael and Molly Moderation bought a high-quality, six-person, offshore life raft that stowed in a canister on deck. They also purchased a 406 MHz EPIRB, which they mounted on a bracket near the companionway. They registered the EPIRB with Michael's parents as the contact. Their abandon-ship bag included a 6-gallon-per-day watermaker and an extensive array of other equipment. Before they left on passage, they added their submersible VHF handheld radio and their flares to the ditch kit. All this fit into a dedicated abandon-ship bag that stowed in their cockpit locker on passage. Including their harnesses and tethers, this safety equipment cost Molly and Michael over $6,000.

Hugh and Hilary had the life raft inspected and repacked and found that it was still in good condition. It stowed in a valise in a watertight aft locker near the transom specifically designed for a life raft. The EPIRB tested out fine once they changed the battery, so they re-registered it with their daughter as the contact. They also purchased a smaller 406 MHz EPIRB for their life raft along with a handheld watermaker, strobe light, laser flare, and submersible VHF. All these went into a dedicated abandon-ship bag along with a variety of other equipment. The Highlifes spent just over $4,000 on their on-deck safety equipment.

Though the three crews have made different choices with respect to the equipment they carry aboard, each is comfortable with the compromises they have made.

CHAPTER 8
Other Equipment: Navigation, Communications, and Comforts and Conveniences

A FEW DECADES AGO, offshore voyaging meant going days or even weeks without knowing your boat's position on passage with any certainty, without hearing from family and friends, without any possibility of assistance in the event of an emergency, and without almost every shoreside comfort including a dry bed, nutritious food, and plentiful fresh water. While some cruisers still go to sea this way, most of us opt for a more civilized existence. Today, most voyagers find their exact position at the push of a button, communicate weekly if not daily with family and close friends, and receive assistance in the event of an emergency just about anywhere in the world. But some things have not changed. Even with modern equipment, being at sea in a cruising boat will never be as comfortable as staying home.

As you read this chapter, bear in mind that if you've upgraded your boat's hull and decks, added sails and ground tackle, and fitted a dinghy and self-steering, you could sail away after buying a compass, lead line, handheld GPS, handheld VHF, and some charts, knowing that your boat would be better equipped and more seaworthy than many that have completed circumnavigations. With few exceptions, the equipment discussed in this chapter is optional and comes at a price. A chartplotter, watermaker, or satellite phone can cost the equivalent of six months or more of cruising. This equipment must be maintained, which takes both time and money. To carry everything they want to bring along, some people buy bigger boats, further increasing cost and complexity. Remember *Simplicity*, and try not to fall into that trap.

NAVIGATION EQUIPMENT

Knowing your location takes two things: an accurate chart, and a way to determine your position on that chart. Offshore, there are no landmarks to help you figure out where you are. Generally speaking, your position can be determined only with respect to celestial bodies (the sun, moon, and stars) using a sextant, or satellites using the global positioning system (GPS). Sailing coastally, you can locate yourself on the chart in any number of ways. You can use a compass to take bearings on nearby landmasses, a depth sounder to identify depth contours, radar to pick out distinctive features, or a GPS unit to get an exact latitude and longitude.

In many parts of the world GPS positions are more accurate than the charts upon which they are plotted. For this reason, good seamanship dictates that when sailing in the vicinity of land, your GPS unit should not be relied upon as the sole aid to navigation. The position it provides must be confirmed using one of the other methods for fixing your position coastally.

Boat electronics are becoming increasingly integrated. Today, sophisticated navigation systems combine instrumentation, chartplotting, GPS, radar, forward-looking sonar, electric autopilot controls, and even onboard video, and display it all on multifunction displays (MFDs) located in the nav station, within reach of the helm, and anywhere else in the boat it may be useful. Some cruisers find these systems tremendously useful, and others think they are excessively expensive.

For those who want to keep costs down, the best solution is to avoid most integration and most instrumentation. A GPS with a simple screen and basic chartplotting capabilities mounted in the navigation station and a depth sounder with a digital display protected from the elements but visible from the helm provide the essential capabilities for the least expense.

Position Finding

There can be no doubt that GPS has completely revolutionized position finding. It has transformed navigation from a task that once took an hour or more per day to a push-button exercise. Position accuracy offshore used to be measured in miles; now it can usually be measured in feet. No one can deny that GPS has made cruising safer and easier.

But GPS is an aid to navigation like any other. When coastal sailing, you need to know not just where your position puts you on the chart, but how the chart translates into the landmarks around you. When you're not sure which headland you're trying to get around or which little island you leave to port, you'll need to use other aids to navigation to figure it out.

The position-finding tools that follow are organized in the order you would use them when closing with land, starting with a sextant and GPS unit at sea and ending with a compass to take bearings inshore. Although a GPS is used at every stage of this process, when making landfall you will not be certain of chart accuracy. You will need to rely on other aids to navigation to determine the margin of error.

Sextant, Tables, and Chronometer

Now that a GPS can be purchased for about $100, only dyed-in-the-wool purists or fools would consider heading offshore without one. These days, most voyagers carry several. But reliable as they have become, GPS units do fail on occasion. A GPS is a piece of delicate electronic equipment that requires a source of electricity to provide your position. A direct lightning strike will almost always destroy a fixed GPS unit and has been known to damage backup units stowed on board, even those not plugged into the electrical system. We believe good seamanship dictates carrying a sextant, the necessary tables, and a chronometer and having the skills to use them.

We know from experience that this is not a popular point of view among cruisers fitting out their boats, under pressure to learn everything from basic first aid to diesel repair while watching their savings evaporate at a frightening rate. Most will not want to invest money in a sextant or spend time taking a course on celestial navigation. They argue that carrying several GPS units provides redundancy, and that the chance of a lightning strike destroying all of them is extremely small. If it were to happen, they say, they would be able to get fixes from passing freighters as many cruisers did in the days before GPS. We cannot disagree with any of this, but we would never want to be without the means of finding our position at sea.

If you do choose to carry a sextant, learn how to use it before you go. Mary Blewitt's book, *Celestial Navigation for Yachtsmen*, offers a concise, intuitive description of how celestial navigation works and easy-to-follow instructions for reducing a sight.

Sextants range from a couple hundred dollars for a plastic model to more than $1,000 for a metal one. Metal sextants are better than plastic, as plastic expands and contracts more with temperature, reducing the accuracy of the sights. But plastic works fine for a backup you don't intend to use regularly. In addition to the sextant, you will need three things: annual tables that provide the declinations of the various celestial bodies, tables that simplify the sight reduction calculations, and a way to tell Universal Time accurately down to the second.

Various nautical almanacs, including *Reed's Nautical Almanac*, carry the annual tables necessary for reducing a sight. The two most popular sight reduction tables come from the Hydrographic Office (H.O. 229 or H.O. 249). The almanacs must be purchased new every year. Alternatively, *The Complete On-Board Celestial Navigator* by George Bennett collects everything necessary for taking a sight into a single volume that includes five years of tables as well as a primer on celestial navigation to refresh your memory.

Celestial calculators and computer programs can be used in place of both the almanacs and sight reduction tables to reduce the sight for you, taking care of all the messy arithmetic. Celestial calculators are expensive, and not worth the investment if you're only concerned about backup, but if you're interested in mastering celestial navigation or hope to learn the stars in an unfamiliar sky, a calculator or computer program will facilitate the process. If you take a celestial calculator along, carry spare batteries and replace them every year or so to be sure the calculator will work when you need it.

For each second your timepiece is off, your position will be out by ¼ mile. Time signals are broadcast on select short-wave frequencies, and these should be used to regularly check the ship's chronometer—which might be anything from a fancy quartz clock mounted on a bulkhead to a cheap digital watch stowed in the navigation station. Rather than correcting the chronometer to the time signal, the difference should be noted in a log every few weeks. That way you'll be able to tell the rate at which the timepiece loses or gains time and correctly adjust the time if you lose all your electronics.

Those who master the sextant and create a perfect cocked hat with the vessel's position right in the center will feel a sense of achievement and satisfaction that can be matched by few things in our technological world, certainly not by pushing a button on a GPS. They will also get a better appreciation both for the celestial bodies above us and for the people in whose wakes we follow, who had to use the heavens to find their way. That won't be enough reason for a pragmatist to carry a sextant, but it might convince a few poets.

Global Positioning System (GPS)

Created by the United States Department of Defense (DOD), the global positioning system was originally intended for military use but has become so accurate that it now helps lost tourists find street addresses in unfamiliar cities. The receivers pick up signals from a set of geostationary satellites and use these to determine position anywhere on the face of the globe to an accuracy of 6 meters 95 percent of the time.

But GPS units do far more than provide your latitude and longitude. They also calculate the distance and direction to a waypoint, tell you if you have gotten off course from your route, show how quickly you are moving, and use that to determine how long it will take you to reach the waypoint. GPS provides some of the same information as costly and sophisticated instrument systems—heading, distance traveled, velocity made good, time to destination—along with things such as course over ground, speed over ground, and cross-track error to allow the helmsperson to compensate for current or leeway. The most sophisticated systems combine position finding and position fixing by plotting the position continuously on an electronic chart.

GPS units range from handheld versions costing as little as $100 to sophisticated chartplotters that can be displayed on a flat screen alongside radar and sonar images for many thousands of dollars. Some optional GPS features greatly increase safety, and some have little practical application aboard. The features we use regularly and find most useful include the following:

- **Combined position finding and charting.** A whole host of errors can be introduced when moving between a handheld GPS and a paper chart. Numbers can be transposed, measurements can be made inaccurately, or one waypoint stored in the GPS may be mistaken for another. Combining an electronic charting system with the GPS using a chartplotter or electronic charts on a laptop computer eliminates all such sources of error and is well worth the investment if you can afford it.
- **Secondary displays.** A GPS repeater within sight of the helm station keeps you informed of how you are doing against your course. It displays course and speed over ground, course and distance to the selected waypoint, and cross-track error, which quantifies the boat's deviation from your planned course. By keeping your cross-track error to zero, you can be confident of not straying into danger.
- **Interface with the steering system.** If supplied with GPS information through a National Marine Electronics Association (NMEA) interface, the autopilot can steer more accurately, correcting for currents or leeway. Instead of steering to a compass heading, the autopilot will keep the cross-track error to zero. This allows you to stay exactly on your route, a nice feature when navigating through an area with many underwater hazards or with strong currents.

In addition, your primary GPS will be much more useful and accurate if it is mounted in the navigation station, set up to use ship's power instead of batteries, and wired to an external antenna. A screen large enough to be comfortably seen from the navigator's seat and user-friendly buttons sized for normal human fingers will be greatly appreciated when creating routes. All this argues against a handheld GPS and for a larger, more sophisticated fixed-mounted chartplotter if you can afford it.

Radar

A decade ago, radar was considered a necessity for offshore voyaging. A 16-mile radar could locate land after the sextant or satellite navigation (satnav) receiver put you within range. Radar could also be used to safely clear an island or enter a wide reef pass. These functions have been supplanted by GPS in most of the world, though radar still makes a valuable second aid to navigation. By comparing the distances to a headland calculated by radar and GPS, we can confirm that the charts are accurate to within 100 feet or so.

Radar's remaining unique contribution is its ability to locate objects—ships or land—in low- or no-visibility situations such as in fog or at night and to warn you of their existence by visual means or with an alarm. With the introduction of AIS (automated identification system) commercial ships are now required to transmit an identification signal on VHF frequencies that can be picked up by other vessels equipped with a marine antenna, receiver, and compatible plotting system. The signal includes the ship's position, bearing, and rate of speed, and the system can be set up to sound an alarm if the vessel is on a collision course with your vessel. The data can be plotted on a dedicated display, compatible radar screen, or compatible computer charting system. AIS has just begun to find its way aboard sailing vessels, but if it ever becomes widely available and reasonably affordable, it will supplant radar as the best solution for avoiding shipping traffic in low-visibility situations.

Until then, radar continues to be fitted aboard many cruising boats, primarily for avoiding collisions. But it has drawbacks and limitations, even for this purpose. Most radars with LCD screens draw 2 to 3 amps per hour, making continuous use feasible only on boats equipped with generators that run for several hours per day at sea. On most boats, a radar unit can reasonably be used for 3 or 4 hours a day while sailing or all the time while motoring.

How well and how far radar "sees" depends on a number of things, including the size and type of antenna, the power with which the antenna transmits its signal, the height of the antenna, the distance to the target, and atmospheric conditions. While radar can normally see through fog fairly well, it has great difficult penetrating heavy rain. That means radar is of little use in locating shipping traffic or land in a heavy downpour, though many cruisers find it useful for avoiding tropical squalls or—if the crew is in need of a shower—rendezvousing with them.

To reach their rated range, radar antennas need to be mounted high—for example, on top of a mizzen mast. But at that height, the radar will not be able to pick up things very close to the boat. On a sailboat, we're much more concerned with being able to identify targets within a mile of us than we are with seeing something at a range of 25 miles. Mounting the radar antenna on a pole or an arch will reduce its effective range, but it will give a more reliable return on targets close to the boat.

LCD displays use less energy than CRT displays, but they can be hard to read in low light. The flat-screen, color, thin-film-transistor (TFT) LCD displays offer excellent visibility and can be used to display sonar and chartplotter output as well, but there's a significant price premium to move to color. Monochrome LCD radars run around $1,000, while radars with fully functional TFT displays can cost $2,500 or more. An integrated system including radar, sonar, and chartplotting all displayed on a single color LCD display can cost $5,000 on up—a great deal of money, though it can be cheaper than buying each piece of equipment separately.

Although radar has its uses, and although it will be an integral (and integrated) part of the navigation system of the future, for now radar offers the cruiser far less value than it did before the advent of GPS. For areas where fog is common and shipping traffic is heavy, such as the Maine coast, the Pacific Northwest, and parts of northern Europe, a radar would be useful if you could afford it. On a trade wind circumnavigation, radar is by no means essential and should be considered only after buying a good chartplotting system.

Depth Sounder

The depth sounder provides the one bit of navigation information not supplied by a GPS. We know many offshore voyagers who have sailed thousands of miles without GPS, wind instruments, or any other electronic equipment but considered a functioning depth sounder essential. In conjunction with an accurate chart, the depth sounder pinpoints your position when you are close to land. It enables you to navigate along the depth contours on the chart, warns you if you enter shoal water, and helps you determine how much scope must be put out when you set your anchor.

Today's depth sounders are much more reliable than their predecessors. Some models can be installed without putting a hole in the hull or running wires around the boat. These work using a transducer capable of reading through the hull that transmits a radio signal to the display. If you do not plan to install an integrated instrument system, this alternative provides a simple way to get soundings for a couple hundred dollars.

Depth sounders provide a single-point reading of the bottom depth. They have no capability to do what we would most like them to do—look forward to warn us of a shoaling bottom or a single large rock. Fishfinders, named for their use in fishing, provide a two-dimensional picture of the bottom contours directly underneath the boat. With wide-beam-width transducers, the sonar spreads out more to the side and fore and aft, resulting in a larger area being displayed. Although they do give you more information about the bottom contours in your immediate vicinity, current models don't provide that much in the way of forward visibility. As such, they offer little beyond what the depth sounder does.

Recently, forward-looking sonar units have been introduced that can theoretically provide a picture of the bottom 100 feet in front of the boat. Although some cruisers have had good experiences with these units, others have reported poor reliability (the transducer is vulnerable to floating debris), hard-to-read displays, and limited real-world effective range. When these products become more reliable and user-friendly, they will make a welcome addition to the navigation station.

Until then, a handheld depth sounder that can be used from the dinghy offers a better solution for gunkholing in areas where the charts may not be detailed or accurate. These look like a small flashlight and work off dry-cell batteries. Some give a single reading whenever the button is pushed; others can be used to scan the bottom contours within 120 feet. We have found this a useful tool when exploring uncharted coves in Chile, using the dinghy to find a passage for the boat into a tricky inlet, or making sure we have sufficient depth off our transom at low tide when taking a stern line to trees ashore. Of course, a good old-fashioned lead line would work just as well, but it would be significantly more cumbersome and time consuming. These handheld depth sounders cost about $150. While the original models were not all that rugged, we averaged a couple years of use before they failed.

Compass and Binoculars

A high-quality binnacle-mounted compass with a light for use at night is the most basic and necessary piece of navigation equipment aboard. In addition, every boat should carry a good hand-bearing compass or a pair of high-quality binoculars with a built-in compass. Either can be used to take bearings on headlands to plot your position on a chart. Binoculars are critical for everything from sighting land at a distance to identifying shipping traffic, and a good pair should be carried aboard in any event.

The best binoculars for boat use are 7 × 50—that is, they magnify things seven times and have an objective lens 50 millimeters in diameter. Greater magnification only increases the shake caused by the boat's motion, making the binoculars virtually unusable unless they

BEYOND THE DEPTH SOUNDER: ADDITIONAL INSTRUMENTS

Instrument systems on boats are often problematic. Logs get fouled by barnacles or grass; birds or dirt can easily damage masthead wind instruments; and instrument displays, even those designed for the cockpit, are rarely watertight and are subject to failure. Although very few cruisers leave without a depth sounder, many budget cruisers make do without any other instrumentation and rarely miss it. The one exception is a Windex; a quick and accurate way to measure wind angle will prove useful just about every day aboard any boat. Buy a good one and install it properly.

On *Hawk*, we carry a full instrumentation system that's integrated with our GPS and our electric autopilot, and we have found that it helps us sail the boat better. If you decide to go with an expensive instrumentation system, the following attributes will increase its usefulness aboard:

Figure 8-1.
Our four instrument displays are protected under the hard dodger but visible from the helm and offer a full range of information to the helmsperson.

- **Flexible displays.** On *Hawk*, the instrument transducers give us apparent wind speed and direction, speed through the water, depth, water temperature, and our magnetic heading. The GPS provides course over ground, speed over ground, and all the normal steering information including distance and bearing to the waypoint. The various black boxes in the system use this basic information to calculate a vast array of information including true wind angle and direction and velocity made good dead upwind or downwind. Large LCD screens are used to display all these data. Any display can show any of the information gathered or calculated by the system. Though there are several programmed screens that come up at the push of a button, each display can also be separately programmed.
- **Large displays visible from the helm.** We have four displays mounted under our hard dodger (Figure 8-1), visible from the helm. Three of these can display information from the navigation system and instruments. The fourth is our autopilot control head. Most of our displays are what are called 20/20 displays. They can display two things simultaneously in a size that we can easily read in normal conditions from the helm 8 feet away. One of our cockpit displays is a 40/40 display. This carries a single value at twice the size of the numbers on the 20/20 displays. We can read this from the helm in pouring rain, sleet, or snow when we cannot make out the 20/20 displays.

(continued on next page)

- **Display at nav station.** We also have one display in the navigation station. We use this when filling out the log on passage, for seeing if the wind is increasing or decreasing during a gale, for making sure we have enough water under our keel at low tide, and for checking the water temperature to see if we feel like going for a swim!
- **Full integration with the autopilot.** Steering accuracy increases greatly if the autopilot is fully integrated into the instrument system. This allows the autopilot to steer using wind angle or cross-track error. The first improves steering efficiency in shifty wind conditions or when trying to make the best course upwind or downwind. The second keeps the boat on course even where there are strong currents, increasing safety.

On average, one major component has failed in this integrated system each year we've been cruising. If you choose to go with such a system, be prepared to continue to spend money on it, and make sure that all the components work independently so that you'll never be without an autopilot because part of the instrument system died.

Given the initial cost of the system and the cost of repairing it, we'd never say that the system has been a good investment. And yet we would not choose to give it up. We like the information it provides, and we like the convenience of multiple displays. We sail the boat better with accurate information on wind speed and angle, boat speed, and velocity made good. We make better routing decisions. We sail more safely and efficiently across a range of conditions using wind angle or NMEA modes to steer the boat. It is a luxury, no doubt about it, but one we'll continue to indulge in as long as we can afford it.

are stabilized. The large objective lens allows in enough light to ensure image clarity at dusk or dawn and at night when looking at a lighted target. Stabilized binoculars cost significantly more but provide a clear image even in heavy seas at much higher levels of magnification.

Charting Options

When it comes to safety gear, most lists start with life rafts and EPIRBs. But Evans and I would put the most up-to-date charts at the top of our personal list of safety equipment. Accurate charts keep us out of danger on a daily basis. As described in Chapter 15, of the eight times when we got ourselves in enough trouble that we might have seriously damaged or even lost our boat, four of them in some way involved problems with charting.

Knowing your position doesn't help you navigate unless you can plot it on a chart. Paper charts used to be the only option, but today your position can also be displayed on an electronic chart using a chartplotter or a computer. This eliminates the many errors that can arise when moving between the chart and the GPS. Table 8-1 compares the costs, pros, and cons of these three options.

In addition to these three charting options, cruising guides contain information on harbors and anchorages. The best include large-scale chartlets with more detail than the available charts and complete instructions on entering and anchoring based on local knowledge. Cruising guides also include essential information on everything from clearing customs to obtaining supplies, and we often carry two or three for the area we are cruising.

Over the course of a circumnavigation, any charting solution can easily exceed $10,000. Guides cost $20 to $50 each, and that also adds up. The expense has encouraged budget cruisers to find alternatives, not all of them legal. Cruisers regularly sell or exchange old charts. They also borrow charts and guides and photocopy them. On the digital front, several versions of pirated charts and charting software circulate throughout the cruising community.

As shown in Table 8-1, chartplotters and computer charting programs share many of the same pros and cons. One important difference between electronic charting options and paper charts has to do with using small-scale charts. A small-scale paper chart, such as might be used for an ocean passage, will show all isolated hazards even if they're somewhat out of scale to the chart—every little island, every shoal patch, every reef. But small scale on many electronic charts is also low resolution. Small hazards relative to the scale of the chart may not appear until you zoom in to a larger-scale view. Thus it's possible to plot a route from Tonga to New Zealand on an electronic chartplotter without seeing that it passes directly over Minerva Reef, an isolated, midocean atoll that's barely above sea level. This hazard would be obvious on any paper chart, and cruisers need to be aware of this shortcoming in the current generation of chartplotters. But the advantages of electronic charting far outweigh the few disadvantages, significantly increasing safety aboard.

TABLE 8-1. COMPARISON OF CHARTING OPTIONS

Type of Charting	Cost of Charts	Estimate of Costs to Cover the United States	Pros	Cons
Paper charts	• ~$12–$25/original • ~$3–$10/copy • ~$20–$100/regional chart kit	• From ~$2,000 using chart kits or photocopies to $10,000+ using waterproof original charts	• Not subject to failure • Not dependent on electricity • Local charts or photocopied charts can be inexpensive	• Difficult to stow • Information must be transferred to GPS and vice versa
Chartplotter	• ~$100–$300 per region	• From $5,000–$8,000 for charts in addition to $500–$2,500 for the chartplotter	• Shows vessel position on chart • Eliminates errors from transferring information • Greatly reduces chart stowage requirements	• Requires electricity • Subject to failure from variety of causes • Needs backup • Can miss hazards using small-scale resolution
Computer	• ~$200–$300 per region outside the United States (free U.S. electronic charts are now available)	• From $3,500–$7,000 for proprietary charts plus $500–$1,000 for the software in addition to the computer	• As for chartplotters; plus some programs offer additional features like ARPA, routing, and vector charts	• As for chartplotters; plus computer must be running to use, and computer is less robust than marine chartplotter

A chartplotter is a stand-alone unit, but for a computer to run charting software, it needs a navigation software product, a GPS unit, and a cable to connect the chartplotter to the GPS. Although both chartplotters and charting software come with a set of small-scale charts that cover the world, additional software has to be purchased by region to get detailed charting capability. This adds significantly to the initial purchase price, as can be seen in Table 8-1. This expense can be hard to justify if you will only visit a place one time and don't plan to cruise there extensively.

If you decide to use electronic chartplotting, you have to consider what you will do if the system fails. It hardly makes sense to spend thousands of dollars on electronic charts and then duplicate that expense buying paper charts to back them up. In the end, you need to come to a total charting solution that provides four things:

1. Small-scale charts for passagemaking and sailing in coastal areas you do not intend to cruise extensively.
2. Large-scale charts for areas you intend to cruise extensively, including detailed harbor charts.
3. Detailed harbor information at a level that may not be available on charts.
4. Backup charting options for electronic charts.

Table 8-2 shows four alternatives for meeting these four needs, arranged in order of increasing expense. There are cheaper and more expensive alternatives. We know a few hand-to-mouth cruisers who manage by scavenging out-of-date guides and discarded charts at marinas and yacht clubs and from other cruisers. We also know a few affluent cruisers who buy a complete set of electronic and original charts for every cruising area. But these are not viable alternatives for most of us.

TABLE 8-2. ALTERNATIVES FOR MEETING CHARTING NEEDS

Approach	Small-Scale Charts	Large-Scale Charts	Harbor Details	Backup
Budget	Photocopied NGA[1] chart kit	Photocopied NGA charts for main harbors/select locally produced charts	Cruising guide	Not needed
Paper only	Photocopied NGA chart kit	Locally produced, full-color charts[2] of all areas to be visited	Locally produced charts, cruising guide	Not needed
Paper plus	Chartplotter/computer charting	Locally produced charts of all areas to be visited	Locally produced charts, cruising guide	Photocopied NGA chart kit
Electronic with backup	Chartplotter/computer charting	Regional software for chartplotter/computer charting	Regional software, cruising guide	Photocopied NGA chart kit, select locally produced charts

[1]NGA stands for the National Geospatial-Intelligence Agency, formerly the DMA (Defense Mapping Agency). Unlike British Admiralty charts, U.S. charts are not copyrighted and can be photocopied.
[2]Most countries produce charts for their coastal waters, which are usually significantly less expensive than NGA or British Admiralty charts.

THE CRUISER'S LAPTOP

Does a computer make sense aboard? If you already have a laptop computer and use it regularly, it will quickly become an integral part of your life afloat. If you aren't computer literate but want the most convenient way to stay in touch with family and friends and get good access to weather information, it's time to take a computer course.

A computer will be the brain of the integrated navigation station of the future. Today, in addition to the word-processing, record-keeping, and entertainment functions of home computers, onboard computers provide electronic chartplotting, weather information through an SSB or satellite communications system, worldwide e-mail through the SSB or satellite networks, and tide and navigation information (see the Onboard Software section in the resources for this chapter in Appendix 1 for a list of some useful programs and websites where they can be obtained). All that capability requires minimal electrical consumption and little if any investment in software.

In addition, a computer provides a wealth of information. Reference books on CD are easily searchable, and lighter, smaller, and more water resistant than paper versions. We carry the last five years of the Seven Seas Cruising Association *Bulletins*, *Bowditch* on CD to answer any navigational questions, and the *Merck Manual* on CD for medical information, diagnosis, and treatment. We also have two DVD encyclopedias (*Britannica* and *Encarta*). These have proven valuable when we have a question about some place we are visiting or some item of news.

Our computer also makes possible the viewing and storage of digital photos and allows us to pass them on to others through e-mail or CDs. It entertains us with games and movies, and lets us entertain others with a slide show of the places we've visited.

But laptops need to be protected from the corrosive and concussive marine environment. At sea we normally store the laptop in a shockproof, waterproof case (available from camera stores or marine chandleries). When we get the laptop out we fasten it with Velcro to the outboard side of the navigation table, easily accessible but out of the way of normal chart work. We have found that the Velcro attachments hold even in rough conditions and do not place any major obstacles on the navigation desk when the computer is stowed away. The first laptop we had on the boat lasted only three years. Each successive laptop has enjoyed a longer life than the last, and we're now up to a life expectancy of a bit over five years. That seems comparable to the marinized desktop units with waterproof keyboards.

We run the laptop off its own battery when getting weather faxes or doing e-mail by radio, as this minimizes RF noise. Several of our friends have serious trouble getting faxes with their desktop computers due to RF noise produced by the computer or the inverter/generator that powers it.

There are two specific connection issues. First, getting the most from a performance-routing package requires that the computer be equipped with two remote ports. A third would be useful for doing e-mail by radio, or for keeping an Iridium phone or Sat-C unit permanently connected. In the past, these have been serial ports, but many of the applications can now use USB ports. Second, we have managed with the simplest possible cables, but on many boats additional "black boxes" are needed to minimize RF noise. We suggest trying simple cables first, and if you experience RF or feedback problems, get help from one of the professionals who supply software for onboard applications.

We have a computer aboard because we write for a living and need to submit articles by e-mail. We don't depend upon it as the only source for any essential information—weather, navigation, tidal, or celestial—but we enjoy having it and wouldn't choose to sail without it.

HIGH-SEAS COMMUNICATIONS

For most cruisers, communications systems fall into two distinct categories: inshore, or what we use when we are in port or near shore; and high seas, or what we use when we are offshore or cruising remote areas with no communications infrastructure. High-seas communications, which require that equipment be installed in the boat before you leave, are considered in this chapter. Inshore communications do not require special equipment and are considered in Chapter 12.

Table 8-3 shows the universe of communications needs and the equipment available to meet those needs on the high seas.

TABLE 8-3. HIGH-SEAS COMMUNICATIONS EQUIPMENT

Communications Capabilities	Radio-Based Systems				Satellite-Based Systems		
	VHF Radio	Short-Wave Receiver	Marine SSB	Ham SSB	EPIRB	Sat-C	Sat Phone
Emergency signaling	LOS		✓	✓	✓	✓	✓
Emergency advice	LOS		✓	✓		✓	✓
Weather	LOS	✓	✓	✓		✓	✓
Boat-to-boat radio	LOS	R	✓	✓			
Boat-to-shore radio	LOS	R	✓	✓			
Boat-to-boat telephone							✓
Boat-to-shore telephone				✓			✓
E-mail			✓	✓		$	✓
Electronic position reports			✓	✓		$	✓
Internet							$$
Entertainment		✓	✓	✓			

Key: LOS = communications within line of sight only; R = receive only, no transmit capability; $ = expensive compared with other options; $$ = prohibitively expensive for most cruisers.

As high-seas communications have improved, they have taken on an ever-expanding role in obtaining weather information. Before finalizing the communications equipment aboard your boat, you will need to decide what weather information you want to receive on board and how you want to receive it. Table 19-7 compares the types of weather information and costs of obtaining it using the various high-seas communications systems. The widest range of weather information can be accessed using an SSB or ham radio in conjunction with a laptop computer.

Radio-Based Systems

Of the high-seas communications equipment shown in Table 8-3, the VHF (very high frequency) radio is both the most limited and the only piece of communications equipment it's virtually impossible to do without. The VHF has become the worldwide standard for line-of-sight communications between vessels at sea and between vessels and land stations. In selecting a VHF, make sure to buy one with "International–U.S." capability to get a full range of frequencies for global use. In addition, a handheld waterproof VHF or a remote cockpit microphone for the main VHF will allow you to communicate with marinas and officials while in the cockpit.

Long-distance radio communications require a high-frequency (HF) radio. As Table 8-3 shows, marine SSB and ham provide a full range of offshore communications capabilities. Many offshore voyagers would rank an HF radio near the top of the list of essential equipment.

Although it can be used to contact rescue services or medical personnel in an emergency, HF radio plays a much more central role in daily life. It serves as the offshore voyager's party line, an information highway linking cruisers the world over. Marine nets operate in every ocean, providing port information, weather forecasts, and route tips. Friends keep their own radio schedules or "scheds" with others in the same ocean. HF radio offers access to a wide range of weather services and keeps cruisers in touch with the rest of the world through shortwave broadcasts from the BBC (British Broadcasting Company) and VOA (Voice of America). In the last decade, HF radio has become the standard high-seas e-mail

THE SHIP'S BAROMETER

Good medium- to long-term weather forecasts depend entirely upon communications systems, with one critical exception. The barometer is to a synoptic weather chart what a depth sounder is to a navigation chart: it provides critical information on the vessel's position. But where a depth sounder helps fix the boat's position on a chart, the barometer places the boat with respect to the procession of weather systems sweeping over the face of the globe. It remains a critical piece of equipment aboard, essential to interpreting all the weather information now available to a crew at sea, and should be carried by every cruising boat.

Like a depth sounder, a barometer gives you a single reading at a point in time, though you can track trends just as you can with a depth sounder. And like a depth sounder, it's not really predictive and doesn't tell you much without a chart. Just because depths have been increasing doesn't mean there isn't a single large rock ahead that could harm your boat. Just because the barometer is steady doesn't mean you won't get a lot of wind, and just because it is dropping quickly doesn't mean you will.

As discussed in the What the Barometer *Really* Tells You sidebar in Chapter 19, it takes a synoptic weather chart to interpret what the barometer is saying. In conjunction with wind direction and an idea of the weather patterns in your area, barometric readings can give you plenty of valuable information. They can tell you which side of a front or a low you are on and can give you an idea of how soon the system will pass over you and in what direction the wind will shift. Your barometer signals the approach and retreat of low- and high-pressure systems and tells you how far away you are from their centers. It gives you time to prepare for a serious blow and allows you to relax when the worst is over.

Although any good barometer will do the job, we prefer one that displays more than the current reading. These range from reasonably priced home or office wireless weather forecasting stations with digital displays to old-fashioned barographs with a rotating drum that cost $1,000 or more. Any of these will allow you to see the trend at a glance—to know when the barometer has bottomed out and how quickly it is rising or falling.

solution for cruisers as well. SSB or ham radio is likely to remain the central high-seas communications system on most boats, because both installation and transmission costs are substantially lower than the alternatives, as shown in Table 8-4.

Ham radios cost less but can only be used for amateur radio, whereas marine SSB can be used for business or commercial purposes. To obtain a license to operate a marine SSB means filling out a few forms, but to get a ham license means passing an exam. The test requirements have been getting easier, but it still takes some effort. The two types of HF radio use the same overall radio frequency spectrum, with each assigned adjacent blocks of frequencies within that spectrum. Radios come configured for one set of frequencies or the other, though an internal modification can make either type capable of receiving the entire range of frequencies. Although it is legal to use only the frequencies you're licensed for, no one would be likely to quibble in an emergency.

Besides ham radio being less expensive than marine SSB, ham users can be patched into a local phone system to make local phone calls (though this is not legal in all countries). To do this means finding a ham operator in the same calling area as the person you wish to speak to, which works far more often than it sounds as if it would. If you intend to conduct business over the radio (in theory, including business-related e-mails), you should install a marine SSB. Otherwise it will be less expensive, though a bit more time consuming, to buy a ham radio.

To transmit well, any HF radio requires a properly installed antenna, usually one incorporated into the vessel's backstay. Most problems with these radios result from incorrect installation. Make sure to obtain expert assistance to equip your boat with an HF radio or to sort out one that's not functioning well.

To send and receive e-mail over an HF radio requires four things: a computer, a specialized modem, some software, and specialized land-based servers. The modem may cost as much as $1,250 and must be configured for the protocol supported by the land-based servers. If you're using a ham radio, you can be patched into a Winlink or Netlink server by a shore-based ham. Though your modem may come with a software package, most hams prefer Airmail (see the Onboard Software section in the resources for this chapter in Appendix 1). If using a marine SSB, you can access land-based "host" stations run by a nonprofit cruising group directly on designated frequencies. Users pay a fixed fee of a couple hundred

TABLE 8-4. COMPARISON OF HIGH-SEAS DATA COMMUNICATIONS OPTIONS

Option	Examples	Hardware Cost[1]	Data Transmission Rate	Cost for Data Transmission	Pros	Cons
Radio	Marine SSB or ham	$500–$1,500 for ham; $2,000–$3,000 for SSB; ~$800–$1,250 for Pactor modem	2,700 bps (5,000 with compression)	~$200 annual fee for SSB, free for ham	• Inexpensive • Full range of communication capabilities	• Transmission depends on radio propagation—may be times when cannot transmit at all • Ham radio requires license • Cannot conduct business over ham radio
Satellite data only	Inmarsat-C	$3,000	600 bps	25¢/32 characters	• Bulletproof equipment • Worldwide coverage • Free weather forecasts • Push-button distress signaling • Not subject to propagation problems	• No voice communications • Expensive—use for telex-style messages only • Accepts e-mails from registered senders only • Unit must be on to receive messages—electrical draw
Satellite phone	Globalstar, Iridium, Inmarsat Mini-M	$500–$6,000	2,400–9,600 bps	$1–$1.60 per minute plus monthly fee; special plans can reduce cost	• Full range of communication capabilities • Not subject to propagation problems • Some units offer worldwide coverage	• Can be expensive ($300 per month or more) without good compression software

[1]Equipment only; does not include installation costs.

dollars annually for this service, called SailMail, and use the software package it provides. Whether using ham or SSB, once you're connected to the shore-based server, the software program accesses your mailbox and retrieves messages and passes any messages in your outbox to the server to be distributed. As an added bonus, with either system you can post position reports on the Internet so that friends and family can follow your progress while you are on passage. The Onboard Software section in the resources for this chapter in Appendix 1 provides contact information for both SailMail and Winlink.

Radio-based systems provide limited, cost-effective, onboard e-mail capability that meets the needs of most cruisers. But don't expect to get the kind of e-mail capability you have in your home. Transmission rates for high-seas e-mail are agonizingly slow by shoreside standards, as shown in Table 8-4. The boat systems are too slow to send and receive anything but short- to medium-length, plain-text e-mails. Servers for high-seas systems generally strip off any attachments and use complex compression algorithms to increase transmission efficiency. Some providers (including SailMail) restrict the size of messages sent and received or total use per day. In addition, radio-based systems are dependent upon propagation of radio waves through the atmosphere to work. There may be times when atmospheric conditions will not allow you to get through, or when others broadcasting in your vicinity with a stronger signal block you from getting onto the system in the first place.

HF radio provides cruisers with a low-cost, well-established, reliable, specialized communication system that meets almost all their high-seas communications needs, but not all voyagers carry one. Some can't afford it. Others don't like the intrusion of "scheds" into the privacy of passagemaking. For these people, a world-band receiver offers most of the capabilities of a transceiver at a very affordable price. Although they cannot be used to "chat" with other cruisers or call for help, they allow the crew to receive all the short-wave bands, so they can listen to the marine nets and offshore weather forecasts. More expensive units can be connected to a laptop computer to receive weather faxes. A world-band receiver provides time signals for sextant sights and offers hours of entertainment from the BBC and VOA. Unlike a high-frequency transceiver, a world-band receiver can be run off dry cells in the event something goes wrong with the electrical system. It also makes a good backup to an HF radio.

Satellite-Based Systems

Satellites carry an increasing amount of communications traffic worldwide, which has dramatically changed high-seas communications. Though not originally designed for the offshore sailor, satellite-based communications systems offer global coverage and reach for everything from emergency signaling to full telephone capabilities.

EPIRBs were discussed in Chapter 7. Although their capabilities are limited to emergency signaling, they play a critical role as the communications system of last resort. Two other types of satellite-based communications systems get used regularly aboard cruising boats, as shown in Table 8-3: Inmarsat-C, which provides limited data transmission coupled with emergency signaling; and satellite telephones, which offer a full range of communications capabilities.

Inmarsat-C

Inmarsat-C (or Sat-C) was specifically designed to meet minimal GMDSS (Global Maritime Distress and Safety System) requirements for receiving maritime safety information and transmitting distress signals and information from any place on the globe. It has no voice capability but can transmit and receive data. The hardware has a built-in GPS and consists of an antenna and a "black box" that stores messages until they are downloaded to a computer. A distress button on the face of the unit automatically transmits the vessel's position and identity when activated.

In addition to receiving weather and safety information, Inmarsat-C can also be used to send and receive telex-style e-mails. To do e-mail using Inmarsat-C requires a computer and a service provider. With Inmarsat-C, the sender pays, which means that you can send mail to anyone you like (and get charged for it), but only senders registered with your service provider can send mail to you. They will then be charged for any e-mails they originate.

As shown in Table 8-4, Inmarsat-C is both slower and more expensive than any other high-seas e-mail option. To send this page as plain text would cost between $35 and $40. Most Inmarsat-C service providers do not offer store-and-forward capability, so the unit must be left on to receive messages. Since it draws a bit more than an amp per hour, this will have a meaningful impact on low-energy-consumption boats.

Given the expense of the hardware and the other disadvantages in comparison with HF radios, Inmarsat-C is not common on tropical cruising boats. Yet the system does offer advantages, and those cruisers who have it aboard are often quite dedicated to it. First, because it was developed for the commercial ship market, the equipment is virtually bulletproof. Second, it provides free weather forecasts several times per day that, unlike weather faxes, marine nets, and high-seas radio broadcasts, are not dependent upon radiowave propagation. Third, the limited e-mail capability is perfect for telex-style messages on passage: "41 37S 167 20E. Good wind, all well. ETA Sat." High-latitude cruisers are more likely to carry Inmarsat-C because of its worldwide coverage, free weather broadcasts, and reliability.

Satellite Telephones

Satellite phones work like cellular phones, with satellites playing the role of land-based towers in receiving and transmitting the signal. Like any telephone, satellite phones offer a full range of voice capabilities, and those equipped for data transmission can also be used for accessing the Internet to do e-mail or download weather information (see the Downloadable Weather Files section in Chapter 19). HF radio can be considered the cruiser party line, while satellite phones provide the equivalent of private telephonic high-seas communications—at a price.

The handsets and hardware for satellite telephones range from $500 up to $6,000. Using standard plans, airtime costs from $1 to $1.60 per minute in addition to monthly fees of $20 to $30 for some services.

Iridium provides global coverage using handsets produced by Motorola. The handsets cost $1,500 new, not including a data kit to use the phone for e-mail or an external antenna and docking station to mount the phone in the navigation station. The handsets are larger and bulkier than cell phones. As with a cell phone, you have to buy a calling plan from a service provider, and different providers offer different rates. Standard plans charge $1.50 per minute plus a monthly fee of $20 or $30. Specialized plans can reduce this to $1 a minute or a bit less and eliminate the monthly fee, but these impose certain restrictions. Local carriers may charge outrageous rates for calls to Iridium phones, many times more than charges for international calls. Calling cards for use from landlines can be purchased that access the Iridium system directly and significantly reduce the cost.

Globalstar offers a regional satellite service with interesting features. Coverage includes waters up to 200 miles off the coasts of North, Central, and South America, much of the Caribbean, Europe, Australia, and New Zealand. The handset is very similar to the Iridium handset but costs only about $600. Airtime costs about $1 per minute plus a $20 monthly fee, though special plans can bring the cost per minute under 20 cents. Data transmission rates are up to twice as fast as Iridium. When within a cellular coverage area, the phone can be set up to allow calling on the cellular network instead of over the satellite system, further reducing costs and increasing speed. For those planning on spending a number of years in a coverage region, Globalstar makes sense. But cruisers who want a satellite phone that offers full global coverage will need to go with Iridium.

E-mail with any of these systems requires a cable to connect the phone to the computer, software, and an Internet service provider. Although it is possible to use this system just as you would a cell phone or a phone onshore to browse the Internet or to check e-mail, the incredibly slow data rate and the cost per minute make this highly inefficient and prohibitively expensive. Just downloading a Web page can take 10 minutes or more. Specialized Internet service providers have created e-mail services designed for the limitations of satellite phones (see the Onboard Software section in the resources for this chapter in Appendix 1). These provide programs that dial in to the server, retrieve any mail waiting there, pass along any messages to the outbox, and then shut down. The most sophisticated of these have been carefully designed to cut airtime to the absolute minimum. Using one of these programs, we can send and receive a half-dozen e-mails in about a minute, as opposed to 8 minutes or more when we went directly to our own ISP, making it affordable for us to send and receive e-mail daily on the boat.

Although satellite phones do not provide access to marine nets or short-wave radio broadcasts, they do offer a full range of private data and voice communications that are not dependent on propagation. As with cell phones, we have very occasionally had poor reception and sometimes been cut off in mid-conversation, but we have always been able to get through. If you plan to run a business from the boat or need to be certain of staying in touch with an older parent or a troubled child, satellite phones give you that capability at a surprisingly reasonable cost.

COMFORTS AND CONVENIENCES

While most experienced cruisers would agree with the "keep it simple, stupid" (KISS) philosophy, the definition of "simple" varies a great deal from crew to crew. What some call a simple boat carries a variety of goodies and gadgets meant to make life easier aboard, including watermakers, generators, air-conditioning, washer/dryers, and so on; these crews argue that because they can do without any of these items, the boat is still simple. For others, "simple" means no electrical or electronic equipment of any kind (with the possible exception of a GPS), no engine, and no sail handling equipment. These crews view a simple boat as one on which they can fix absolutely anything on board. Most of us fall somewhere in between. We have to trade off our desire to take all our shoreside comforts with us against the cost and complexity of doing so. Each crew has to come to their own particular balance between comfort and complexity that can be sustained over the long term.

Refrigerators/Freezers

Of all the things discussed in this section, refrigeration comes the closest to being a liveaboard standard. In the last decade, refrigeration systems have become much more reliable (though they still break—see Table 8-8) and much more affordable (though they're still expensive). The best are able to keep food frozen for weeks or months at a time, allowing the crew to provision and cook more or less as they would ashore and to have ice for their drinks and cold beer on demand.

But such luxuries come at a price. Refrigeration systems cost anywhere from $700 up to $10,000 or more. On most boats, the engine or generator will need to be run a minimum of 2 hours per day for engine-driven or AC refrigeration. Twelve-volt refrigerators average about 50 amps per day in electrical usage, which will utilize about 200 amp-hours (Ah) of battery capacity.

As discussed in the Galley Upgrades section in Chapter 4, an efficient, reliable refrigeration system starts with a well-insulated icebox. Inexpensive and less efficient refrigeration equipment can be made to work quite well with a heavily insulated box, but the best and most expensive equipment will give disappointing results if the box is underinsulated.

The key component of any refrigeration system is the compressor, which can be run directly off the boat's engine or by an electric motor of some kind. It can be used to cool an evaporator, as in a refrigerator ashore, or to freeze a *holding plate*—a large, metal plate filled with eutectic fluid similar to the gel used in ice packs. These elements can be combined in a variety of ways to come to the most appropriate solution given the boat's electrical capacity and the crew's budget.

Compressors can be air cooled or water cooled. For refrigeration to function in the tropics, where temperatures will often exceed 90°F and rise even higher in the enclosed space where the compressor is working, water cooling of some sort is essential.

Deciding on a refrigeration system can easily devolve into a chicken-and-egg question. The decision of how to run the compressor depends upon the configuration of the boat's electrical system, as shown in Table 8-5. Yet on many boats the energy requirements for fridges and freezers represent half or more of the daily energy consumption of the boat, so the decision to carry refrigeration will often force an upgrading of the entire electrical system (see the Electrical Systems for Three Offshore Voyagers section in Chapter 9).

In DC systems, the compressor runs off a 12-volt motor, which will draw 4 to 6 amps and run up to 10 hours a day in the tropics. To meet this daily electrical draw takes a large battery bank and efficient charging systems. Alternatively, the compressor can be belted off the engine

TABLE 8-5. WAYS TO RUN REFRIGERATION				
Refrigeration	**Compressor Run By**	**To Cool**	**Power Required in Tropics[1]**	**Electrical System**
Engine driven	Engine	Holding plate	Run engine ~2 hours per day	Less than 200 Ah battery capacity
DC electrical	12 V electric motor	Holding plate or evaporator	25–70 amps @ 12 V per day; average ~50 amps	~400–600 Ah battery capacity
AC electrical	120 or 240 V electric motor	Holding plate or evaporator	Run generator several hours per day	AC generator

[1]For a 6-cubic-foot box with 4 inches of insulation and an ice-cube-tray-sized freezer compartment.

or a generator, or it can run off the AC power supplied by a generator. More sophisticated—and costly—systems combine these options. For example, an engine-driven holding-plate system may be used to cool the box whenever the engine is running; when the engine is shut off, a DC system will take over to keep the refrigerator and freezer at operating temperatures. Or the compressor can run on AC power whenever the generator is on; when it's off, it reverts to DC power. These combination systems allow the crew to leave the boat for a period of time without emptying the fridge and freezer or arranging for someone to run the engine or generator.

On boats equipped with generators that will be used several hours each day to generate electricity and make water, AC electrical systems will provide low-cost, relatively efficient refrigeration equivalent to home systems. Most boats set up this way are even equipped with small front-loading refrigerators and freezers instead of the typical boat icebox. On boats with little electrical draw equipped with minimal DC systems, engine-driven refrigeration will be the only option. The engine will need to be run about 2 hours per day in the tropics to keep things from spoiling even in a well-insulated icebox.

Between these two extremes, the optimal solution is less clear-cut. It would seem that an engine-driven system would be significantly more efficient than a DC system, in which engine output gets converted to electrical energy that is stored in batteries before being used to run a compressor, with efficiency losses at every step of the process. But the true measure of efficiency in this case is not total energy use but engine running time.

DC electrical systems provide two advantages over engine-driven systems in this respect. First, they can run on electricity generated by other charging sources such as wind generators or shore power, reducing the engine's share of the energy generation load. Second, on boats with efficient engine charging systems, the 50 amps or so DC refrigeration draws each day can be generated in an hour of running time versus the 2 hours per day it would take to fully freeze holding plates in the tropics. Constant-cycle DC systems can therefore reduce the engine running time dedicated to the refrigeration system from the 2 hours required for holding-plate systems to between nothing and 1 hour, depending on other charging sources.

In addition, constant-cycle DC systems use a thermostat to maintain near constant temperatures, while temperatures can fluctuate significantly over the course of the day with non-thermostat-regulated holding-plate systems. This leads to uneven cooling in the refrigerator or freezer and problems with food spoilage. Finally, although holding plates are more efficient than evaporators, evaporators are considerably cheaper. For the price of any holding-plate system, you could buy three or even four inexpensive constant-cycle DC evaporator systems. For all these reasons, constant-cycle DC refrigeration has become the preferred solution.

Table 8-6 summarizes the four most common refrigeration options on cruising boats. Crews on boats without generators but with large battery banks and multiple charging sources generally end up picking one of the middle two. Though expensive, combination engine-driven/DC systems offer an alternative to upgrading the electrical system on boats with moderate electrical charging and storage capacity. The engine does the bulk of the work during the daily recharging of the batteries, so the DC system uses a minimum of electricity to keep the refrigerator cool the rest of the time. If the boat has a large battery bank and multiple charging sources, the all-DC system represents a more efficient solution.

Watermakers

Watermakers are even more expensive than refrigeration. But unlike refrigeration, where there is no real alternative if you want cold storage in the tropics, in most of the world there are a number of alternatives for getting fresh water on board, and most of them are either free or very inexpensive. Water will be available every few weeks in one form or another most of the time. This is not the case in a few arid areas like the Bahamas, parts of the Mexico coast, and the Tuamotus in French Polynesia.

TABLE 8-6. COMMON REFRIGERATION SOLUTIONS

Refrigeration Options	Compressor Cools	System Runs	Approximate Cost[1]	Most Often Used by Boats With
Engine-driven holding plate	Holding plate	When engine running	$2,500–$3,000	Limited battery capacity
Combined engine-driven/DC units	Holding plate	When engine running and on a thermostat rest of time	$5,000	~200–400 Ah battery capacity and limited charging sources
Constant-cycle DC	Evaporator	Continuously on a thermostat	$700–$1,500	400+ Ah battery capacity and multiple charging sources
Combined AC/DC	Evaporator	On AC when generator running; on DC rest of time	$600–$1,500	AC generator as primary charging source

[1]Equipment only (for a refrigeration system sized to cool a 6-cubic-foot box with 4 inches of insulation and an ice-cube-tray-sized freezer compartment; a separate freezer can double the cost); does not include installation costs.

The expense of a watermaker begins to justify itself if you intend to cruise extensively in such areas, if you plan to have guests aboard frequently, or if your water tankage is limited to less than 25 gallons per regular crewmember (see the Do You Need a Watermaker? sidebar in Chapter 14).

The reverse-osmosis watermakers most commonly used on cruising boats work by pressurizing salt water and forcing it through a semipermeable membrane that removes not only the salt but also bacteria and viruses. These watermakers depend upon two things to operate: an energy source that can generate the necessary pressure (around 800 psi), and a membrane that is free of contamination by any number of substances.

As with refrigeration, the pump that drives the system can be belted off an engine or an alternator or run on DC or AC electrical power. Engine-driven pumps for watermakers are large, about the size of a big compressor, and don't fit conveniently aboard most cruising boats. Instead, most watermakers in widespread use today run on either DC or AC electricity.

Since output closely correlates to electrical usage, the highest output can be obtained using AC watermakers (Table 8-7). If run when a generator is being operated, these can deliver 20 gallons or more per hour. Twelve-volt watermakers have become increasingly efficient and reliable, and the high-output units can make quite a lot of water for their size. Though still expensive, they offer a viable alternative for boats that do not carry a generator. Deciding between these options depends upon how much water you will use in a day. The Freshwater Management section in Chapter 14 discusses water usage in detail and will help you form a realistic expectation of your water needs.

Friends of ours with AC watermakers aboard generally need to run the generator for 2 to 4 hours per day for refrigeration, air-conditioning, and charging. In most cases, they produce a surfeit of water in that time. Their boats are fitted with heads and deck washdowns that use fresh instead of salt water, and they do not think twice about taking two or three showers a day. On the other hand, the lowest-output DC watermakers that produce 1.5 gallons per hour (gph) will do little more than meet the drinking water needs of a couple if run for 2 hours every day. These units can supplement other sources of water or serve as a backup to meet basic needs if water is not available any other way.

High-output DC watermakers can make a real difference to life aboard, relieving the crew of the need to fill

TABLE 8-7. TYPES OF WATERMAKERS

Watermaker Type	Output (gph)	Electrical Consumption	Approximate Cost[1]	Comparative Size/Weight
Low-output DC	1.5–4	4–8 amps @ 12 VDC	$2,500–$4,000	Bicycle pump/10–30 lb.
High-output DC	7–12.5	18–30 amps @ 12 VDC	$4,000–$5,000	Briefcase/35–100 lb.
AC	18–25	25–30 amps @ 110 VAC	$7,000–$9,000	Small generator/200+ lb.

[1]Equipment only; does not include installation costs.

up shoreside while letting them use more water per day than their tankage would allow. As with refrigeration, high-output DC watermakers will have a significant impact on the electrical system. On average, 12-volt units use between 2 and 3 amps per gallon produced. Every 10 gallons of water produced daily will use approximately 100 Ah of battery capacity. The battery bank and charging sources need to be able to absorb the daily demand in addition to other normal loads. These watermakers are large enough that it will be a challenge to find room for them on boats 40 feet and under. Modular units (as opposed to the fully framed units, in which all the components are encased in a large frame) are easier to find room for but a bit more complicated to install.

In considering whether or not to install a watermaker, be realistic about its shortcomings. Watermakers are sensitive to oil, sewage, and dirt, and should never be run in a crowded harbor. When the system is not going to be used for more than a week, the membranes need to be "pickled" to protect them from drying out or becoming contaminated. According to a survey of SSCA members, more than one-third of watermakers break every year (Table 8-8). They are more prone to breakage than any other piece of equipment on board, and parts are expensive. The few people we know who have never had a breakdown service the watermaker regularly, pickle it whenever there's a chance it won't be used, and never use it in harbor or when sailing coastally if there's any question about the water quality.

TABLE 8-8. PRODUCTS MOST PRONE TO BREAKDOWNS (SSCA 2005 EQUIPMENT SURVEY)

Product	Percentage of Units That Break Down Every Year[1]	Sample Size
Watermakers	36.1	83
Water generators	28.4	7
Heads	16.3	127
Wind generators	15.0	68
Barbecues	14.5	97
Propane detectors	13.5	38
Autopilots	13.3	146
Refrigerators	12.2	100
Cabin lights	11.6	66
Freezers	11.5	63
Inflatable dinghies	11.4	50
Cabin fans	10.2	232
Diesel generators	10.0	34

[1]Weighted average percent of units that break each year based on survey of 159 SSCA members in 2005.

Heating and Cooling Systems

Over the course of a tropical circumnavigation, you may need a heating system a couple of times—for the first few weeks after arriving in temperate latitudes from the tropics and the last few weeks before departing for the tropics again. If you spend that time in a marina, a small space heater plugged into shore power will most efficiently meet your needs. If you're cruising, a bus heater plumbed into the engine cooling system (see the Problem-Proof the Engine and Propulsion System section in Chapter 4) and/or a large kerosene lantern will keep the main cabin warm. Unless you're planning to spend a winter above 35° north or south latitude or to cruise extensively above 45°, you don't need to install a heater.

You also don't need to think about installing air-conditioning for a tropical circumnavigation if your boat is well ventilated (see the Improve Your Boat's Ventilation section in Chapter 4). You will be out of the tropics during the heat of the summer, and during the winter months the breeze will keep the boat cool. If you plan to spend the summer in the tropics, particularly if you plan to spend it in a marina, you may need to buy a small air conditioner that can be plugged into shore power and installed through a hatch. Adding a full air-conditioning system radically increases boat complexity, because it means adding or upgrading a generator and adding through-hulls and pumps. The compressor and evaporator units take a large chunk of stowage space, and more space is lost to ducting running throughout the boat. So unless your boat is highly compartmentalized, poorly ventilated, and fitted with large expanses of fixed glass, avoid putting in air-conditioning.

If you are planning extensive cold-weather cruising, a heater will move close to the top of the list of essential equipment. Not only does it keep you warm, but it helps dry wet clothes and boots, keeps the cabin free of condensation, and prevents hypothermia. The three types of heaters commonly used on high-latitude cruising boats are summarized in Table 8-9.

Do not install an open-flame propane or alcohol heater on a boat. These create tremendous amounts of condensation. In a humid climate such as is found through much of the high latitudes, water will be dripping off every interior surface after a few hours of use.

TABLE 8-9. HEATING SYSTEMS FOR CRUISING BOATS

Heater Type	Fuel	Approximate Cost[1]	Pros	Cons
Solid-fuel heaters	Wood, coal, peat	$150–$500	• Simple • Inexpensive • Use no electricity	• Can be smoky • Have to find fuel • Need fans to help circulate heat • Difficult to run underway
Drip-diesel heaters	Diesel or kerosene	$700–$1,000	• Simple • Reliable • Use no electricity	• Can be smoky if not properly vented • Heat needs to be circulated using fans or hot-water system • Difficult to run underway
Forced-air diesel heaters	Diesel	$2,500–$3,500	• Soot and smoke free • Even heating • Can run while underway	• More complicated • Expensive • Use electricity • Ducting takes up stowage space
Hot-water diesel heaters	Diesel	$2,500–$4,000	• As for forced-air heaters, plus hose runs are smaller and more compact	• As for forced-air heaters, plus small radiators need to be installed around the boat

[1]Equipment only; does not include installation costs.

Solid-fuel and drip-diesel heaters are both simple, consisting of a small version of a potbellied stove ducted to the outside of the boat. The heat radiates from the stove and may need to be circulated by fans or a hot-water system to get the entire boat warm. If not properly set up and vented, the wind can blow smoke and soot back down the stack and even put out the flame. These systems can be problematic to set up for use underway, especially when the boat is heeled. But for smaller, simpler boats drip-diesel heaters offer the best solution because they take up little space, work efficiently, and do not use electricity.

Many of these problems are avoided with forced-air or hot-water heaters, which pass heated air or water through ducting running inside the boat and release heat through registers or radiators placed in various locations. This heats the boat much more evenly, and registers or radiators can be closed off in unused areas. The system can also be used when underway unless the boat is heeled past about 30 degrees. Forced-air and hot-water heaters are expensive and complicated, however, and require electricity in addition to diesel fuel. Forced-air or hot-water heaters suit larger, more compartmentalized boats with moderate to large battery banks.

Crews on large boats that require air-conditioning and are equipped with generators can install a heat-pump system capable of heating or cooling the boat. One big advantage of these systems is that they dehumidify as they heat, eliminating condensation and drying the boat in cold, wet climates. Provision will need to be made for getting rid of the water produced. With 90 percent humidity, a 16,000 Btu system will generate 5 to 10 gallons of condensate per day.

Other Goodies and Gadgets

An offshore boat can be equipped with an almost endless list of goodies and gadgets designed to make life more comfortable aboard. Most cruisers would put hot-water heaters and pressure water near the top of the list, viewing a hot shower more as a necessity than a luxury. Either the engine/generator cooling water or AC electricity can be used to power a marine water heater. Using electricity to heat large quantities of water takes huge quantities of power, however. Although not a problem when plugged into shore power, when "off the grid" most crews' hot showers come from heat supplied by the engine or generator cooling water. This works as long as the engine or generator is run once or twice a day, but when you're sitting at anchor in the tropics for long periods of time, solar showers provide a simple, effective alternative to hot-water heaters.

Table 8-10 lists some galley conveniences along with their costs and electrical draws. Appliances require AC power, so they must be used when a generator is running or with an inverter. The prices quoted are for marine units designed to minimize space, power, and water. Much less expensive models can be purchased from home appliance stores, though they may not last as long in the marine environment.

Washers are a real convenience aboard but require installation space, a watermaker to supply the water, and enough power generation capability to cover the needs of both the watermaker and the washer. Dryers require significantly more power or else they take a long time to dry things—up to 4 hours for some models. In the tropics,

TABLE 8-10. GALLEY GOODIES AND GADGETS

Equipment	Approximate Cost[1]	Electrical Draw	Water Consumption for One Cycle
Microwave oven	$150–$200	7–12 amps @ 120 VAC	
Washer/dryer	$1,000–$1,500	13 amps @ 120 VAC	12–20 gal.
Dishwasher	$300–$500	4–6 amps @ 120 VAC	3–8 gal.
Trash compactor	~$600	4–6 amps @ 120 VAC	
Propane barbecue	$150–$600		

[1]Equipment only; does not include installation costs.

everything will dry in a couple of hours in a brisk trade wind breeze, so doing without a dryer is no hardship.

Most people take along goodies and gadgets for entertainment as well. CD players and AM/FM radios meant for car use run off 12 volts and can be easily adapted to the boat. It can be lots of fun to invite friends over for a movie in a remote anchorage. But be aware that standards for television broadcasting and for formatting DVDs differ from country to country. An American television will not function with most foreign signals, and an American DVD player will not play foreign DVDs. If you want television aboard, buy one of the multi-system televisions designed to work with all international formats. These can be purchased at major electronics stores in metropolitan centers. If you just want movies, buy a flat screen and connect it to your computer. You can then purchase a program off the Internet that will allow you to play DVDs from any region on your computer.

Apple's iPods provide endless diversion. Many cruisers download a new set of music and books before leaving on a passage and have all the entertainment they need right at their fingertips. Other goodies and gadgets you might want to bring along include a digital camera, video camcorder, underwater camera, and digital voice recorder.

EQUIPMENT CHOICES FOR THREE OFFSHORE VOYAGERS

Simplicity, *Moderation*, and *Highlife* were each equipped very differently when they were purchased, and their crews had divergent views on how much they needed in the way of comforts and conveniences. Table 8-11 summarizes what each boat carried at the time it was purchased and how each boat was equipped when its crew set off on its voyage.

Simon and Susan were not interested in taking their shore lives with them. They wanted to re-create the feeling they had when camping of being totally self-sufficient and living close to nature. Their focus was strictly on the essentials. During the refit, Simon had added an extra water tank to increase the boat's capacity to 60 gallons, which they judged would be plenty for the two of them. They then created a list of the things they really felt were critical to their safety. These included a handheld GPS, a handheld VHF radio, a good pair of binoculars with a compass for taking bearings, an inexpensive wireless depth sounder that worked through the hull, an analog barometer, and a world-band receiver. From their student years, they each had a laptop computer. They were able to download shareware for tides and weather fax off the Internet, and they put these programs on both computers. With the weather fax program, the world-band receiver gave them three sources of weather information: the marine nets, the high-seas weather forecasts, and weather faxes.

That left charts. A friend in the local yacht club put them in touch with a couple who had just completed a circumnavigation. Susan and Simon were able to copy almost all the charts for the Indian and Atlantic oceans and bought a number of large-scale charts of major harbors. They also found some used cruising guides in secondhand bookstores.

Moderation came with a reasonable selection of equipment for a coastal boat, but Molly and Michael felt they needed some additional equipment to be sure the children would be safe and healthy. The VHF that came with the boat was relatively new. They bought two handheld VHFs so the family could communicate when some of them were ashore. Molly went to the London Boat Show and got her ham license, and they bought a ham radio. They also bought a Pactor modem so they would be able to do e-mail from the boat. They brought along two laptop computers from their old businesses, to be used for homeschooling and doing e-mail over the radio, and the laptops and ham radio would give them many options for obtaining weather information. They installed an analog barometer in the navigation station. Just as they were leaving, a friend gave them a compact desk weather station with a digital barometer that showed the last 6 hours of readings.

Moderation had come with a handheld GPS, but the Moderations wanted to be able to see a graphical representation of the boat on a chart. They bought the least expensive color chartplotter they could find along with chart chips for the Mediterranean, plus a fairly complete set of paper charts and cruising guides for their first year of cruising. They installed a GPS repeater in the cockpit

TABLE 8-11. EQUIPMENT CHOICES FOR THREE OFFSHORE VOYAGERS

Equipment	*Simplicity* (30-year-old, 33-foot cutter)	*Moderation* (13-year-old, 40-foot catamaran)	*Highlife* (8-year-old, 52-foot, cutter-rigged ketch)
Navigation:			
Original	• Binnacle-mounted compass	• Binnacle-mounted compass • Handheld GPS • Full instrument system	• Binnacle-mounted compass • Chartplotter • Handheld GPS • Full instrument system • Digital barometer • Radar
Additional upon departure	• Handheld GPS • 7 × 50 binoculars with compass • Depth sounder • Barometer • Shareware weather fax software • Shareware tide program • Copied charts, secondhand guides	• Chartplotter • GPS repeater for cockpit • 7 × 50 binoculars with compass • Two barometers (digital and analog) • Shareware weather fax software • Shareware tide program • Charts and cruising guides	• Computer charting program with all Pacific charts • AIS receiver and connections to display output on integrated chartplotting system • Stabilized binoculars • Instrument upgrades • Weather fax software • Tide program • Charts and cruising guides
Approximate cost of upgrades	$1,000	$4,000	$6,600
Communications:			
Original	• VHF radio	• VHF radio	• VHF radio • SSB radio • Pactor modem • Handheld VHF
Additional upon departure	• Handheld VHF • World-band receiver	• Two handheld VHFs • Ham radio • Pactor modem	• Handheld VHF • Iridium phone • Marinized computer
Approximate cost of upgrades	$100	$3,000	$10,000
Comforts and conveniences:			
Original		• Pressure water system • Engine-driven/shore-power hot-water heater • Engine-driven refrigerator	• Pressure water system • Engine-driven/AC hot-water heater • AC and DC refrigerator/freezer • High-capacity AC watermaker • Air-conditioning/heating system
Additional upon departure	• Boom box/CD player	• 12 V, 3.5 gph watermaker • Propane barbecue • CD player/stereo • Apple iPods	• Washer/dryer • Trash compactor • Dishwasher • Propane barbecue • Flat screen for DVDs/TV • Satellite television/radio • CD player/stereo • Apple iPods
Approximate cost of upgrades	$0	$6,000	$9,800

so the helmsperson would always be aware of the course and cross-track error. Michael and Molly debated about installing radar, but decided they would not really need it. They have not regretted that decision.

Moderation had come with pressure water, a hot-water heater, and refrigeration that worked off the engine. After researching the different systems, they had wanted to install a 12-volt refrigeration system so they could leave the boat for a week or more at a time when traveling, but they had already exceeded their $45,000 refit budget. Adding 12-volt refrigeration and the battery capacity to run it would cost close to $5,000. They decided to try living with the engine-driven refrigeration and see how things went.

The watermaker was an even tougher decision. *Moderation* carried 120 gallons of water, which Molly felt was marginal for long passages with the four of them aboard. She pointed out that on a thirty-day passage, they would be limited to 1 gallon of water per day when they should be drinking close to that amount in the tropics. Though it was expensive, they decided to install a 3.5 gph watermaker that ran off the batteries. Running this 2 hours per day, they found they could easily go a bit over a month between tank refills.

Though *Highlife* had been well equipped by her previous owners, Hugh and Hilary wanted to add a full range of luxuries. In addition to the marine SSB radio, they wanted to be able to get in touch with their children by phone, so they purchased an Iridium phone.

They also wanted to integrate the various electronics in their navigation station and to use computer chartplotting without having to replace all the equipment they already had aboard. To do that, they bought a marinized desktop computer with a large flat screen, a waterproof keyboard, and a hard drive specially insulated from shocks. They purchased charting software that could be integrated with their existing radar and instrument system. They kept the chartplotter that had been on the boat as backup, and they bought coverage of their planned route for both the chartplotter and their computer charting software.

Although *Highlife* came equipped with a full complement of comforts and conveniences, they added the real luxuries—washer/dryer, dishwasher, and trash compactor. All these run off AC electricity through inverters. The watermaker and refrigeration also run off AC from the generator when it is running. They normally run the generator for a few hours before dinner, so that all the galley goodies will be available when they're needed. During that time, they can make between 35 and 50 gallons of water, far more than they could use in a day even with the washing machine, freshwater heads, and freshwater deck washdown.

In total, the Simplicitys spent $1,100 on new equipment. The Moderations spent $13,000 in total, including 80 labor-hours to install the new equipment. The Highlifes spent $26,000 in total for the equipment and 130 labor-hours to install it. Although the Highlifes have a significantly more luxurious home than the Simplicitys, both crews get to sail to the same places and spend time in the same anchorages, and the Simplicitys spend a lot less time fixing things and a lot more time enjoying being there.

CHAPTER 9

Configuring Your Electrical System

HAVING DECIDED WHAT equipment your boat will carry, you'll have to design your electrical system to accommodate the demands of that equipment. This can be one of the most challenging parts of fitting out a boat. It involves quantifying the average and peak electrical draws from the equipment to be carried and matching that to electrical charging and stowage capacities. You need to start by balancing electrical sources and uses, and then install enough battery capacity to keep everything running between charging sessions. This chapter uses *Simplicity*, *Moderation*, and *Highlife* to illustrate the process.

ANALYZING ELECTRICAL NEEDS

You can come at the problem of electrical balance on board in one of two ways. The first is to decide what equipment you want to carry, and then add up the daily electrical draw from each piece of equipment to come to an average and peak draw. From this, you can calculate the parameters of your electrical system, including generating capacity and battery bank size. Alternatively, you can decide how you want to generate your electricity and how often you are willing to run an engine or a generator. This will determine the total draw the system can support, which will determine how much electrical equipment you can carry. This chapter will illustrate both methods.

If boat electrical demand were the same on passage and at anchor and consistent from day to day, life would be much simpler. But electrical demand can be looked at several different ways, resulting in several different numbers and a range of electrical charging and stowage requirements. Average daily demand when swinging to the anchor in a tropical anchorage will not be the same as average daily demand on passage. Peak demand—when every piece of equipment on board gets used in a 24-hour period—will be higher than the average, and on most boats will be highest on passage. Balancing the electrical system means figuring out how to cover this range.

As seen in previous chapters, the crews on *Simplicity*, *Moderation*, and *Highlife* have taken very different approaches to equipping their boats. As a result, the boats have widely divergent electrical demands. Not surprisingly, each crew had a different priority when it came to configuring the electrical system:

- ***Simplicity.*** The Simplicitys wanted to minimize their average demand and find the simplest, most trouble-free solution for meeting that demand. They also wanted to be independent of the engine in meeting their electrical needs.
- ***Moderation.*** The Moderations' priority was to meet their average daily demand. They didn't mind running the engine for an extra hour or two to meet their peak demand once in a while.
- ***Highlife.*** The Highlifes' primary concern was to meet their peak load when they had guests aboard. They didn't mind oversizing their electrical system to meet their peak demand.

Calculating Loads

Whether you plan to size the electrical system to meet onboard demand or size the demand to stay within your

A BACK-OF-THE-ENVELOPE CALCULATION FOR DAILY ENERGY USAGE

As you're deciding what equipment to carry, use a rough calculation to see what kind of energy load you'll be creating. Table 9-1 provides broad ranges for the power demands imposed by various electrical loads. For ease of comparison, all figures are quoted in amp-hours (Ah) at 12 volts.

To calculate a rough estimate of your peak daily demand at anchor based on the equipment you intend to install, start with the 50 Ah basic house load and add 50 Ah for refrigeration; 50 Ah for a DC watermaker if you plan to make more than 10 gallons per day; 50 Ah for small AC appliances if you plan to carry two or three and use them every day; and 50 Ah if you plan to carry an SSB, a laptop, and other electronic equipment such as video recorders and digital cameras with rechargeable batteries. You will end up with between 50 Ah and 250 Ah of daily demand.

That number will probably increase on passage. Add 100 Ah if you plan to use a below-deck autopilot continuously, and add 50 Ah if you plan to run a chartplotter or laptop computer continuously and keep a radar on standby overnight. Your total will now be between 50 and 400 Ah. If in addition to all this you intend to carry an air conditioner and other home appliances such as a washer/dryer, you'll need to add at least another 100 Ah.

The final number you come up with is what you will need to be able to generate each day. If you plan to do the bulk of your charging once a day, your battery bank should be sized to four times your average demand. At an absolute minimum it can be sized to two and a half times your peak demand, but battery life will be noticeably shortened.

Below 200 Ah, you should have little trouble maintaining your energy balance without a generator. To meet a 200 to 300 Ah peak demand per day without a generator will require multiple charging sources and careful monitoring of energy use. Over 400 Ah, a generator is the easiest, but not the only, way to meet electrical demand.

TABLE 9-1. ESTIMATING AVERAGE DAILY DEMAND

	Daily Demand Range/ Average @ 12 V	Depending On
Basic house load: interior lights, anchor light, LPG solenoid, bilge pumps, pressure water pumps, etc.	20–100 Ah/50 Ah	• Size of boat • Number of lights • Use of low-energy interior and anchor lights • Number of pumps
Refrigerator	25–70 Ah/50 Ah	• Icebox size • Amount of insulation • Separate freezer can double electrical draw
DC watermaker	~2–3 Ah/1 gal. of water	• Size and efficiency of watermaker
Communications and entertainment: VHF radio, SSB radio, computer, stereo, recharging camera/video/phone batteries, etc.	30–75 Ah/50 Ah	• Transmit time • Computer time • Number of items running on rechargeable batteries
Small AC appliances: toaster, coffeemaker, hair dryer, TV, microwave, bread maker, vacuum cleaner, etc.	100–150 Ah/125 Ah	• Which appliances and how long they are in use
Wheel or tiller autopilot	12–24 Ah/15 Ah	• Size of autopilot • Sea conditions
Below-deck autopilot	50–100 Ah/80 Ah	• Size of autopilot • Sea conditions

It may take several iterations using this back-of-the-envelope calculation to find a rough solution for balancing your electrical sources and uses and sizing your battery bank. Once you've finalized your equipment list, you will then need to go through the detailed calculation as shown for *Simplicity*, *Moderation*, and *Highlife* to ensure that your electrical configuration will meet your energy requirements.

charging and stowage limits, at some point you will need to calculate the boat's peak daily energy usage. This can be defined as the maximum amount of electricity all the equipment on the boat could draw in a 24-hour period. To calculate it, you need to take each piece of equipment, figure out how much electricity it draws, and then multiply that by the maximum number of hours it might be used in a day (see the A Few Useful Electrical Notes sidebar below). This will need to be done for two scenarios: sitting at anchor, and underway on passage.

The calculation is done over 24 hours because most cruisers choose to run their engine once a day, so that's the period over which the batteries must be able to meet whatever draw the boat's systems place upon them. On most boats, the peak draw will be on passage, when electronics, navigation lights, and autopilots get run 24 hours per day. When not on passage, the 24-hour peak demand for most boats comes when anchored for several weeks in an idyllic atoll where the crew would like to minimize engine-running time.

Tables 9-2 and 9-3 consolidate the information from the previous chapters to show *Simplicity* and *Moderation*'s peak electrical demands at anchor. In Tables 9-2 to 9-9, electrical draws are listed from largest to smallest to show which equipment takes the most power on each boat. Throughout this chapter, 12-volt electrical draws will be used to facilitate comparison among the boats, despite the fact that *Highlife* would almost certainly be equipped with a 24-volt DC/240-volt AC system in the real world.

TABLE 9-2. *SIMPLICITY'S* PEAK AND AVERAGE ELECTRICAL DEMAND AT ANCHOR

	Amps @ 12 V	Hours/Day	Ah/Day	Comments
Laptop computer	2.50	3	7.5	
Reading lights	0.42	2 × 4	3.4	Two lights @ 4 hours each night
LPG solenoid	0.50	3	1.5	
Anchor light	0.11	12	1.3	Low-energy portable anchor light
VHF radio	0.50	2	1.0	Morning/evening local net
Interior lights	0.08	2 × 4	0.7	Two lights @ 4 hours each night
Bilge pump	5.00	0.1	0.5	6 minutes per day
All-band radio	0.00			Runs on dry-cell batteries
CD player	0.00			Runs on dry-cell batteries
Fans	0.00			Run on dry-cell batteries
Total Peak Draw at Anchor			**15.9**	
Average Draw at Anchor			**10.0**	1 hour of computer usage instead of 3; fewer lights

Susan and Simon have worked to minimize demand from the ship's batteries wherever possible in their rebuild. By using a portable anchor light that draws just 0.11 amp and by installing LED dome lights and reading lights with xenon bulbs, Susan and Simon were able to reduce *Simplicity*'s lighting electrical load (the sum of reading, interior, and anchor lights) from 30 Ah per day down to just over 5 (Table 9-2). Susan and Simon's all-band radio, CD player, and fans all run on dry-cell batteries. Only the laptop computer draws power from the ship's batteries. The laptop is, in fact, their largest single daily draw, though they rarely use it for 3 hours a day as shown in their peak demand calculation. Their average demand is only about 10 Ah per day.

Moderation's electrical draw (Table 9-3) would be typical of many cruising boats today. Her peak draw at anchor is six times as much as *Simplicity*'s. If the Moderations installed the same low-energy lighting fixtures as Susan and Simon put aboard *Simplicity*, they could reduce their lighting demand by 85 percent. *Moderation*'s comforts and conveniences, all of which run off the ship's batteries, account for the rest of the difference in electrical usage between the two boats. At 95 Ah per day, the Moderations' peak demand exceeds their average demand by about 20 Ah. The difference tends to be in the area of activities, for when they are happily engaged snorkeling, hiking, exploring, or visiting friends off the boat they don't use most of the other entertainment available to them.

At sea, both boats use significantly more electricity than at anchor, as shown in Tables 9-4 and 9-5. That's despite using less for house loads. When running watches on passage, half the crew will go to bed early and not be using lights. If reading or listening to music, most crews use book lights or portable battery-operated CD players with headphones so as not to disturb the off-watch. But navigation equipment more than makes up for the reduced house loads. Even on a minimally equipped boat like *Simplicity*, navigation load at sea exceeds peak load at anchor.

Hugh and Hilary want to size their electrical system for themselves and four guests, a total of six people. They have calculated their peak load assuming everyone aboard showers every day, the decks get washed with fresh water every day, and fans run all night every night. As a result, *Highlife*'s house load is two and a half times that of *Moderation*, though she carries almost exactly the same equipment (Table 9-6). With just Hugh and Hilary aboard, the house load drops by 50 Ah per day.

Highlife's needs are far more complicated than *Simplicity*'s or *Moderation*'s. Total DC loads at anchor come to 230 Ah at 12 volts, or three times *Moderation*'s aver-

TABLE 9-3. *MODERATION*'S PEAK AND AVERAGE ELECTRICAL DEMAND AT ANCHOR

	Amps @ 12 V	Hours/Day	Ah/Day	Comments
House load:				
Reading lights	1.0	4 × 4	16.0	Four lights @ 4 hours each night
Anchor light	0.8	12	9.6	Masthead anchor light overnight
Interior lights	0.5	3 × 4	6.0	Three lights @ 4 hours each night
Pressure water	10.0	0.5	5.0	Four showers/day, three dishwashings/day, etc.
Fans	0.3	4 × 4	4.8	In aft cabins in the evening; in galley and engine room as needed
Saltwater washdown	10.0	0.2	2.0	Clean decks, dinghy
LPG solenoid	0.5	3	1.5	
Shower sump pump	4.5	0.2	0.9	
Bilge pump	5.0	0.1	0.5	6 minutes per day
Total House Load			**46.3**	
Comforts:				
Watermaker	8.0	2	16.0	Make 5 gal. of water per day
Refrigerator	0.0	1.5	0.0	Engine-driven refrigeration
Total Comforts			**16.0**	
Activities:				
Laptop computer	2.5	6	15.0	2–3 hours of schoolwork, e-mail, movie
SSB	12.5	0.5	6.3	Transmit e-mail/chat on marine net
VHF radio	0.5	12	6.0	Listening watch for friends
Other entertainment	2.0	3	6.0	Stereo, recharge batteries, etc.
Total Activities			**33.3**	
Total Peak Draw at Anchor			**95.6**	
Average Draw at Anchor			**75.6**	Half the "activities"; fewer lights, fans

TABLE 9-4. *SIMPLICITY'S* PEAK ELECTRICAL DEMAND AT SEA

	Amps @ 12 V	Hours/Day	Ah/Day	Comments
Navigation load:				
VHF radio	0.50	24	12.0	Monitor 24 hours per day
Navigation lights	0.84	12	10.1	Tricolor overnight
Laptop computer	2.50	0.5	1.3	Download weather fax once per day
Depth sounder	0.03	24	0.7	
Compass light	0.05	12	0.6	
GPS	0.00			Runs on dry-cell batteries
Total Navigation Load			**24.7**	
House load:				
LPG solenoid	0.50	3	1.5	
Reading lights	0.42	1 x 2	0.8	One light @ 2 hours for chartwork, etc.
Bilge pump	5.00	0.1	0.5	6 minutes per day
Interior lights	0.08	1 x 2	0.2	One light @ 2 hours during meal prep
Portable CD player	0.00			Runs on dry-cell batteries
All-band radio	0.00			Runs on dry-cell batteries
CD player	0.00			Runs on dry-cell batteries
Fans	0.00			Run on dry-cell batteries
Total House Load			**3.0**	
Total Peak Passage Draw			**27.7**	
Average Passage Draw			**15.7**	Turn VHF on only when another vessel is in sight

TABLE 9-5. *MODERATION'S* PEAK ELECTRICAL DEMAND AT SEA

	Amps @ 12 V	Hours/Day	Ah/Day	Comments
Navigation load:				
Autopilot	2.0	24	48.0	Below-deck autopilot
Chartplotter	1.5	24	36.0	Running all the time
Navigation lights	2.0	12	24.0	Tricolor all night
Instruments	0.7	24	16.8	
VHF	0.5	24	12.0	24-hour listening watch
SSB	12.5	0.5	6.3	Weather fax, marine nets, e-mail
Laptop usage	2.5	1	2.5	Weather fax, e-mail
Spreader lights	7.0	0.3	2.1	One major sail change per night
Compass light	0.05	12	0.6	
Total Navigation Load			**148.3**	
House load:				
Fans	0.3	2 x 8	4.8	In aft cabins overnight; in galley
Interior lights	0.5	2 x 2	2.0	Two lights @ 2 hours during evening meal
Reading lights	1.0	2	2.0	2 hours/night for chartwork, etc.
Pressure water	10.0	0.2	2.0	Two showers/day, three dishwashings/day, etc.
LPG solenoid	0.5	3	1.5	
Shower sump pump	4.5	0.1	0.5	
Bilge pump	5.00	0.1	0.5	6 minutes per day
Total House Load			**13.3**	
Comforts:				
Watermaker	8.0	2	16.0	Make 4–8 gal./day to keep tanks full
Refrigerator	0.0	1.5	0.0	Engine-driven refrigerator
Total Comforts Load			**16.0**	
Activities:				
Other entertainment	2.0	5	10.0	Stereo, recharge batteries, etc
Total Activities			**10.0**	
Total Peak Passage Draw			**187.6**	
Average Passage Draw			**156.6**	Check chartplotter a few times per day

TABLE 9-6. *HIGHLIFE'S* PEAK ELECTRICAL DEMAND AT ANCHOR WITH FOUR GUESTS ABOARD				
	Amps @ 12 V	**Hours/Day**	**Ah/Day**	**Comments**
DC Loads: **House load:**				
Interior lights	2.0	5 × 4	40.0	Five lights @ 4 hours each night
Anchor light	2.0	12	24.0	Masthead anchor light overnight
Reading lights	1.0	4 × 4	16.0	Four lights @ 4 hours each night
Pressure water	15.0	1.0	15.0	Six showers/day, three dishwashings, etc.
Electric toilets	20.0	0.3	6.0	
Deck washdown	10.0	0.5	5.0	Clean decks/equipment daily with fresh water
Fans	0.3	2 × 8	4.8	In aft cabins overnight; in galley
LPG solenoid	0.5	3	1.5	
Shower sump pump	4.5	0.3	1.4	
Bilge pump	5.0	0.2	1.0	6 minutes per day × two pumps
Total House Load			**114.7**	
Comforts:				
Refrigerator/freezer	10.0	4	40.0	DC draw when generator not in use
Total Comforts			**40.0**	
Activities:				
Desktop computer	5.0	8	40.0	On all day
Communications			13.0	Iridium phone, Inmarsat-C, cell phone
Other entertainment	2.0	5	10.0	Stereo, recharge batteries, etc.
SSB	12.5	0.5	6.3	Transmit e-mail/chat on marine net
VHF radio	0.5	12	6.0	Listening watch for friends
Total Activities			**75.3**	
Total DC Loads			**230.0**	
AC Battery Loads			**311.9**	From Table 9-7; through inverters
Peak Daily Draw from Batteries			**541.9**	@ 12 V; translates to ~6,500 Watt-hours or 6.5 kWh
Average Daily Draw from Batteries			**~300.0**	Without guests use half house load, half activities load, half AC loads

age. But in addition to that, a variety of small AC electrical appliances draw energy out of the batteries between charging cycles, as shown in Table 9-7. AC appliances are unbelievably power hungry, and with only moderate usage the total draw from the batteries through the inverters to run these appliances exceeds *Moderation*'s daily DC demand. The batteries must be sized to handle this draw as well as the DC draw.

To meet both AC and DC demands, *Highlife* will need sufficient battery capacity to take 600 Ah out of her banks between charging cycles. But her charging capacity has to be significantly greater than that. In addition to the electricity that will be drawn from the batteries as shown in Tables 9-6 and 9-7, *Highlife* has AC loads that will be met only when her AC generator is running. The bulk of the cooling on her refrigeration systems will be done using 110-volt power when the generator is on; the rest of the time the system will draw DC power from the batteries as needed. Her watermaker and air-conditioning systems both run off AC power supplied by the AC generator when it is running. Assuming her crew runs the watermaker, air-conditioning, and refrigeration system as

TABLE 9-7. *HIGHLIFE'S* INVERTER LOADS AT ANCHOR WITH FOUR GUESTS ABOARD				
	Watts	**Amps @ 12 V (watts ÷ 10)**	**Hours/Day**	**Ah/Day**
Washer/dryer	1,430	143	1.0	143.0
Hair dryer	1,250	125	0.5	62.5
Toaster	1,200	120	0.2	24.0
Coffeemaker	1,000	100	0.2	20.0
Microwave	880	88	0.3	26.4
Vacuum cleaner	800	80	0.2	16.0
TV/DVD	100	10	2.0	20.0
Total Inverter Load				**311.9**

TABLE 9-8. *HIGHLIFE*'S PEAK DAILY ENERGY CONSUMPTION WITH FOUR GUESTS				
	Amps	**Watts**	**Hours**	**kWh**
Battery charging	~240 @ 12 V	2,400	~3	6.5
AC refrigerator/ freezer	1.0 @ 120 V	120	4	0.4
AC watermaker	28.0 @ 120 V	3,360	1	3.4
AC air-conditioning	15.0 @ 120 V	1,800	3	5.4
Total Load				**15.8**

shown in Table 9-8, *Highlife* will have a total electrical demand of 16 kilowatts per day.

At sea, *Highlife*'s navigation systems increase the total DC load significantly, as shown in Table 9-9. However, Hugh and Hilary limit the use of the AC appliances to the coffeemaker and the microwave on passage, which just about offsets the increased demand from the navigational systems. This makes their peak demand on passage just about the same as their peak demand at anchor with four guests aboard.

Based on the electrical demands calculated in this section for our three voyagers, we can now look at the implications for charging and stowage capacity aboard each boat.

Generating Options

The electrical demand calculated in the last section must be generated each day to make up for what has been used. There are a limited number of options for generating electricity aboard a boat, and these must be combined to meet the daily electrical demand. Different combinations of these charging options make sense for different levels of demand. Low-demand boats like *Simplicity* will be able to meet their charging requirements using only passive charging sources such as solar panels. At the other extreme, boats like *Highlife* with all the comforts of home—and a house-sized electrical appetite—will need to run a generator to meet their charging needs.

Generating Sources

When it comes to generating electricity "off the grid," with no shore power, a limited number of options exist, and all of them have their advantages and disadvantages as shown in Table 9-10. Almost every boat has an engine, and almost every engine is fitted with an alternator. The standard alternator on most engines will be rated at 50

TABLE 9-9. *HIGHLIFE*'S ELECTRICAL DEMAND FOR NAVIGATION EQUIPMENT AT SEA				
	Amps @ 12 V	**Hours/Day**	**Ah/Day**	**Comments**
Autopilot	4.0	24	96.0	Below-deck pilot
Chartplotter	2.0	24	48.0	Runs 24 hours a day
Radar	3.0	12	36.0	Watchkeeping at night
Powered winches	100.0	0.3	30.0	Raising main, trimming sheets
Desktop computer	5.0	6	30.0	Weather, e-mail, charting, etc.
Navigation lights	2.0	12	24.0	Tricolor overnight
SSB	12.5	1.5	18.8	In addition to normal transmit time
Instruments	0.7	24	16.8	
Spreader lights	3.0	0.5	1.5	One major sail change per night
Compass light	0.05	12	0.6	6 minutes per day × two pumps
Total Navigation Load			**301.7**	

A FEW USEFUL ELECTRICAL NOTES

If you've forgotten your high school physics, here are a few basics to make things easier.

1. Current can be either direct or alternating (generated as a sine wave). For our purposes, direct current (DC) can have an electrical potential of 12 or 24 volts. At lower voltages, a higher current has to be passed to get a given output. To pass higher current means using larger-diameter wire in order to keep resistance to a minimum and avoid generating heat. Thus, 24-volt systems save weight and reduce the bulk of wiring harnesses. All but the largest American boats run on 12 volts. Many European boats over about 50 feet run on 24 volts, but some boat electronics (such as VHF radios) are not readily available in 24 volts, so to some extent these boats run a dual system. Alternating current (AC) can have an electrical potential of 120 or 240 volts (also referred to as 110 and 220). The United States and Canada use 120-volt, 60-cycle-per-second (or 60 Hertz) AC systems, and most of the rest of the world uses 240 volts at 50 cycles per second.
2. Total electrical demand is defined as power used over time and can be measured as amp-hours (Ah) or kilowatt-hours (kWh). The power use has to be defined in terms of voltage. Thus, a VHF radio will be described as drawing 0.5 amp at 12 volts on standby and 6 amps at 12 volts when transmitting. Total electrical demand is then calculated by multiplying the draw by the amount of time the equipment will be in use. If the VHF will be left on listening watch all day, the total electrical demand would be 0.5 amp $\times$ 12 hours, or 6 Ah, plus 6 amps times the amount of time in hours spent transmitting.
3. Power (P) in watts equals current (I) in amps multiplied by electrical potential (V) in volts: $P = I \times V$. If the electrical draw for DC equipment is given in watts, divide that by the voltage of the equipment to get the electrical draw in amps. If an SSB radio transmits at 150 watts (W), it will draw $150 \div 12 = 12.5$ amps at 12 volts (or 6.25 amps at 24 volts).
4. When DC power is put through an inverter to generate AC power, some efficiency is lost. Therefore, in estimating DC loads for AC appliances, instead of dividing the wattage by 12 and 24 for 12 and 24 volts, divide instead by 10 or 20. Thus a hair dryer that draws 1.25 kW (1 kilowatt = 1,000 watts) will draw 125 amps at 12 volts ($1{,}250 \div 10$) when being run through an inverter off a 12-volt bank of batteries (62.5 amps at 24 volts).

amps, which means it can in theory produce 50 amps per hour of motoring. High-output alternators can produce 100 to 250 amps. A high-output alternator can be substituted for an existing alternator or, on larger engines, installed in addition to the standard alternator. This costs very little and makes use of a "free" resource when the motor is in use.

Increasing alternator output doesn't necessarily result in reducing charging times. Batteries can only accept so much current at a time, which means an oversized alternator won't charge the batteries any faster. To charge efficiently, the alternator should be rated at one-quarter of the battery bank's total capacity. Thus, a 100 amp alternator would be appropriate for a 400 Ah battery bank.

But running the engine just to generate electricity will mean running it at idle without adequate load, which will increase wear and shorten its useful life. For that reason, among others, additional charging sources are used to generate some or all the daily electrical demand on most boats.

Solar panels provide completely worry-free, maintenance-free energy, and almost every cruising boat that doesn't rely on a generator for its electricity carries one or more. Most of us would do all our charging with solar panels if we could, but the size of the panels limits how many can be safely installed on most boats. Rigid panels can be permanently mounted on radar arches or on a solid stainless steel railing around the stern of the boat. For maximum power generation, the panels need to be kept in direct sunlight and perpendicular to the sun's rays. A telescoping mount that allows the panel to be locked at different angles as the sun moves overhead increases their efficiency.

TABLE 9-10. COMPARISON OF CHARGING OPTIONS

	Limited By	Pros	Cons
Engine charging	Logistics of mounting two high-capacity alternators	• Uses "free" energy when motoring • Can produce 200+ amps/day	• Uses diesel fuel • Extra wear on engine • Noise, smell, heat of running engine
Solar panels	Most boats can't carry more than four large panels	• Quiet, worry-free • No maintenance	• Relatively expensive per watt produced • Generating capacity limited to ~100 amps/day • Space requirements • Need sunshine
Wind generators	Most boats can't mount more than two wind generators	• Can produce more than 100 amps/day in the right conditions	• Generate little below 10 knots of wind • Need to regulate to avoid damage to batteries • Noisy • Can be dangerous in high winds • Some models not reliable; regular maintenance required
AC or DC generator	Boat size—difficult to fit aboard boat less than 45 feet long	• Can produce an almost unlimited amount of power	• Cost and complexity • Uses diesel fuel • Noise, smell, heat of running generator • Space requirements • Maintenance load

Flexible panels generate far less electricity per square foot than rigid panels, but they can be glued or screwed to just about any surface on the boat, and they're tough enough to be treated just like the boat's deck. They can be installed on top of the coach roof or pilothouse where the crew may walk from time to time. Such a large surface area can make up for their lower efficiency.

Solar panels need light to generate electricity and will produce at their rated outputs for only a few hours per day when the sun is at its zenith. Even then, the voltage reaching the batteries will be less than that generated due to inefficiencies in the system. For a realistic assessment of what a panel will produce in sunny weather in the tropics, divide the panel's rating in watts by 4 to find an average output in amp-hours per day. Thus, you can expect a 100 W panel to generate an average of 25 Ah per day in the tropics over the course of a season. Total output is limited by the size of the solar array the boat can carry, with a maximum of about 100 Ah per day on cruising boats between 40 and 50 feet long (Table 9-11).

When it comes to wind generators, cruisers are divided as to their usefulness. Some cruisers swear by them and rely on them for most of their electrical charging; others are disappointed in the output, dislike the noise, and feel they can be dangerous in high winds. Of a group of 100 cruising boats surveyed in New Zealand, every boat that did not carry a generator carried one or more solar panels, but less than a third carried wind generators. Some of the differences in attitude toward wind generators can be traced to differences among brands, with some having had serious reliability problems.

TABLE 9-11. OUTPUTS FROM DIFFERENT CHARGING SOURCES

	Maximum Output (amps @ 12 V)	Realistic Maximum/ Day (Ah)	Using	Comments
Solar panels	0.5–6.7	~100	4 × 100 W panels	Array 60 × 112 in; 120 lb.
Wind generators	2.0–7.5	~100	2 × 300 W units	Average trade wind conditions
Engine charging	30–165	~300	165 amp alternator mounted on engine in addition to manufacturer's original alternator	Run engine 2 hours/day; limited by charge-acceptance rate of batteries
AC or DC generator	> 1,000	> 1,000	One DC or AC generator running 4 hours per day	Limited by charge-acceptance rate of batteries

If you're considering installing a wind generator, be realistic about its potential. Wind generators produce little output below 10 knots of wind, and most decent anchorages have under 10 knots of wind virtually all the time. Cruisers who depend on wind generators often anchor farther out in a harbor in order to have more wind, but they then have a longer and wetter dinghy ride to shore. If you are considering buying a wind generator, carefully compare noise levels, outputs between 10 and 15 knots of wind speed, and reliability.

On passage, water can be used as well as wind to generate electricity. Some wind generators even double as tow generators. This option can be a valuable addition at sea when navigation equipment increases electrical demand. The boat needs to be moving at 5 knots or so for tow generators to produce much electricity, so they're not much use in light winds. But in stronger winds, they can generate as much as a wind generator, significantly increasing charging capacity. Tow generators can be a hassle to deploy and create some drag, but a minority of cruisers rely on them to cover navigation loads on passage.

Gasoline and diesel generators can provide almost unlimited power for boats with high electrical demand. We occasionally see small gasoline generators used to top up batteries, and these work well as a backup to meet unusual loads, but they are noisy to use on a regular basis and have to be run on deck to safely vent the exhaust. If you plan to rely on a generator for daily charging load, it should be properly installed in the boat, use diesel fuel for safety reasons, be water cooled to limit noise, and be optimized to meet your specific needs. Adding such a generator requires a good deal of space, comes at a high initial cost, and greatly increases complexity. A generator will require at least as much maintenance as the engine. The engine should still be equipped with its own high-output alternator as a backup to the generator.

Any generator will need to be installed well away from the main living area with enough soundproofing and ventilation to keep noise and fumes from reaching the crew. There are three common configurations for generators on cruising boats:

1. **DC genset.** A 5 to 10 hp diesel engine can be fitted with one or two high-output alternators for generating large amounts of electricity. A watermaker motor and a refrigerator compressor can also be belted off the motor, so that in addition to charging the battery banks, the genset can make the day's supply of water and cool the refrigerator. This solution takes the electrical generating load off the engine, thereby reducing wear and eliminating the need to run the engine with too little load. It can be set up to run everything at optimal rpm, something that can't be done when the engine is also being used to maneuver the boat. DC gensets are sized to meet average loads and often run for 4 to 6 hours per day.
2. **AC genset backed by large DC system.** A 5 to 20 kW AC genset can be used in much the same way as a DC generator, but instead of creating DC current, the genset produces AC current. This can be used to run any AC appliances aboard, but also to charge the batteries through a battery charger. Thus, while the generator is running, an AC watermaker can be making water and a compressor that runs off AC can be cooling the refrigerator and freezer. When the batteries are fully charged, the genset is shut down, and the boat draws from the batteries directly for DC loads and through inverters for AC loads. A large battery bank, on the order of 1,000 Ah or more, will be required to buffer the AC system and meet AC loads when the genset is not running. An AC genset used this way will be hit with all the electrical demands of the boat in the few hours it is run, so it needs to be sized to meet peak demands.
3. **Continuous AC genset.** For larger boats with all the comforts of home, a 5 to 10 kW AC genset running continuously will supply unlimited power to AC refrigeration, AC watermakers, AC galley appliances, and even AC air-conditioning. The genset can also charge a battery bank through a charger, but the bank would not have to be particularly large, as most of the boat's electrical demand will be met through the AC systems. This option, long used aboard large motoryachts and ships, has become more common on cruising boats over about 60 feet long with the introduction of more compact gensets. While the genset needs to be designed to meet peak loads, with continuous operation the peak demands should be lower than when an AC genset is run only a few hours per day.

In the decade we have been out cruising, we have seen generators become common equipment on cruising boats over 50 feet. In that time, generator, battery charger, and inverter technologies have improved radically. Units are getting smaller and more sophisticated. Multistage battery chargers charge battery banks much more efficiently without risk of damage. Sophisticated, powerful inverters can be used to run equipment sensitive to voltage or waveform. The generator solution costs more than the alternatives and increases complexity aboard, but it provides a single-source charging option that can meet any demand.

Combining Generating Sources to Meet Demand

You will need to use some combination of these generating technologies to meet the electrical demands you calculated in the first section. Table 9-12 illustrates some standard solutions for differing demands.

For a moderately complex boat with an average electrical draw of 150 Ah per day, you might choose to rely on engine charging alone, on an array of solar panels in conjunction with a wind generator, or on solar panels with engine charging. The advantages and disadvantages for each generating source as shown in Table 9-10 would help you determine which makes the most sense for you. As you consider the options, try to build in some redundancy so that you always have a way to charge even if one system breaks down.

A few rules of thumb may help you find your way through the maze of generating options:

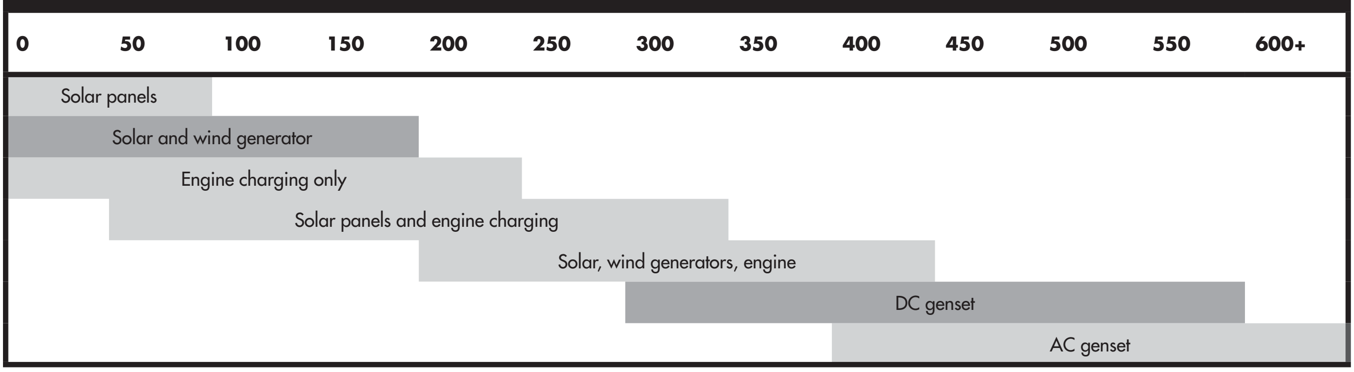
- **Low energy needs (less than 100 Ah per day).** If you have a low-energy boat, solar panels in conjunction with running the engine every few days offer the most effective, lowest-maintenance way to meet your energy demands. The refrigeration system will be the highest energy user on most low-demand boats. Installing a DC refrigerator and a large solar array will keep you from having to run the engine just to cool down the refrigerator and allow you to leave the boat for several days without having to get someone to run the engine for you.
- **Moderate energy needs (100 to 300 Ah per day).** If you can meet half your needs with solar panels and/or wind generators, you'll be better off relying on the engine to meet the rest of your charging needs rather than incurring the expense and complexity of a generator.
- **High energy needs (300+ Ah per day).** Start looking at one of the generator options or radically scale back your demand.
- **Unbalanced needs.** On passage, a below-deck autopilot can add 50 to 100 Ah to the daily demand, which can throw the entire electrical system out of balance. You can install a wind vane to reduce demand, increase motoring or generator running time to cover the additional demand, or use a tow generator to augment your electrical charging capacity while underway.

Simplicity, *Moderation*, and *Highlife* illustrate the process of selecting generating options to meet a boat and crew's needs. *Simplicity*'s crew needed to generate about 10 Ah to cover their average daily usage, but on passage they might need to generate as much as 30 Ah. They could have met that demand using solar panels, a wind generator, or the engine. The engine was fitted with a 25 amp alternator; running it every other day for an hour would have met their needs. However, *Simplicity* didn't carry enough fuel to run the engine that often, and the engine was not that reliable. Susan and Simon decided they had to be independent of the engine for their charging needs.

They turned to wind generators and solar panels and tried to figure out which would better suit their situation. The wind generators would have to be mounted above head level, were noisy, required more maintenance, and would have to be tied off in gale conditions. Solar panels offered a less expensive alternative that better met their energy requirements.

But *Simplicity* lacked the deck space to carry large, rigid panels. Smaller panels that could be mounted to the coach roof and were tough enough to walk on offered a better solution, but these did not produce nearly as much power. To meet their peak demand of around 30 Ah per day, they would have needed four 30 W panels, but four was more than they could afford. The two panels they affixed to the coach roof produce about 15 Ah per day, which has proven adequate for their average usage both on passage and at anchor. When necessary, they run the engine to top up the batteries. Unlike *Moderation* and

TABLE 9-12. GENERATING OPTIONS TO MEET VARIOUS LOADS (Ah/DAY)



Highlife, none of *Simplicity*'s essential systems depend on electricity, so the Simplicitys do not need an additional charging source for backup.

Moderation's needs varied from 75 Ah on average at anchor to almost 200 Ah for their peak demand at sea. While Molly and Michael planned to size the system to their average load, they wanted to have a way to meet their peak demand if the need ever arose. They considered engine charging, solar panels, wind generators, or some combination of all three.

Their decision would have been much more complicated except that the boat came with engine-driven refrigeration. That meant they would be running at least one of the engines every day for an hour or more to keep the refrigerator cool. By installing high-output alternators on both engines, they would be able to meet their average or peak electrical demands during the time they ran the engine to cool down the refrigerator. With two engines, Michael and Molly had built-in redundancy when it came to charging.

A generator was the only way to satisfy *Highlife*'s voracious appetite for electricity. When Hugh and Hilary bought her, she was set up with a 10 kW AC genset backed by a large battery bank. The manual recommended running the generator at 35 to 70 percent of rated output to maximize life. By spreading their 16 kW peak daily load over 3 to 4 hours of running time, the average load of 5 kW would fall nicely within that range. The generator was installed in a well-insulated engine room, away from living spaces, so they didn't mind running it when their guests were aboard.

The Highlifes did buy two 75 W solar panels to keep up with the refrigeration when the boat was left unattended for short periods and to keep the batteries topped up when the boat was to be left for several months at a time. These were installed across the arch of the dinghy davits. The solar panels and the high-output alternator on the engine gave them ample charging alternatives to keep essential systems running if the generator broke down.

Stowing Electricity

Generating enough electricity to meet the boat's daily demands won't be of any use if that energy cannot be stored until it is needed. The boat's battery bank serves as its reservoir of energy. To meet the demands of the electrical system efficiently and to maximize the life of the batteries, it must be sized and configured appropriately; the right batteries need to be selected for the boat's loads; and charging needs to be regulated and optimized.

Sizing and Configuring the House Battery Bank

Despite perennial promises of new innovations just around the corner, batteries remain a surprisingly inefficient way to store electricity. A battery's useful life depends upon how often and how deeply it is discharged. Discharging a battery by more than 50 percent of its capacity greatly reduces its life. A battery can be quickly and efficiently recharged up to 70 or 80 percent of its capacity; beyond that, charging efficiency plummets. No matter what type of equipment you have, topping a battery from 80 percent to fully charged will take hours. Further, batteries charge less efficiently in colder temperatures and as they get older. Batteries are tested and rated at an ambient temperature of 77°F. Charging efficiency falls by half when temperatures drop to near freezing and by even more if the batteries are several years old.

Most crews charge their batteries once a day, so the house battery bank must be capable of delivering the total daily demand between charges. If you only discharge the battery by 50 percent and recharge it to 80 percent, then whatever average demand you have calculated must be supplied by 30 percent of the battery bank's capacity. For a 50 Ah load, that translates to a minimum of 167 Ah of capacity. If you add in a 20 percent safety margin for age and temperature differentials, you need a 200 Ah battery bank—four times your daily demand—to support a minimal load. While it's not good to do it often, batteries can be more deeply discharged to meet peak demands. But peak loads should not exceed 40 percent of battery capacity, which translates into a battery bank two and a half times the size of the peak demand. The bottom line is that the smaller the proportion of battery capacity you cycle through each day, the quicker the battery will recharge and the longer it will last.

While oversizing the house battery bank increases battery life and charging efficiency, batteries are heavy and take up a lot of space. On most moderately complicated, midsized cruising boats, it will be a challenge to find enough space for sufficient battery capacity to meet the boat's average electrical demands. Undersizing the battery bank will mean constantly monitoring battery level and worrying over turning on any additional piece of equipment. Battery life will be reduced, and charging will take longer. If the battery capacity is too small, you will be forced to charge twice daily to have enough electricity to meet normal house demands. But every charging cycle decreases battery life, so charging twice a day means cutting the effective life of your batteries in half. Optimizing the size of the battery bank so it can meet realistic average and peak loads will save money and frustration in the long run.

Table 9-13 summarizes the battery capacities our three voyagers need to meet their average and peak demands as calculated in Tables 9-2 to 9-9.

Most batteries come in standard amp-hour ratings in increments of around 100, 200, or 300 Ah. *Simplicity*'s

TABLE 9-13. SIZING HOUSE BATTERY BANKS FOR THREE OFFSHORE VOYAGERS

	Simplicity	*Moderation*	*Highlife*
Average daily DC loads at anchor (Ah)	10	76	300
Peak daily DC loads on passage (Ah)	28	188	542
Battery capacity to meet average load (Ah; average load × 4)	40	302	1,200
Battery capacity to meet peak load (Ah; peak load × 2.5)	70	470	1,355
Approximate battery bank size (Ah)	**100**	**400**	**1,300**
Percent of capacity to meet average load	10	19	23
Percent of capacity to meet peak load	28	47	42
Approximate weight of battery bank (lb.)	50	240	950
Approximate size of battery bank (sq. ft.)	1/2	2	9

loads are so small, they will easily be met by a single battery of around 100 Ah. The Moderations are not too concerned about meeting their peak demand, but they want to easily meet their average demand without stressing the batteries. They would need about 300 Ah of battery capacity to handle their average demand. However, their peak demand would then be two-thirds of their capacity. Such a deep discharge would shorten battery life if done more than a couple of times. To be sure they can meet their peak demand if necessary, they will install a minimum of 400 Ah of batteries. The Highlifes want to be sure they can meet their peak demand when they have guests aboard. To do that, they will need to install at least 1,300 Ah of battery capacity. Their batteries will weigh close to 1,000 pounds and require over 9 square feet of storage space.

Anyone who has ever gone out to the garage in the morning to find the car battery dead will appreciate the wisdom of dividing the batteries into multiple banks. With two or more battery banks, there should always be a fully charged battery available to get the engine running to recharge the dead bank. When boat electrical demands were minimal, and the power needed to start an engine was large in comparison, most boats were set up with two battery banks of the same size. These would be alternated daily, with one always in use and one "resting" at a fully charged level.

As boat electrical demands have grown, the size of the bank needed to power house loads has increased dramatically, while the power necessary to start the engine has changed little. The weight and size of the batteries needed to power house loads on boats like *Moderation* and *Highlife* make it difficult to find space for one adequately sized battery bank, let alone two. As a result, most modern boats have a single large battery bank sized to meet house demands, and a separate, much smaller starting battery for cranking the engine over.

Where space permits and house loads are not excessive (less than 100 to 150 Ah per day), we still prefer the old-fashioned solution. By having two equal banks, either of which can handle our house loads, we end up cycling each bank half as often, which should extend battery life. If anything happens to one battery bank or our charging ability, we have a fully charged bank in reserve, which, on passage, could mean the difference between being able to use emergency communication systems and not. Finally, if we ever wanted to add more energy-hungry equipment, we could reconfigure our battery bank into a single bank with double the capacity of our current configuration without having to find space for more batteries. Besides the weight of carrying two "house" banks, the major disadvantage of this approach is that the voltage drop from engine starting can momentarily interfere with other electronics, causing displays on instruments to blank out and low voltage alarms on inverters to sound.

Each of our crews has chosen a battery configuration that reflects their needs. *Simplicity* has only one battery, which serves both engine cranking and house needs. *Highlife* carries one large house bank sized as shown in Table 9-13 and a separate engine-starting battery.

The Moderations had the most difficult decision to make. They wanted to be able to install DC refrigeration in the future, but that would increase their demand by 50 to 100 Ah per day, which would mean they would need an additional 150 to 300 Ah of battery capacity. Because they couldn't mix batteries of different ages in one bank, adding DC refrigeration would mean trashing whatever batteries they bought at the start of their voyage and replacing them with a whole new set of batteries sized to meet this greater demand.

Instead, they decided to install two equal-sized battery banks of about 400 Ah each and alternate between them. Then if they decided to add DC refrigeration, they could combine the two banks into a single house bank and buy an engine-starting battery. While this doubled the weight and size requirements for their battery bank as shown in Table 9-14, they felt this was the only way they'd be able to afford DC refrigeration in the long run.

TABLE 9-14. FINAL BATTERY BANK CONFIGURATION FOR THREE OFFSHORE VOYAGERS

	Simplicity	*Moderation*	*Highlife*
Approximate size of house bank (Ah)	100	400	1,300
Additional batteries	None	Second 400 Ah bank	Starting battery
Total weight of batteries (lb.)	50	480	985
Total size of all battery banks (sq. ft.)	1/2	4	10

Choosing Batteries

Battery technology continues to change, and the next few years will likely bring a host of new alternatives to the market. For now, there are three types of batteries commonly installed in house banks on sailboats. Each has its advantages and disadvantages, and the right choice for you will depend upon how you intend to use the batteries, how diligent you are about maintenance, how budget-conscious you are, and how concerned you are about safety. Table 9-15 compares the three types of batteries.

Automotive batteries are designed to handle cranking loads a few times and then to be recharged completely; they spend the vast majority of their life fully charged. Marine batteries have to handle constant cycling with occasional deep discharges while going months at a time without being fully charged. Although the initial cost of automotive batteries versus high-quality marine batteries may make automotive batteries look like an attractive alternative, they will not last as long as house batteries on any boat with even moderate loads.

AN ALTERNATIVE APPROACH TO BALANCING THE ELECTRICAL SYSTEM

This chapter has looked at designing the electrical system in the standard way: determining your electrical loads and from that calculating the necessary battery capacity and charging requirements. This generally leads to charging-intensive solutions that require the engine or generator to be run an hour or more a day in the tropics. But there is another way to balance the electrical system. You can start by deciding how often you want to run the engine or a generator and then design the boat's electrical demand around that.

Start by figuring out how many and what type of solar panels your boat can comfortably carry. Then figure out how large a battery bank you can comfortably install. Given your usage and the solar panel output, how long will it take to discharge the batteries by 30 percent? How much will you get from engine charging over the course of a week based on your preferred running time? If you're using more than you're generating, you'll either have to reduce the boat's energy demand or add other generating sources.

For example, the crew of a 40-foot boat would like to be able to sit for three days in an anchorage without running the engine, and they want to have to run the engine no more then 4 hours per week. They can comfortably install two 75 W rigid solar panels on their stern rail, and they calculate they'll get 20 to 25 Ah from each of these daily, for a total of 40 Ah per day on average. They plan to carry a house bank of 400 Ah of batteries, which gives them 120 Ah of capacity between charges (30 percent of 400). In three days, then, they will be able to use 120 Ah from the solar panels in addition to the 120 Ah from the batteries for a total of 240 Ah.

Their daily house draws will run around 50 Ah. They would like to install DC refrigeration, which will add another 50 Ah for a total of 100 Ah per day or 300 Ah in three days. That gives them a deficit of 60 Ah over three days or 20 Ah per day. The best solution to this deficit is to decrease their usage by 20 Ah per day, perhaps by installing low-energy anchor and interior lights. If they can't completely close the deficit, they could add one more 75 W solar panel, a low-output wind generator, or an additional 240 Ah of battery capacity. With any of these solutions and with a high-output alternator on their engine, they would need to run the engine a bit less than 2 hours every three days or 4 hours per week while at anchor. If they were moving from anchorage to anchorage every few days, they would rarely have to run the engine just to charge.

TABLE 9-15. TYPES OF MARINE BATTERIES			
	Wet-Cells	**Gel-Cells**	**AGM**
Initial cost	• Least expensive	• 1.5–2 times as much per Ah as wet-cells	• 1.5–2 times as much per Ah as wet-cells
Charging sensitivity	• Accept voltages in excess of 14.1 volts	• Charging voltage cannot exceed 14.1 volts at 68°F	• Accept voltages in excess of 14.1 volts
Charge acceptance rate	• Low to moderate	• High	• High
Cycle life[1]	• 500–1,000 cycles	• 500 cycles	• 300 cycles
Temperature sensitivity	• Charging rate can decrease by half in near freezing temperatures	• Low temperatures do not greatly decrease charging rate	• Low temperatures do not greatly decrease charging rate
Safety	• Vent hydrogen gas into battery compartment • Can spill battery acid • Must be installed upright	• Minimal gas release • Sealed—no acid spills • Do not need to be installed upright	• Minimal gas release • Sealed—no acid spills • Do not need to be installed upright
Self-discharge	• 6%–7% per month	• Less than 3% per month	• Less than 3% per month
Sensitivity to discharge	• Lose significant capacity if left discharged for 30 days	• Lose no capacity if left discharged for 30 days; can be left unattended for several months	• Can be left unattended for several months
Maintenance	• Electrolyte must be replenished • Must be equalized every few months	• Maintenance free	• Maintenance free
Other	• Best deep-cycle performance	• Electrolyte cannot be replaced when overcharged	• Electrolyte cannot be replaced when overcharged

[1]Average number of 100% discharge cycles before battery fails to hold half its rated capacity.

All batteries rely on a chemical reaction between lead and sulfuric acid to store and release electrical energy. Wet-cells or flooded batteries use a liquid solution of sulfuric acid, while in gel-cell batteries and AGM (absorbed glass mat) batteries, the acid is contained in a semisolid material.

The liquid acid from wet-cells can spill if the battery is inverted. As the battery charges, it vents hydrogen gas, and the level of liquid falls. To prevent damage to the lead plates, wet-cells have to be periodically topped up with distilled water. They do not hold their charge indefinitely and will discharge completely if left unattended for several months. Once discharged for a month or so, they will never return to their original capacity. Wet-cells also need to be equalized every few months, which means charging them at a higher than normal voltage to remove sulfation from the lead plates and restore charging efficiency.

Gel-cell and AGM batteries were developed to overcome some of these problems. They are sealed, so they need no topping up with water. Their construction eliminates the possibility of an acid spill if they are inverted. They have much lower discharge rates and are much less sensitive to being discharged completely. Also, they can be charged more quickly than wet-cells because they have an acceptance rate up to a third higher. They do not need to be equalized and are virtually maintenance free. Gel-cell batteries have proven themselves since they were introduced in the 1990s, and their strengths and weaknesses are pretty well understood. AGM batteries have been available for only a few years, and the jury is still out on how they will perform on offshore boats. Both types require sophisticated regulators that sense the temperature of the battery and adjust the charging voltage accordingly.

If properly maintained, wet-cells are the most robust and least expensive of the three battery types. The lower initial cost and greater number of cycles mean they can end up costing a quarter of what a sealed battery would cost per amp-hour over the course of their life. They will not be damaged by being charged with higher voltages than normal or by being deeply discharged a few times. Most of the disadvantages of wet-cells are not serious if you are living aboard the boat and using the batteries on a daily basis.

Sealed batteries make sense if you are concerned about safety or if you cannot install the batteries upright. If you intend to leave the boat unattended for long periods of time, gel-cells' low discharge rates and ability to recharge to 100 percent capacity from a fully discharged state will make them worth the extra money. If you have a high-energy-demand boat, the faster charging rates of sealed batteries may also make them worthwhile. Otherwise, high-quality wet-cells will meet the needs of most cruisers at a significantly lower cost.

Like many cruisers, we prefer 6-volt, deep-cycle batteries designed for use in golf carts. Golf carts demand a cost-effective, long-life battery that can handle deep discharges, high amp draws, and constant vibration. If properly maintained, golf cart batteries can be cycled up to 1,000 times without reducing battery capacity. Having also carried high-priced gel-cells, premium deep-cycle marine batteries, and regular marine batteries on our two boats, we have found golf cart batteries to be the most cost-effective, longest-life alternative for our cruising electrical demands. Two 6-volt golf cart batteries will need to be wired in series to create a 12-volt battery.

Engine-starting batteries are designed to produce high electrical output for short periods of time to meet engine-cranking loads. Although deep-cycle batteries will handle engine loads, they are not optimized for this. If you decide to have a dedicated battery for cranking the engine, install a high-quality marine starting battery.

No matter which battery type you choose, buy good batteries from reputable suppliers. Don't mix battery chemistries or batteries of different ages in a single bank. Either can result in battery deterioration and a significant reduction in battery life.

All of our offshore voyagers needed new batteries for their house banks. In all three cases, the existing house bank was undersized compared to the requirements calculated in Table 9-13. In addition, the batteries aboard *Simplicity* and *Moderation* were more than 5 years old. The choices our three crews made in batteries reflect their situations.

Simplicity's single battery will be used both for starting the engine and for meeting her minimal house electrical demands. Susan and Simon purchased a dual-purpose 80 Ah battery designed to handle both types of loads. This was cheaper and weighed less than an equivalent deep-cycle battery.

The Moderations did not intend to leave the boat for long periods of time. By the time they got to the electrical system, their first concern was cost. They opted for 6-volt, deep-cycle golf cart batteries. Two of these batteries connected in series gave them a single 12-volt battery with a 215 Ah capacity. They purchased eight of these batteries and split them into two banks of 430 Ah each.

The Highlifes intended to leave the boat for several months each year, so they wanted a battery with a low discharge rate that wouldn't be damaged if it became totally discharged. Given their high daily electrical usage, they also wanted to limit charging time as much as possible. Safety was another concern, as they hoped to have young grandchildren aboard before the end of their voyage. For all these reasons, they opted for gel-cell batteries, purchasing six 225 Ah batteries for a total house bank of 1,350 Ah. The engine-starting battery was nearly new and still rated at its full capacity, so they did not replace that.

Optimizing Charging

No one wants to run an engine longer than necessary. The best way to limit engine-running time is to set up an efficient charging system. To do that, you'll need to invest in two things: a "smart" regulator and a battery bank monitor.

Automotive chargers are "dumb": They are designed to crank a relatively low fixed voltage into the batteries for as long as the engine is running. Although they can be used on marine batteries, they will not charge a deeply discharged battery bank efficiently. "Smart" regulators adjust charging voltage to match the battery bank's acceptance rate at various stages of charging. They use sensors to measure the parameters that determine how much charge the batteries can accept. A smart regulator can cut charging time by a third, and it will also protect the batteries from overcharging. This is particularly important for gel-cell batteries, which can be seriously damaged if charged at a voltage greater than 14.1 volts. Smart regulators can also be programmed to equalize a bank of wet-cells by charging at high voltages for a specified time.

Battery bank monitors allow you to keep track of the battery bank's voltage. Simple ones display voltage for a single bank. Complex ones can show a host of details for several banks including voltage, charging amps, draw in amps, amp-hours used since last charge, and amp-hours left in the batteries. These are useful tools for tracking energy usage and knowing when it is time to charge. The more complex your charging system, the more you will benefit from a good monitor.

Even with daily engine charging, batteries will gradually lose capacity the longer you are off the grid. This is a function of the fact that over the last 20 percent of battery capacity, the charge-acceptance rate falls to a couple of amps. To fully charge the batteries therefore takes hours, and it takes longer as battery capacity declines. Nothing will make your batteries happier than a long, soaking charge plugged into shore power, and when you're in a marina, you will want to be able to indulge them. To do that, you will need a high-quality battery charger.

BATTERY-DOWN EXERCISE

No piece of electrical gear on an offshore boat can be trusted implicitly. You need to ensure that if you lost your batteries or charging capability, your boat could still function. The best way to do this is to perform a "battery-down" exercise. Think the exercise through first. Then try it on your shakedown passage, while you are still within reach of chandleries and boatyards.

To perform the exercise, turn off the main battery switch for an entire day and see what problems arise. If you have a GPS hooked to ship's power, you will need to dig out the sextant or a handheld, battery-operated GPS. If you have pressurized water, you will need to figure out how you are going to get water out of the tanks. Once it gets dark, you will need spare flashlights. For a day, you'll be without your SSB or ham radio. You will also lose your VHF, unless you carry a handheld that was fully charged when you started the exercise. You won't have any instruments, radar, electronic chartplotting, GPS repeater, deck lights, navigation lights, 12-volt refrigeration, or 12-volt watermaker. What serious problems develop? What if you also lost your engine?

This exercise will show you how dependent you are on your electrical system and help you prepare for the reality of doing without it. Several critical areas may need special attention on your boat, including the following:

- **Emergency equipment.** With the exception of an EPIRB with its own battery and flares, most emergency communications equipment requires power to function. A satellite phone or e-mail system, SSB or ham radio, and VHF radio will all be useless with the battery switch turned off. Handheld VHFs and spare batteries for satellite phones may give you another hour or two of critical communication time.
- **Propane solenoid.** On most boats, the propane system requires an electrical solenoid to function. This is an important safety feature. If you ever lose your batteries, you will need to bypass the solenoid switch to serve hot meals.
- **Electric bilge pump.** If your primary bilge pump uses electricity, you will need to check the bilge regularly for water during the exercise. No boat should go cruising without a manual bilge pump as a backup for the electric pump.
- **Safety lighting.** Flashlights and plenty of spare batteries may not be enough if you have no other electricity. Consider how you will warn a large ship of your presence if you are on a collision course at night and you have no VHF or navigation lights. A flare will be more likely to bring the other vessel to your aid and endanger you instead of making them steer clear. Two alternatives are a handheld spotlight that can be reflected off the sails or a hurricane lantern that can be raised into the rigging.
- **Time signals.** To use the sextant as a backup to the GPS, you need some method of getting time signals. A world-band receiver that operates on dry cells is one option. A ship's clock and a time log are another.
- **Batteries.** The exercise should convince you that you never want to be short of dry-cell batteries. You need to know where the batteries are and be able to get them into the necessary equipment in the dark or with a flashlight.

In addition, the exercise should demonstrate the value of carrying at least one small solar panel for emergency use. This should be able to charge a battery bank enough to run some emergency communications equipment. A small solar charger for rechargeable batteries would also increase the usefulness of a handheld VHF.

Not all chargers are created equal. Like smart regulators, multistage chargers adjust voltage to suit the battery's acceptance rate, making charging as efficient as possible. For a charger to work outside the United States, it must accept 220 (or 240) volts and 50 Hertz; to work in the United States and Canada it must accept 110 (or 120) volts and 60 Hertz. To work worldwide, both voltage and cycle rate (50 or 60 Hertz) must match the local current, but most marine chargers can only be adjusted for voltage. Either buy one of the few marine chargers that can be switched from 110/60 to 220/50, or buy a second charger when the need arises.

Simplicity's single battery will rarely be discharged deeply; it will not require sophisticated technology to recharge it efficiently. The automotive regulator that came with the engine will charge the battery reasonably quickly, and the battery is robust enough that it is unlikely to be damaged by high voltages.

Both *Moderation* and *Highlife* have two battery banks and more sophisticated needs. Both couples installed a smart regulator to facilitate charging, as well as a battery bank monitor to keep track of electrical use. They also installed a battery charger capable of working efficiently with both types of current.

ELECTRICAL SYSTEMS FOR THREE OFFSHORE VOYAGERS

The various components already considered must all be brought together and integrated into a seamless electrical system that meets the boat's electrical demands whether plugged in, at anchor, or at sea. The electrical system should balance the demand for electricity against the crew's preferences with respect to engine-running time and other charging options. Engine- or generator-running time for charging should be about the same as what is needed for other engine-driven equipment such as refrigerators or watermakers.

So far, this chapter has treated configuring and upgrading the electrical system as a neat analytical exercise. But electrical systems on most older boats are anything but neat. Once you've decided where you want to end up, you'll need to go back and deal with the reality on board your boat. Finding your balance may take several iterations and require reconfiguring some of the systems on board to match demand and supply. Once the boat is balanced electrically, any new piece of equipment is likely to force changes in battery capacity, generating options, or both. *Simplicity*, *Moderation*, and *Highlife* help illustrate this process.

As with all the other systems, *Simplicity*, *Moderation*, and *Highlife* each came with an existing electrical system. Table 9-16 summarizes the electrical system on each boat at the time of purchase, and Table 9-17 summarizes the system after each crew finished their refit.

As *Simplicity* illustrates, most crews on small, simple boats avoid investing in complex electrical and charging systems by minimizing their electrical demands. Susan and Simon's two flexible solar panels meet their needs at anchor and their average demands at sea. Including replacing high-energy light fixtures and some corroded wiring while upgrading the boat (Table 4-5), Susan and Simon invested about $1,400 and 29 labor-hours into upgrading their electrical system.

The Moderations faced some tough decisions when it came to the electrical system. When they bought her, *Moderation* had been used coastally, and her battery and charging systems were set up like many coastal boats. Her 200 Ah of batteries were plenty for weekend use and for starting the engine, but they weren't going to meet liveaboard demands. The original engine manufacturer's alternators on her engines wouldn't generate enough power to charge efficiently.

To further complicate things, they wanted to be able to install DC refrigeration without having to completely reconfigure the battery system. That's why they opted for two equal-sized banks of 430 Ah each so they could convert to one bank of 860 Ah that could handle the refrigeration loads. They also installed a smart regulator and a battery bank monitor, replaced some corroded wires, added reading lights throughout the boat, added red lights to preserve night vision in the galley and nav station, and installed a 12-volt outlet in the nav station for using the laptop computer and charging batteries in their small appliances. All this came to a total of $7,000, close to $3,000 of which was labor.

Highlife came with an 800 Ah house bank of relatively new batteries. The previous owners had found that this was not sufficient when running all the navigation equipment on passage. The Highlifes calculated they would have to run the generator 6 hours per day when they had guests aboard or on passage unless they increased battery capacity. That meant replacing the entire house bank, because they couldn't mix old batteries with new. With the new battery bank, they found they needed to run the generator 4 hours per day to meet their peak demands, make water, and run the air-conditioning. When they did not have guests aboard, they ran the generator only 2 hours per day on average.

In addition to reconfiguring their house bank, the Highlifes added a battery charger capable of working off the electrical grid anywhere in the world. They installed 12-volt plugs in the nav station and in the main saloon for running their computers, and a 3000 W inverter in the engine room wired to outlets in the galley and nav station. The total cost of their electrical upgrades came to just over $6,800, including 20 hours of labor.

After cruising through the Med and across to the Caribbean, the Moderations were sick of running an engine 2 hours per day just to keep the refrigerator cold. Michael was worried about the wear and tear on the engines from being run without adequate load. Molly disliked the complexity of having to empty the refrigerator completely whenever they left the boat. She also missed having a working freezer. Despite the cost, they decided to add DC refrigeration and a proper freezer in the Caribbean.

This completely changed their electrical balance, as shown in Table 9-18. Although their battery bank could easily be reconfigured to meet the new demand, they had to add some sort of generating capacity. The cost

TABLE 9-16. ORIGINAL ELECTRICAL SYSTEMS ABOARD THREE OFFSHORE VOYAGERS

	Simplicity	*Moderation*	*Highlife*
Charging sources	• Engine manufacturer's alternator on engine	• Engine manufacturer's alternator on each of two engines	• 165 amp alternator on engine • 10 kW AC generator
Regulating equipment	• Standard automotive regulator	• Boat manufacturer's regulator	• Smart regulator
Monitoring equipment			• Battery bank monitor
House battery bank age and size	• 15-year-old, 50 Ah automotive battery	• 8-year-old, 200 Ah bank of standard marine batteries	• 3-year-old, 800 Ah bank of deep-cycle marine batteries
Engine battery bank age and size			• 3-year-old, 100 Ah engine-starting battery

TABLE 9-17. ELECTRICAL SYSTEMS ABOARD THREE OFFSHORE VOYAGERS AFTER REFIT

	Simplicity	*Moderation*	*Highlife*
Charging sources	• **Two 30 W solar panels**[1] • Engine manufacturer's alternator on engine	• **High-output, 100 amp alternator on each of two engines**	• **Two 75 W solar panel**s • 165 amp alternator on engine • 10 kW AC generator
Regulating equipment	• Standard automotive regulator	• **Smart regulator**	• Smart regulator
Monitoring equipment		• **Battery bank monitor**	• Battery bank monitor
House battery bank	• **New 80 Ah dual-purpose battery**	• **Two banks each with four new 215 Ah 6 V golf cart batteries**	• **Six new 225 Ah gel-cell batteries**
Engine-starting battery			• 3-year-old, 100 Ah engine-starting battery
House bank size (Ah)	80	430	1,350
Primary generating source	• Solar panels	• Engine for 2 hours per day[2]	• Generator for 4 hours per day[3]
Ah per day from primary source	15	160	850+
Average DC load at anchor (Ah)	10	76	300
Deficit at anchor (Ah)	—	—	—
Peak DC passage load (Ah)	28	188	542
Deficit on passage (Ah)	(13)	(26)	—
Other sources	• Run engine as needed	• Run second engine as needed	• Engine when motoring • Solar panels when unattended
Cost of upgrades	~$1,400	~$7,000	~$6,800

[1]Upgrades to original electrical system in **bold**.
[2]To cool refrigerator.
[3]To cool refrigerator/freezer, and run watermaker and air-conditioning using AC power directly from generator.

of solar panels was prohibitive if they were to install enough to meet their refrigeration needs: an array of ten 56 W panels would have cost around $7,000. Instead, they opted for a wind generator rated at 7.5 amps in 20 knots of wind that cost $1,500 and took Michael 20 hours to install. In addition, they installed a separate 100 Ah engine-starting battery, since they now had only one battery bank.

The output from the wind generator was erratic and depended on where they were anchored. They got nowhere near the rated capacity in anchorages where they were sheltered from the wind. After a few months, they decided to add some solar panels to balance their generating capacity. They added two 75 W panels, which gave them almost 40 Ah per day and almost always kept the batteries topped up with whatever the wind generator was producing.

After these changes, they almost never had to run the engine for charging when they were at anchor. On passage, they went from having to run the engine 2 hours a day to running it once every three or four days unless they were drawing at their peak demand. Michael and Molly figured that the savings in wear and tear on the boat's engines more than made up for the $5,500 and 95 labor-hours invested in solar panels, wind generators, and the DC refrigeration system.

Each of the three boats now has an electrical system that is well balanced to their energy usage, though they represent completely different solutions to the electrical balance problem.

TABLE 9-18. *MODERATION*'S ELECTRICAL BALANCE BEFORE AND AFTER INSTALLING DC REFRIGERATION

	Before DC Refrigeration	**After DC Refrigeration**
Average DC loads at anchor (Ah)	76	146
Peak DC loads on passage (Ah)	188	258
Battery capacity to meet average load (Ah; average load × 4)	304	584
Battery capacity to meet peak load (Ah; peak load × 2.5)	470	645
House bank size (Ah)	**430**	**860**
Second battery bank size (Ah)	**430**	**100**
Primary charging source	Engine	Wind generator
Ah per day from primary source	160	50–80
Secondary charging source		Solar panels
Ah per day from secondary source		~40
Maximum engine use to meet average loads at anchor	1–2 hours daily[1]	2 hours per week
Maximum engine use to meet peak loads at sea	2 hours daily	2 hours every 2 days

[1]To cool refrigerator.

HOW LONG CAN YOU LEAVE THE BOAT?

When you've taken a first pass at creating a balanced electrical system, ask yourself one more question: how long could you leave the boat without having to ask someone to run the engine in order to keep the batteries from being discharged beyond 50 percent?

Table 9-19 summarizes the answer for our three offshore voyagers, with *Moderation* shown both as originally equipped and as refit with the 12-volt refrigeration system. The table shows that *Simplicity* can be left unattended for an unlimited time. Susan and Simon will be able to close up the boat and leave it for the winter when they get to Montreal for their postdocs.

Prior to installing DC refrigeration, *Moderation* could go almost two weeks unattended, but the Moderations had to empty the refrigerator before leaving or have someone run the engine daily to keep it cold. After adding DC refrigeration, the Moderations can leave the boat for an unlimited time in such areas as the Caribbean and the Pacific with steady trade winds, but they can leave the boat for only a bit over a week where the wind does not blow consistently and they have to depend on the solar panels.

The Highlifes have the least flexibility and have to arrange to have someone run the generator for them if they plan to be away for more than five days at a time. But their liveaboard lifestyle—with six to nine months on the boat followed by several months back in the States—means that they will leave the boat on the hard, where there will be no electrical draws. The solar panels will trickle-charge the batteries, keeping them topped up.

TABLE 9-19. TIME LEFT UNATTENDED FOR THREE OFFSHORE VOYAGERS

	Simplicity	***Moderation* (engine-driven refrigeration)**	***Moderation* (12 V refrigeration)**	***Highlife***
Electrical draws (Ah):				
Anchor light	1.2	9.6	9.6	24.0
Bilge pump	0.5	0.5	0.5	1.0
Refrigerator/freezer	—	—	70.0	100.0
Total Draw	**1.7**	**10.1**	**80.1**	**125.0**
Primary generating source	Solar panels		Wind generator	Solar panels
Secondary generating source			Solar panels	
House bank size (Ah)	80	430	860	1,350
Ah per day from charging sources	14	0	50–150	40
Maximum deficit per day	—	(10)	(30)	(85)
30% of battery capacity	24	129	258	405
Total Days Until 50% Discharged	Unlimited	~13	~9	~5

CHAPTER 10

Putting It All Together: From Refit Plan to Balanced Boat

ONCE YOU HAVE bought a boat for long-distance voyaging, your focus will shift to fitting out that boat for the task ahead. That process will go much more smoothly if you develop a refit plan to help you prioritize and organize tasks and prioritize your spending. While it comes last in this section, a comprehensive refit plan should come first in your actual refit.

The well-set-up voyaging yacht, her gear, and her crew represent a balanced system along several key dimensions. The crew can manage the routine maintenance required to keep systems running without outside assistance most of the time. The electrical generating sources and battery capacity are sized to meet peak and average demands between charging sessions. The overall cost of the yacht, her equipment, and its maintenance fit comfortably within the crew's budget. The boat can handle the weight of all her stores and gear without losing too much sailing performance, and everything aboard can be securely stowed for offshore passagemaking. *Simplicity*, *Moderation*, and *Highlife* demonstrate how every crew comes to its own balance along these key dimensions.

This chapter pulls together the upgrade and refit chapters in this part by starting from the refit plan and ending with the balanced boat. It uses a real-world example of a refit plan and the refit that followed to illustrate the process. It then returns to *Simplicity*, *Moderation*, and *Highlife* to see how they put together their refit plans, how much money and time the refits took, and how the boats compare in terms of lifestyle and the balance each represents.

A REAL-WORLD EXAMPLE: REINVENTING *GINNY*

On a perfect October day in 1997, I stood on a dock in a marina on Kent Island, Maryland, in the northern part of the Chesapeake Bay, gazing down at a 20-year-old, sadly neglected Cal 39 called *Chispa*. Walker Vought, the boat's proud new owner, bounced from foot to foot next to me wearing a big grin, barely able to contain his enthusiasm. "I sailed her yesterday," he told me. "She sails like a dream—even with 20-year-old sails. We're leaving first thing in the morning to take her home to Connecticut." His ever-practical wife, Ginny, added, "Assuming they manage to fix the leaking head."

Most people would not have been so enthusiastic given the boat's badly weathered teak, bird-soiled decks, chafed running rigging, and cracked and leaking ports and hatches. Down below, eight years of neglect were evident in the sour smell of mildew, the sagging headliner, the scuffed wood of the cabin sole, and the water stains on every hatch and port surround. To buy a 20-year-old Cal 39 cost about $60,000 at that time, a bargain by offshore boat standards, but this boat would need a significant investment before it would be a comfortable home. They both knew that while their patient search for a boat had finally ended, the work had only just begun. Four years and some significant investments still separated them from their cruising dream. But they approached the refit with single-minded determination and realism. They knew exactly how they were going to go about converting their newly acquired, rundown coastal cruiser into a proper offshore yacht.

A Sensible Four-Year Refit Plan

Walker and Ginny's approach to refitting their new boat, which they renamed *Ginny*, reflected their budget and cash flow situation. They needed another three and a half years of income from both of their full-time jobs to finance the fitting out. They planned to work on the boat evenings and weekends from fall through spring, returning her to sailing condition in time for each summer season. Not only would this give them a break from the hard work, but it would let them get to know their new boat.

Table 10-1 summarizes the plan they laid out for me on that balmy October day. Their approach would make the boat livable and sailable as quickly as possible and leave the purchase of expensive offshore equipment until they were nearing their expected departure date in the spring of 2001. They estimated they would spend $20,000 per year plus a large investment of their own labor. They budgeted an additional $20,000 for the winter of 2000–2001 to address any unforeseen problems they discovered along the way. By the spring of 2001, they hoped to have a boat capable of sailing around the world and voyaging in both tropical and temperate latitudes.

Executing the Plan

The sequences of images in this section illustrate changes that took four winters and several thousand labor-hours to realize. By the end of the period, the combination of Walker's meticulous craftsmanship and Ginny's elegant and refined taste had transformed *Ginny* into a vessel that could properly be called a yacht.

The original interior with its dark wood and brown and tan upholstery had a brooding, claustrophobic feel (Figures 10-1 and 10-3). Walker started by stripping the headliner, cushions, and most of the furniture out of the boat. He replaced all the old wiring and the portlights. Then he installed a simple batten system in the ceiling and painted the major bulkheads white. When he was finished, the interior had been completely transformed and now has an airy sense of space (Figures 10-2 and 10-4). The battens carry the eye from beam to beam and make the boat feel much wider. The white bulkheads add a sense of height. Cherry trim offers a colorful counterpoint to the darker teak. The handgrips have been moved from the cabintop to the bottom of the coach roof, where Ginny can reach them.

Walker told me, "The biggest change in the boat, the thing that makes the biggest impression on everyone—

TABLE 10-1. ORIGINAL REFIT PLAN FOR *GINNY*

	Winter of 1997–98	Winter of 1998–99	Winter of 1999–2000
Primary goal	• Make livable and sailable for coastal cruising	• Redo interior layout and accommodations	• Equip for offshore
Interior upgrades	• Replace headliner • Replace wiring under headliner • Replace hoses • Paint bulkheads • Restore floorboards • Replace cushions	• Remodel galley • Replace icebox • Rotate nav station 90° • Modify quarter berth to increase engine access	• Replace stove • Switch from CNG to propane • Install louvers on all locker doors • Redo dining table • Install foot pumps • Install holding tank
Exterior upgrades	• Replace portlights • Install new hatch forward • Restore brightwork • Strip, clean, and wax hull		• Buy new soft dodger • Rebuild chain locker
Sails and rig	• Move traveler into cockpit • Replace genoa • Replace halyards	• Replace spars • Buy new mainsail • Replace primary winches • Upgrade spinnaker gear • Buy new spinnaker	• Install staysail stay • Buy storm jib
New equipment	• Roller furling on genoa • Feathering propeller • Speed/depth instruments • Anchor and chain	• Engine-driven refrigeration • Below-deck electric autopilot • Rigid vang • Wind instruments • Radio and CD player	• Wind vane • Windlass • Life raft • VHF • GPS

Figures 10-1 and 10-2.

Reinventing *Ginny:* Main saloon before (top) and after (bottom) the refit. (Top: Walker Vought photo)

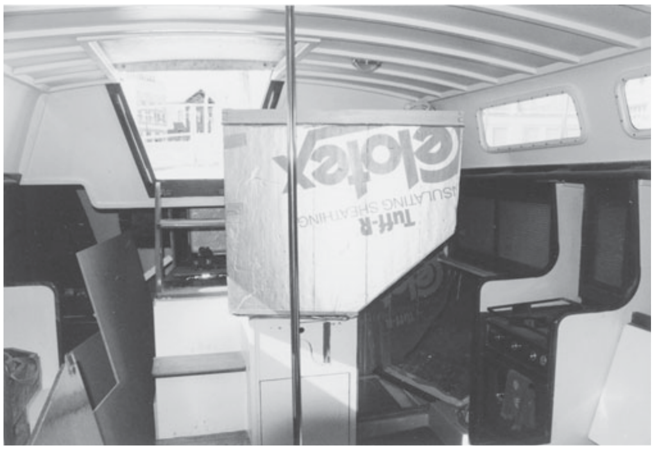
Figures 10-3 and 10-4.

Reinventing *Ginny:* The galley before (top) and after (bottom, with Ginny Vought in the nav station) the refit. (Top: Walker Vought photo)

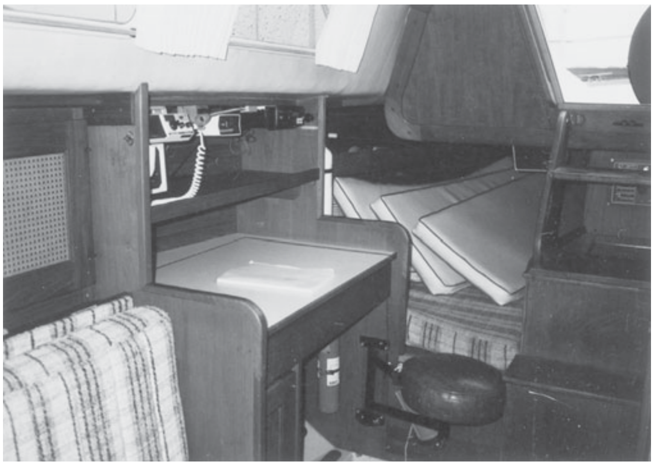
the interior look—was the cheapest thing I did. It cost me about $500 in materials: a few sheets of Formica, some northern pine for the battens, some paint and West Epoxy, and some cherry." And about 500 hours of labor, "not including 'figure and fudge' time."

The original U-shaped galley was reasonably well designed for offshore work (Figure 10-3). Beyond the cosmetic issues, Walker and Ginny wanted to upgrade three things: the single shallow sink, the poorly insulated icebox, and the CNG stove. The first season, Walker rewired the galley, painted the bulkhead white, and installed the battened ceiling as in the main saloon.

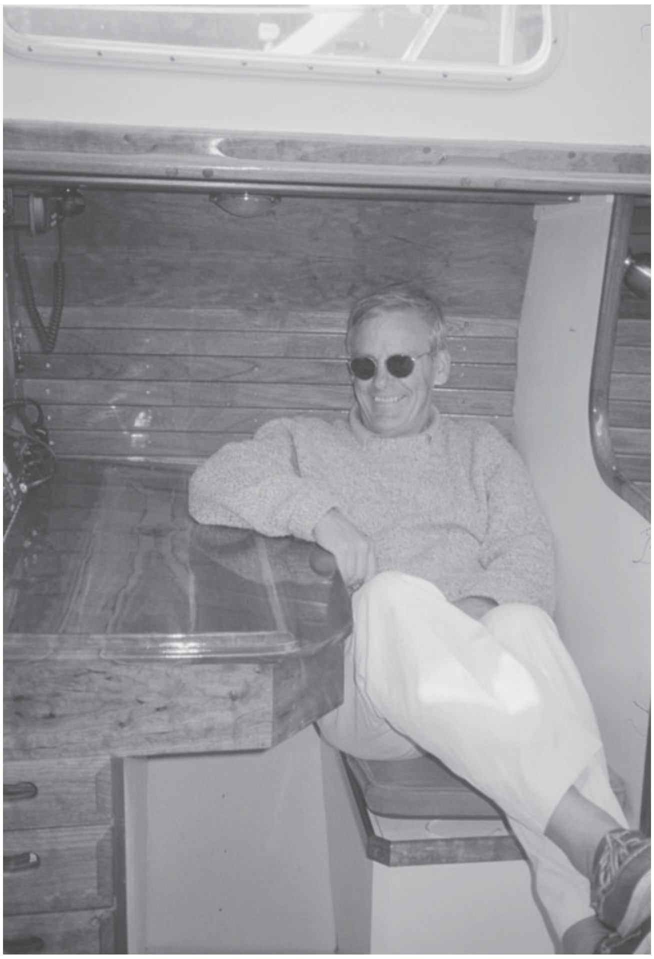
The second season Walker ripped out the countertop in order to remove the old icebox, which turned out to have less than an inch of insulation in most places (Figure 10-5). He completely rebuilt the icebox, glassed it over, and then insulated it with 4 inches of urethane foam used in house building (Figure 10-6). He also pulled out the bulkhead between the galley and the cockpit locker in order to add more lockers at the aft end of the galley. He replaced the CNG stove with one that ran on propane and the single shallow sink with two deep stainless steel sinks. He rebuilt the counters, covering them with white Formica, and added a storage space that extended into the cockpit locker for dishes. The last year he replaced



Figures 10-5 and 10-6.
Reinventing *Ginny:* Original icebox (left); rebuilt and reinsulated icebox (right). (Walker Vought photos)



Figures 10-7 to 10-9.
Reinventing *Ginny:* Quarter berth progression. (Left photos: Walker Vought)



Figures 10-10 and 10-11.
Reinventing *Ginny:* Nav station before (left) and after (right, with Walker Vought) refit. (Left: Walker Vought photo)

the caning on the original locker doors with cherry louvers. The finished galley has a much brighter, more open feel than the original and is far better suited to an offshore voyager (Figure 10-4).

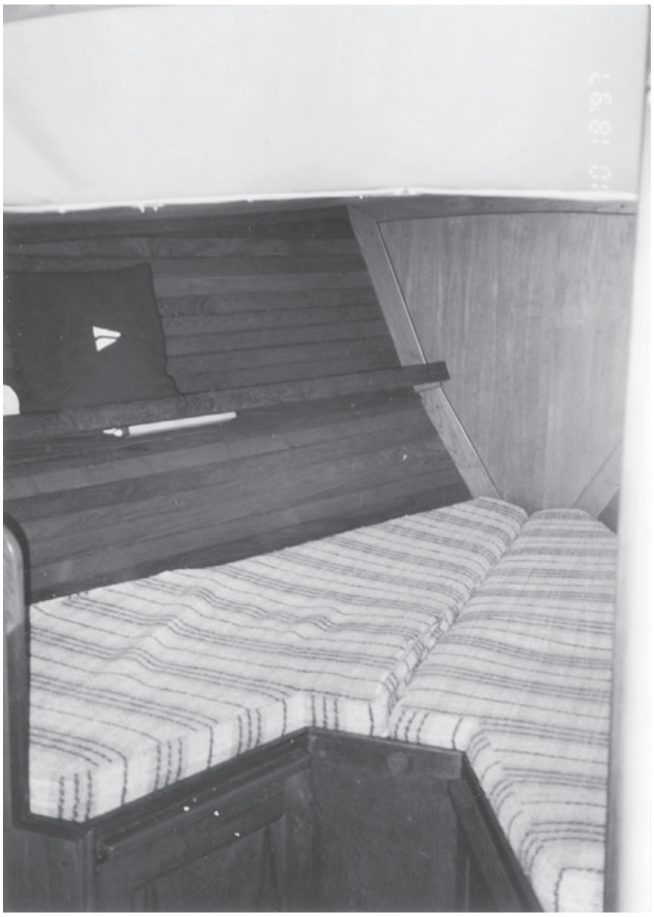
Walker and Ginny devoted almost as much attention to the navigation station and quarter berth as they did to the galley. The quarter berth was dark, yet the bunk was too wide to make a good sea berth (Figure 10-7). The original navigation station ran fore and aft; the navigator sat on a swing-out swivel stool (Figure 10-10). The stool and the bunk limited access to the starboard side of the engine, where the oil and fuel filter were located.

Walker started by pulling out all the furniture in the quarter berth and nav station. In the quarter berth, he created a step between the berth and the engine box, which increased access to the engine while narrowing the berth (Figure 10-8). In the navigation station, he built a bench seat, leaving enough room for a desk.

The finished quarter berth feels much more open and accessible than the original. This area illustrates how small details can make large differences in the look and feel of a space. Cutting away the corner over the quarter berth, painting the aft bulkhead white, and decreasing the width of the trim pieces make the whole interior of the quarter berth visually accessible (Figure 10-9). The side-to-side navigation station is much more comfortable and practical than the fore-and-aft arrangement it replaced (Figure 10-11).

The original forepeak was dark, the foot was too narrow for two people, and there were no accessible stowage spaces (Figure 10-12). The addition of a new hatch in front of the mast allowed much-needed light into the aft end of the forepeak and the passageway to the head. By reducing the size of the frames behind the battens along the hull sides, Walker increased the width of the foot of the forepeak by 6 inches. The cedar-lined sweater locker over the foot of the berth added some needed stowage space while finishing the look of the forepeak (Figure 10-13).

The visible changes hide a host of invisible but time-consuming details. After stripping the interior back to bare



Figures 10-12 and 10-13.
Reinventing *Ginny:* Forepeak before (left) and after (right) refit. (Left: Walker Vought photo)

Figure 10-14.
Chispa on the hard shortly before Walker and Ginny bought her. (Walker Vought photo)

Figure 10-15.
Ginny under sail in Long Island Sound.

fiberglass, Walker watched water leaking in through the toe rail in heavy downpours. He consulted with a boatbuilder, gritted his teeth, and set about removing and rebedding the toe rail. He sealed every piece of wood that went into the boat with epoxy to prevent rot. He replaced every wire and every hose. The shiny varnish and elegant woodwork demonstrate Walker's skills, but these unseen details attest to his dedication and passion for doing things right.

The exterior went through almost as many changes as the interior (Figures 10-14 and 10-15). Walker moved the traveler from the coach roof into the cockpit, added a staysail stay, installed a soft dodger over the companionway, repainted the decks with nonskid paint, and revarnished the teak. Cockpit cushions and a sail cover finished off the exterior.

While Walker contributed the skills and the labor-hours, Ginny brought good sense and good taste to the project. Ginny's elegant touches—a royal blue, patterned porcelain washbasin in the head; brass lanterns in the main saloon; the brightly colored pillows throughout the boat—softened Walker's austere nautical classicism. In the end, the boat reflects both of their personalities, because for both of them, reinventing *Ginny* became a labor of love.

Tallying the Bottom Line

In the fall of 2000, Walker and Ginny were busy preparing for their spring departure. They planned a shakedown cruise to Maine and then a voyage south to the Caribbean.

TABLE 10-2. FOUR-YEAR REFIT PLAN FOR *GINNY* AS EXECUTED

	Winter of 1997–98	Winter of 1998–99	Winter of 1999–2000	Winter of 2000–01
Primary goal	• Make livable and sailable for coastal cruising	• Redo interior layout and accommodations	• Finish interior layout and equip for offshore	• Unfinished/unforeseen projects and final touches
Interior projects	• Replace headliner • Replace wiring under headliner • Replace hoses • Paint bulkheads • Restore floorboards • Replace cushions • **Widen foot of V-berth**[1] • **Install Lavac head** • **Lower handgrips**	• Remodel galley • Replace stove • Replace icebox • Turn nav station 90° • Modify quarter berth to increase engine access • **Install porcelain sink in head**	• Install louvers on all doors • Redo dining table • Install foot pumps • Install holding tank • **Refinish/enlarge drawers** (see Figure 11-2) • **Install sweater locker in forepeak**	• Replace stove • Convert CNG to propane
Exterior projects	• Replace portlights • Install new hatch forward • Restore brightwork • Strip, clean, and wax hull • **Rebed toe rail**		• Buy and install dodger • **Replace washboards** • **Awlgrip hull**	• **Replace rudder** • **Replace lifelines** • **Install stainless steel tubing around cockpit** • **Replace nonskid**
Sails and rig	• Move traveler into cockpit • Replace genoa with used sail	• Replace boom • Buy new mainsail • Upgrade spinnaker gear	• Pull mast, recondition, and paint • Install new halyards • Replace primary winches • Buy new genoa • Install staysail stay • **Install self-tailing winch for main halyard** • **Re-lead mainsheet**	• Buy storm jib • Buy spinnaker • Buy new genoa
New equipment	• Roller furling on genoa • Feathering propeller • Speed/depth instruments • VHF • GPS	• Engine-driven refrigeration • Electric autopilot • Anchor and chain • Rigid vang • Radio/CD player	• Wind instruments • **SSB** • **Watermaker**	• Wind vane • Windlass • Life raft • **Radar** • **Bus heater**
Estimated Cost	**$12,000**	**$19,000**	**$41,000**[2]	**$22,000**
Estimated Labor-Hours	**500**	**700**	**800**	**350**

[1]Items in **bold** represent additions to the original work list.
[2]Includes $11,000 for Awlgripping the hull.

The boat sitting on Walker's mooring at the Pequot Yacht Club resembled the boat I'd first seen almost three years before only in her pleasing lines and tall mast. So how close did they come to their original plan? Table 10-2 summarizes Walker's answer. Not everything went as expected, and they did have their share of unforeseen expenses.

The only thing Walker didn't do was rebuild or replace the engine. The Voughts ended up doing that in their first year of cruising, a rather large expense they hadn't factored into their first year's budget and one of the only things they wished they had done differently. Including the engine, Walker and Ginny spent a bit over $100,000 transforming a worn coastal cruiser into an offshore voyager. Walker invested some 2,350 labor-hours over four winters, more than a year's worth of labor if he had been working full-time.

Ginny ended up balanced along all the dimensions critical to the success of an offshore boat. A bit over an hour of engine time each day charged the holding plate in the icebox, ran the watermaker, and recharged the batteries. She could carry all her equipment without sacrificing sailing performance. The maintenance load was acceptable to Walker and Ginny in return for ice for their drinks and hot water for their showers. She was large enough for the two of them to live comfortably aboard, but small enough that one of them could easily handle her both under sail and power. The cost of outfitting her fit their cash flow and their budget, and her ongoing maintenance costs have not put too much strain on their cruising kitty.

Ginny has proven to be a comfortable liveaboard home and an able offshore passagemaker. Unfortunately, Walker only enjoyed one season cruising the Caribbean before he died of a brain tumor. It took Ginny a year to decide what to do after the sudden U-turn in her life, but since then she and a friend have completed an Atlantic circle aboard *Ginny*.

REFIT PLANS FOR THREE OFFSHORE VOYAGERS

Unless you have purchased a brand-new boat, whatever boat you acquire will come with an inventory of equipment and a set of structural strengths and weaknesses. These form the starting point for the refit plan. The end point should be the crew's vision of their ideal cruising boat. That vision needs to reflect the crew's budget, their skills, their attitudes toward safety, and the compromises they have decided to make with respect to comforts and conveniences.

A good refit plan will allow you to prioritize the improvements you want to make while helping you size the refit to your budget from the outset. The process of developing a comprehensive refit plan starts with an inventory of the boat's equipment and an assessment of the structural upgrades that will be necessary to make her livable and sailable. A good professional survey in conjunction with your own survey of the boat's structure and systems will provide an initial list of basic upgrades and new equipment. Anything you have learned from other owners about specific weaknesses and ways they can be addressed will also be important items on the refit list. Appendix 4 provides a list of upgrades that may be necessary on boats of different ages for use in identifying additional areas that need to be addressed in the refit plan. A good boatyard can give you a rough estimate of costs and timing to prevent unpleasant surprises after the refit gets underway. As was the case with *Ginny*, the refit plan will get modified as you get to know your new boat.

The refit plans and timing for *Simplicity*, *Moderation*, and *Highlife* tie together the chapters in this part and illustrate how refit plans help crews make decisions as they structure and execute a refit. A comparison of what life is like aboard the three boats and the balance each represents should help you and your crew discuss trade-offs as you work toward a unified vision of the ideal, affordable, best-equipped boat for your voyage.

Refit Plans and Time Frames

As we have seen in the preceding chapters, *Simplicity*, *Moderation*, and *Highlife* started from very different places with respect to their basic structure, sail and anchor inventories, equipment lists, and electrical systems. Their owners often had to compromise in developing their refit plans, modifying their preferences to reflect what the boat already carried and what they could afford.

Simplicity

With what Susan's parents had lent them, Susan and Simon had $30,000 to buy, upgrade, and equip a boat. After a great deal of looking and some hard bargaining, they managed to acquire their 33-foot, 30-year-old cutter for $16,000. That left $14,000 to refit the boat.

The first thing Susan and Simon did was to develop a comprehensive wish list that included every improvement they ideally would make before they sailed away. In putting together that list with rough estimates of cost and timing, they quickly realized that it was going to be a challenge to stay within their budget and complete even half the things on the list. They started over again, this time guided by the principle of doing only what was essential to make the boat seaworthy and to keep them both safe. Many people would not be comfortable with their definition of safety, which focused on the fundamental integrity of the boat and did not include an EPIRB or a life raft.

TABLE 10-3. INITIAL REFIT PLAN FOR *SIMPLICITY*

	Description	Equipment/ Materials	Total Labor-Hours
Upgrading basic boat	Rebond bulkhead	$50	20
	Fill blisters/paint bottom	$500	40
	Improve anchoring platform	$300	20
	Restore mast/replace rigging	$1,000	80
	Replace nonskid	$150	20
Total		**$2,000**	**180**
Sails and sail handling	New mainsail	$1,000	—
	Repair genoa	$100	20
	New self-tailing primary winches	$2,000	10
	Change primary to secondary winches	—	10
	New storm jib	$800	—
	Replace halyards	$400	10
Total		**$4,300**	**50**
Anchoring and mooring	New primary anchor/rode	$800	5
	Additional line	$300	—
Total		**$1,100**	**5**
On-deck essentials	Inflatable dinghy/**outboard**[1]	$2,000	—
	Wind vane	$2,000	20
	Tiller autopilot	$800	—
Total		**$4,800**	**20**
Other equipment	GPS	$100	—
	Charts	$200	—
	Depth sounder	$200	10
	Refrigeration	$800	60
Total		**$1,300**	**70**
Electrical equipment	Solar panel	$400	10
	Battery	$100	10
Total		**$500**	**20**
Estimate of Total Costs		**$14,000**	**345**

[1]Items in **bold** in second column considered "luxuries" to be left off if money ran short.

They had eliminated several large projects by the time they settled on their initial refit list (Table 10-3), most notably rebuilding the engine. They decided that having an engine was not a matter of safety, so they would use the engine for as long as it lasted and make do without when the time came.

Their initial refit list did include several items they considered "luxuries"—things that were not essential for safety but that they thought they might have enough money to include. They considered the outboard motor, refrigeration, and the tiller pilot expendable, in that order, if they ran out of money.

They knew from the outset that they would do all the work themselves as they could not afford to pay hourly labor rates to anyone else. They both planned to spend weekends and evenings on the boat for an average of 20 hours each per week. By the time they had found and purchased *Simplicity* and started the refit, they still had eight months of their year-long postdoc positions to go. They thought they would be able to do most of the work over the three winter months, leaving them the spring and early summer to sail the boat and work out any bugs.

They soon discovered that they had underestimated the time and money necessary to upgrade the basic boat and had completely ignored the work required to get the boat watertight. By mid-spring, they had only managed to finish the projects listed in Table 4-5 for an investment of $5,000 and more than 600 labor-hours.

They did not consider any of what they did in the initial rebuild discretionary, but by the time they had finished, their luxury items had all been crossed off the list. They found other ways to cut corners. They were able

TABLE 10-4. REFITTING *SIMPLICITY:* ACTUAL COSTS AND TIMING VERSUS THE REFIT PLAN							
	As Detailed In	**Equipment/ Materials**	**Total Labor-Hours**	**Owners' Labor-Hours**	**Cash Outlay**	**Refit Plan Cost**	**Refit Plan Hours**
Upgrading basic boat	Tables 4-5, 4-6	$5,250	600	600	$5,250	$2,000	180
Sails and sail handling	Table 5-8	$3,300	40	40	$3,300	$4,300	50
Anchoring and mooring	Table 6-6	$900	5	5	$900	$1,100	5
Dinghy	Chapter 7	$300	120	120	$300	$2,000	0
Self-steering	Chapter 7	$1,500	10	10	$1,500	$2,800	20
On-deck safety gear	Table 7-7	$500	20	20	$500	0	0
Navigation equipment	Table 8-11	$1,000	10	10	$1,000	$500	10
Communications equipment	Table 8-11	$100	—	—	$100	0	0
Comforts and conveniences	Table 8-11	—	—	—	0	$800	60
Electrical equipment	Table 9-17	$1,400	30	30	$1,400	$500	20
Total Refit Costs		**$14,250**	**835**	**835**	**$14,250**	**$14,000**	**345**
Refit Budget					**$14,000**		

to buy used sails, winches, and anchoring equipment, which cut the cost of these items significantly. Most of the rest of their refit plan estimates came close to what they actually invested, both in money and labor-hours (Table 10-4). The one exception was the hard dinghy they chose to build instead of buying an inflatable. They finished installing the electrical equipment the weekend before their postdocs ended, so it had taken them the full eight months to get the boat ready to head offshore.

They ended up spending 90 percent of the purchase price equipping *Simplicity* to a level of safety they both felt comfortable with. For double what they spent on the refit, or around $30,000, they could have rebuilt the boat completely, as the Voughts did with *Ginny*, and added a few of their hoped-for luxuries. Nevertheless, when finished, they had an offshore-capable boat that could take them anywhere for just $30,000.

Moderation

The Moderations had budgeted $200,000 to buy and outfit a boat. They had hoped to find a boat for $120,000 so they would have $80,000 for the refit. But in buying their 40-foot catamaran, they ended up spending $145,000—a good price for the boat, but one that left quite a bit less for the refit. They had hoped the catamaran's extensive equipment inventory would save them some money, but they found that most of the equipment on the 13-year-old boat needed to be upgraded or replaced. Their guiding vision for the refit was to do everything necessary to make the boat structurally sound and safe and then to add a moderate range of comforts and conveniences, most of them geared toward making life aboard safer or more enjoyable for the children.

They bought *Moderation* at the beginning of the third year of their five-year departure plan. They sailed the boat for the summer while getting quotes from several reputable boatyards for the work that needed to be done. After surveying the boat, thoroughly checking all the equipment, and getting these quotes, they put together their initial refit list, and it looked as if they would be able to do everything they wanted and stay within their budget (Table 10-5). In the fall, they took *Moderation* to the yard they felt most comfortable with, though it wasn't where they had gotten the lowest quotes. Their plan was to have the work completed over the winter and then to sail the boat for another summer, deciding what else needed

TABLE 10-5. INITIAL REFIT PLAN FOR *MODERATION*		
	Description	**Total Cost**
Upgrading basic boat	Antifoul bottom	$1,500
	Rebed deck fittings	$2,500
	Add hatch/solar screens	$1,500
	Add inner forestay/checkstays	$1,000
	Service engines	$800
	New cushions throughout	$1,500
Total		**$8,800**
Sails and sail handling	Lead reefing/main halyard to cockpit	$800
	Replace halyards	$800
	Install preventer system for mainsail	$1,000
	Buy new storm jib	$800
Total		**$3,400**
Anchoring and mooring	New primary anchor/rode	$1,000
	New secondary anchor/rode	$1,000
	New line	$300
Total		**$2,300**
On-deck essentials	Inflatable dinghy/outboard	$4,000
	Backup self-steering	$2,500
	Life raft	$3,500
	EPIRB	$1,000
Total		**$11,000**
Other equipment	Chartplotter	$3,000
	Ham radio/Pactor modem	$2,500
	12 V watermaker	$4,500
	12 V refrigeration	$4,000
Total		**$14,000**
Electrical equipment	Install new batteries	$1,500
	Install new alternators, regulator, monitor	$3,500
	Install solar panels/wind generator	$3,000
Total		**$8,000**
Estimate of Total Costs (including labor)		**$47,500**
Estimate of Labor-Hours		**350**
Refit Budget		**$55,000**

to be done. Any additional items could be finished over the following fall and winter before they sailed away after school recessed in the spring.

By midwinter, mounting yard bills started to alarm the Moderations. A combination of unforeseen problem areas—such as the plumbing system, much of which needed to be replaced or upgraded, and core failure around some deck fittings—meant that they had already doubled the initial estimate with half the work yet to be done. Michael and Molly took a serious look at their options, and Michael talked to the yard manager. The yard agreed to give them a reduced labor rate if it could use the boat to fill out its capacity that year and the following year. In addition, Michael took over many of the less-skilled jobs, such as rebedding all the deck hardware, working weekends so as not to get in the way of boatyard employees.

By the time summer came, they had completed the major upgrades, and most of what remained was installing equipment. The Moderations cruised aboard *Moderation* for the summer and were happy with the work that had been done.

Most of the rest of the refit went more or less according to their early estimates (Table 10-6). The Code Zero sail and the removable furler were one big exception; their cost more than doubled what they had intended to spend on sails. But after their summer sailing the boat, they had decided they really needed this additional light-air sail, and it was to get a lot of

TABLE 10-6. REFITTING *MODERATION:* ACTUAL COSTS AND TIMING VERSUS THE REFIT PLAN						
	As Detailed In	Equipment/ Materials	Total Labor-Hours	Owners' Labor-Hours	Cash Outlay	Refit Plan Estimate
Upgrading basic boat	Tables 4-5, 4-6	$10,000	325	200	$18,200	$8,800
Sails and sail handling	Table 5-8	$8,300	40	40	$8,300	$3,400
Anchoring and mooring	Table 6-6	$2,100	5	5	$2,100	$2,300
Dinghy and outboard	Chapter 7	$4,500	—	—	$4,500	$4,000
Autopilot ram and service	Chapter 7	$2,000	—	—	$2,000	$2,500
On-deck safety gear	Table 7-7	$6,000	10	—	$6,400	$4,500
Navigation equipment	Table 8-11	$3,300	20	—	$4,100	$3,000
Communications equipment	Table 8-11	$2,300	20	—	$3,100	$2,500
Comforts and conveniences	Table 8-11	$4,300	40	—	$5,900	$8,500
Electrical equipment	Table 9-17	$4,200	70	—	$7,000	$8,000
Initial Refit Costs		**$47,000**	**530**	**245**	**$61,600**	**$47,500**
Add DC refrigeration	Chapter 9	$5,500	95	95	$5,500	
Total Refit Costs		**$52,500**	**625**	**340**	**$67,100**	
Refit Budget					**$55,000**	

use on days when most other boats in the Med were motoring. Safety gear also cost more than they had anticipated.

These costs, along with the unforeseen costs for upgrading the basic boat, put them over their budget. When it came time to install DC refrigeration, they realized it would mean totally reorganizing their electrical system. The holding-plate, engine-driven refrigeration had worked fine on their summer cruises, and they had rarely had to run the engine just to cool the fridge. They decided to set up the batteries so they could convert later, but to see if they could get along without DC refrigeration. As discussed in the Electrical Systems for Three Offshore Voyagers section in Chapter 9, they added the system later, in the Caribbean.

To cover the additional cost of the refit, they ended up working an extra six months at their jobs, quitting in June instead of in January as they had intended. Including installing the DC refrigeration, they spent 46 percent of the purchase price of the boat on the refit, about average for a boat that age that had not been equipped for offshore sailing.

Of our three crews, the Moderations had to walk the finest line in outfitting the boat. The Simplicitys' budget limited them to doing only what was absolutely essential. The Highlifes had the money to indulge themselves even if it meant going overbudget. But the Moderations had to make trade-offs between different pieces of equipment, picking the things that mattered most to the way they wanted to live aboard.

Highlife

The Highlifes set a budget of $500,000 for buying, upgrading, and refitting a boat. They spent $430,000 purchasing *Highlife*, paying a premium to buy a brand-name, nearly new boat that had just been refit by her previous owners. They could have sailed away the day they bought the boat without investing any money at all. They had thought there wouldn't be much they would

TABLE 10-7. INITIAL REFIT PLAN FOR *HIGHLIFE*		
	Description	**Total Cost**
Upgrading basic boat	Install hard dodger/bimini Install variable-pitch prop Convert to freshwater toilets	$2,000 $5,000 $2,500
Total		**$9,500**
Sails and sail handling	Buy new jib Buy Code Zero/removable furling gear Install preventer for mainsail Install furling on staysail/new staysail	$3,000 $10,000 $2,000 $5,000
Total		**$20,000**
Anchoring and mooring	Buy two shore lines and mesh bags	$800
Total		**$800**
On-deck essentials	Buy RIB and outboard Install second autopilot	$7,500 $6,000
Total		**$13,500**
Other equipment	Buy Iridium phone Install marinized computer Buy computer charting program and paper charts Install washer/dryer, dishwasher, trash compactor	$2,000 $5,000 $3,000 $3,000
Total		**$13,000**
Electrical equipment	Inverter/charger Inverters for engine room/nav station Solar panels	$2,500 $1,000 $1,500
Total		**$5,000**
Estimate of Total Costs (including labor)		**$61,800**
Estimate of Labor-Hours		**300**
Refit Budget		**$70,000**

want to do before setting off, but when they finished compiling their wish list, it was considerably longer than they had expected (Table 10-7). Just about everything they wanted to add they considered to be luxuries, with the exception of some of the upgrades to the basic boat including the hard dodger and bimini—essential after Hugh had some precancerous lesions removed from his face.

They got quotes from several yards and went to the one that had done top-quality work on their J/120. The yard agreed to complete the work in two months and gave them an estimate for their work list that totaled about $60,000.

The yard's estimate would have been fairly accurate, except that Hugh and Hilary kept "going overboard," as Hilary put it. They decided to add hatches in each of the aft cabins after trying to sleep in one on a hot night. The hard dodger doubled in cost when they got a naval architect involved because they didn't like the look of the dodger the yard mocked up on the boat. The autopilot installation got more expensive when they decided to upgrade to a gyroscopic compass to make the steering more accurate. The deluxe worldwide charting program and complete charts and guides ended up costing double what they had budgeted. The comforts and conveniences tripled when they went out and bought a large flat screen and a satellite television antenna so they could watch television on the boat. In the end, the refit cost close to $100,000 and took three months to complete (Table 10-8).

The Highlifes freely admitted that just about everything they did to the boat was discretionary. They ended up spending 22 percent of their purchase price on their refit, but that was quite a bit more than most people would have spent on such a well-equipped boat. They exceeded their budget by about $25,000, but the only time they regretted the money they spent was when the extra equipment broke down, which happened far more often than either of them had expected.

TABLE 10-8. REFITTING *HIGHLIFE:* ACTUAL COSTS AND TIMING VERSUS THE REFIT PLAN						
	As Detailed In	**Equipment/ Materials**	**Total Labor-Hours**	**Owners' Labor-Hours**	**Cash Outlay**	**Refit Plan Estimate**
Upgrading basic boat	Tables 4-5, 4-6	$11,500	220	—	$22,000	$9,500
Sails and sail handling	Table 5-8	$17,800	40	—	$19,800	$20,000
Anchoring and mooring	Table 6-6	$300	—	—	$300	$800
New RIB and outboard	Chapter 7	$7,500	—	—	$7,500	$7,500
Second electric autopilot	Chapter 7	$8,000	20	—	$9,000	$6,000
On-deck safety gear	Table 7-7	$4,000	—	—	$4,000	—
Navigation equipment	Table 8-11	$6,000	10	—	$6,600	$3,000
Communications equipment	Table 8-11	$8,000	40	—	$10,000	$7,000
Comforts and conveniences	Table 8-11	$6,000	80	—	$9,800	$3,000
Electrical equipment	Table 9-17	$5,700	20	—	$6,800	$5,000
Total Refit Costs		**$74,800**	**430**	—	**$95,800**	**$61,800**
Refit Budget					**$70,000**	

WHY WEIGHT-CARRYING ABILITY MATTERS

Most long-distance voyaging sailors today want to take along the things that make a boat a home, including refrigerators, freezers, watermakers, pressure water, hot water, microwaves, televisions, VCRs, computers, and even washer/dryers and air-conditioning. Most of these things weren't around, weren't reliable, or couldn't be adapted to 12-volt power supplies even a decade ago when we finished our first circumnavigation. But today, the average boat carries four or five items from that list plus large battery banks and all the equipment for generating and managing the electricity they consume. That's in addition to all the things cruising boats have always had to carry, such as anchors, chain, line, dinghies, navigation equipment, charts, cruising guides, water, fuel, provisions, and, of course, crew.

Although any single item doesn't weigh much in comparison to the boat, when taken together they become a meaningful percentage of the boat's overall displacement, as can be seen from our three offshore voyagers in Table 10-9. More than a third of the half-load displacement on all three boats comes from essentials like fuel, water, and ground tackle. On *Moderation* and *Highlife* these items—in addition to batteries, charging equipment, tools, and spares—make up close to half of each boat's half-load payload.

Offshore boats need to be able to carry an absolute minimum of 1,000 pounds over what they would carry for coastal sailing for each regular crewmember. But overloading a boat affects seaworthiness. A boat carrying a lot of extra weight well above its center of gravity will roll and yaw more and be more prone to getting knocked down. The boat will not be able to point as high or go as fast on any point of sail. Overloading will create additional forces that the hull may not be designed to deal with and that can affect durability.

(continued on next page)

Of our three offshore voyagers, *Moderation* will be most significantly affected by the weight she is carrying, because she started off with a relatively light displacement. The Moderations have worked hard to minimize excess weight wherever possible. The Simplicitys added hardly any weight at all compared with the other two, but what they added is still a significant portion of the boat's displacement. They couldn't afford to add much more without noticeably affecting her sailing performance. *Highlife* can absorb the most weight because she has the highest displacement, but she would sail better without it.

This illustrates the fact that moderate- or heavy-displacement boats are better able to absorb weight than light-displacement or small boats. If you are considering a racer/cruiser, cruising sled, or a multihull, the key to realizing the performance you're after will be keeping weight off the boat.

For two real world examples of how much weight cruising boats carry, see Table 3-11. At half-load displacement, *Silk* carried 4,000 pounds over her published displacement. This seems to be about average for tropical cruising boats her size, as demonstrated by the fact that most first-year cruisers on 40-foot boats raise their waterline by 3 to 5 inches after finishing their refit and moving aboard. On *Hawk*, our high-latitude sailing agenda demands more extensive, heavier ground tackle and the need to carry more provisions, fuel, water, spares, tools, and clothing in order to be self-sufficient for long periods of time. At half-load displacement, *Hawk* is carrying some 7,000 pounds over her published displacement. But she is heavy enough to absorb that weight with only a small loss of sailing performance. If we had tried to carry that amount of extra weight on *Silk*, sailing performance and stability would have been noticeably diminished.

TABLE 10-9. ESTIMATED HALF-LOAD DISPLACEMENT FOR THREE OFFSHORE VOYAGERS

	Simplicity	*Moderation*	*Highlife*
Published displacement (lb.)	**13,500**	**16,000**	**43,000**
Additional equipment[1] (lb.)	410	1,595	4,392
Half-load payload[2] (lb.)	1,781	3,617	4,831
Total additional weight (lb.)	**2,191**	**5,212**	**9,223**
As-cruised displacement (lb.)	**15,691**	**21,212**	**52,223**
Percent increase in displacement	16	33	21
Published DLR	306	112	225
DLR at half-load displacement	356	148	274

[1]Includes batteries and electrical equipment, ground tackle, sails and sail handling equipment, dinghy, and outboard.
[2]Half-full water and fuel tanks, half stores, personal belongings of crew, tools, and spares.

Comparison of Three Balanced Boats

Simplicity, *Moderation*, and *Highlife* ended up in very different places with respect to any measure of cost, comfort, or complexity, yet each boat represents a workable and sustainable balance for her crew.

The costs to buy and fit out the three boats range over more than an order of magnitude (Table 10-10). Yet the investment in each boat fit within her crew's budget, and all three boats ended up as safe, seaworthy craft that can carry their crews to faraway lands. For these three boats, cost and complexity are correlated with size, but that does not have to be the case. We have seen small, complicated, expensive boats and large, simple, inexpensive boats.

These three boats represent three distinct alternatives on just about any measurable dimension of comfort or convenience (Table 10-11). *Simplicity* is small. Her crew has little privacy, and they don't have room to have friends or family stay aboard for long. She has far less space to carry food and spare parts, and no space for anything as large as a generator. Her half-load payload of just under 2,000 pounds is 16 percent of her displacement. She cannot carry much more without adversely affecting her sailing performance.

Both *Moderation* and *Highlife* have considerably more space. Indeed, *Moderation* has as much living space as *Highlife*. Each boat has three private cabins as well as additional workspaces such as engine rooms. Guests can

TABLE 10-10. COMPARISON OF TOTAL INVESTMENT IN THREE OFFSHORE VOYAGERS

	Simplicity	*Moderation*	*Highlife*
Length (ft.)	33	40	52
Age	30 years	13 years	8 years
Cost of boat	$16,000	$145,000	$430,000
Cost of refit	$14,250	$67,100[1]	$95,800
Total Investment	**$30,250**	**$212,100**	**$525,800**
Total Budget	**$30,000**	**$200,000**	**$500,000**

[1]Includes adding DC refrigeration in Caribbean.

have a private stateroom with their own head. Yet there is a real difference in how much weight the two boats can carry. *Moderation*'s half-load payload of 3,600 pounds represents a far higher percentage of her displacement and will have a much greater impact on her sailing performance than the higher weight carried by *Highlife* (see the Why Weight-Carrying Ability Matters sidebar above). Still, either boat carries far more than *Simplicity*. *Simplicity* can stow enough provisions to be completely independent for up to a month at a time, whereas *Moderation* and *Highlife* are each capable of going three to four months without reprovisioning.

Each boat has come to a very different electrical balance. *Simplicity* uses an order of magnitude less electricity than *Moderation*, which uses an order of magnitude less than *Highlife*. *Simplicity* stays in balance by carrying almost no electrical equipment. *Highlife* stays in balance by generating enough electricity to cover almost house-sized electrical loads and carrying a large battery bank for storing that electricity. *Moderation* walks the finest line, using engine charging to even out the differences in generating capacity of her wind generator and solar panels from day to day. If the crew on *Simplicity* or *Moderation* adds one more piece of power-hungry gear—such as a tiller pilot for *Simplicity* or some AC appliances for *Moderation*—they will have to completely reconfigure their electrical systems.

The three boats spend different amounts on diesel fuel to meet their energy requirements. *Simplicity* rarely needs to run her engine just to charge the batteries. Her crew spends less than $300 per year for diesel, and very little of that is actually used for charging. Since the Moderations installed the DC refrigeration, wind generator, and solar panels, they only rarely need to run the engine at anchor. Their fuel costs have dropped by half, and they now spend less than $500 a year on diesel, with only a third of that used solely for charging. The Highlifes have to run their generator or their engines for 2 to 4 hours each day to generate electricity, cool their refrigeration system, and make water as well as to run the air-conditioning some days. They spend an average of $1,500 per year on diesel for charging, motoring, and heating.

Most cruisers view the availability of fresh water as a measure of cruising wealth. On that scale, *Simplicity* is far from rich. With the extra tankage Simon installed while upgrading the basic boat, she carries 60 gallons of water. On passage, the Simplicitys use fresh water only for drinking and for rinsing themselves off after a saltwater shower. At the other extreme, *Highlife* carries 200 gallons of water and makes 30 gallons or more every day. Her crew and guests use fresh water for everything aboard, including flushing toilets and washing down the decks. Even so, the 8 to 10 gallons they use per person per day represent a tiny fraction of what they were used to using ashore. *Moderation* needs to regularly meet the water needs of twice as many people as the other two boats; the 5 to 7 gallons per day from her watermaker allow her crew to use fresh water for most things, as opposed to using it only for drinking.

With respect to maintenance, *Simplicity*'s crew spends fewer than 10 hours per week on preventive maintenance, the majority of it on keeping her sails in good shape and varnishing a few pieces of exterior teak. At haulout time, each crewmember spends about 40 hours painting the boat's bottom and doing other out-of-water maintenance work, including polishing through-hulls, cleaning and greasing winches, sanding and repainting propane tanks, buffing and waxing topsides, and rebuilding the head. They spend less than $1,500 per year on maintenance, most of that at haulout time.

The Moderations average about 15 hours per week on maintenance. Combating chafe and keeping up the cosmetics take the most time, but there also are a host of smaller chores every week: rebedding deck fittings, maintaining the two engines, lubricating blocks and other equipment on deck, replacing corroded connections, and seeing to the watermaker and refrigeration systems. The crew tries to complete one major chore each week: rewiring an electric light, changing the engine oil, or rebuilding a water pump. At haulout time, they spend about the same amount of time as *Simplicity*'s crew, but they hire someone to do the bottom painting. Their time is spent on *Simplicity*'s other chores plus servicing all the equipment from the windlass to the water heater, rebuilding pressure and foot pumps, and servicing the autopilot. Every few months they invest a day or more locating spares for their watermaker, refrigeration system, autopilot, or some other piece of equipment.

TABLE 10-11. COMPARISON OF LIFESTYLE ABOARD THREE OFFSHORE VOYAGERS			
	Simplicity	***Moderation***	***Highlife***
Age	30 years	13 years	8 years
LOA (ft.)	33	40	52
Number of sleeping cabins	One	Three	Three
Number of heads	One	Two	Two
As-cruised payload[1] (lb.)	1,781	3,617	4,831
As-cruised payload as percent of displacement	16	33	21
Fuel tankage (gal.)	45	100	200
Average daily AC and DC energy consumption (Ah)	10	146[2]	1,000
Engine/generator running time to meet average consumption[3]	None	Minimal[2]	3–4 hours[4]
Average daily fuel usage for charging (gal.)	None	Minimal[2]	2
Annual diesel costs	~$300	~$500	~$1,500
Maximum daily DC energy consumption (Ah; 40% battery capacity)	32	344	540
Engine/generator running time to meet maximum consumption[3]	1 hour	Both engines 1–2 hours	3 hours
Water tankage (gal.)	60	120	200
Additional water from watermaker daily (gal.)	None	5–7	30+
Average daily water usage per person (gal.)	1	3	8–10
Use of fresh water on passage	Drinking, rinsing off	Drinking, showers, washing dishes	Everything
Maximum time without filling water tanks	1 month	1 month	Unlimited
Maintenance hours per week	< 10	~20	30–40
Maintenance hours at annual haulout	~80	~120	~160
Annual maintenance costs	~$1,500	~$4,500	~$13,000

[1]Weight of all equipment and crew belongings plus half the water, fuel, and provisions the boat is capable of carrying.
[2]After installation of DC refrigeration.
[3]In addition to passive charging sources.
[4]Only 1 hour to recharge batteries, but additional running time necessary for making water and running refrigeration and air-conditioning.

Though the Highlifes leave the boat in a boatyard for several months of every year with a list of projects to be completed, they still average over 30 hours a week keeping the boat in shape, including the time they spend getting spares through customs, hunting down parts, and talking to manufacturers and their service representatives. They spend more time on sails and teak than *Simplicity* and *Moderation* because they have a larger surface area of both, but these chores represent less than a quarter of their maintenance hours. The generator needs to be maintained as frequently as the engine, so some work gets done on it every week. Maintaining the electrical system averages several hours a week for everything from cleaning corrosion off battery terminals to tightening the alternator belts. In the first four years of their voyage, they have averaged $13,000 per year on maintenance. The number has risen steadily every year, and now that they are in New Zealand they have embarked on a major refit, which will probably cost them $60,000.

All that work gives *Highlife*'s crew luxuries undreamed of by the crews aboard *Simplicity* and *Moderation*. The Highlifes do not need to check the voltmeter before using the microwave. They have almost unlimited fresh water and cold drinks. At sea, they can afford to run the radar 24 hours a day while steering with the electric autopilot. Movies on the flat screen entertain the grandchildren.

The Simplicitys will spend the most time seeing the places they have reached, enjoying the rhythms of voyaging. But *Simplicity* is for the young or the young at heart—for those who have not learned to love their creature comforts. Today, *Moderation* represents the most common configuration for an offshore voyager, with variations according to taste. But there are hundreds of boats like *Simplicity* out there, successfully and enjoyably sailing the world's oceans. A decade ago, *Highlife*-type boats were only cruised coastally or on limited offshore voyages because of the need for good chandleries, transportation, and communications equipment to keep such boats functioning. As yacht facilities have become established along the major cruising routes, more boats like *Highlife* have ventured off for long voyages.

WHAT WE LEFT OFF . . . AND WHY

Most people look at *Hawk*, our Van de Stadt Samoa 47, see her high-performance hull design and her powerful, fractional rig, and assume she carries a complete list of modern equipment aboard. But for the most part she is actually simpler than the Shannon 37, *Silk*, we sailed around the world before building *Hawk*. The ten things we chose to leave off—and why—reflect not only what we learned over the course of 35,000 nautical miles, but also our approach to the cruising life, our cruising itinerary, our budget, and our (lack of) mechanical aptitude.

We're not purists, nor are we Luddites. We don't have any deep philosophical opposition to the majority of the items on this list, and we may add things later if we feel the need. But we most enjoy our comforts when we can have them for a minimum of cash, care, and complexity.

1. **Mechanical refrigeration/freezer.** We had refrigeration aboard *Silk* but found we didn't use it much. Most of our cruising on *Hawk* has been in cold waters in the high latitudes. Her aluminum bilge is always at ambient water temperature and offers an inexpensive solution to keeping things cold. If we were going to cruise extensively in the tropics, we would consider adding 12-volt refrigeration, but we would have to reconfigure our electrical system to do so.
2. **Watermaker.** *Silk* carried 100 gallons of water, and we were never down by more than 50 gallons. We often caught rainwater between dockside refills. On *Hawk*, we preferred the simplicity of extra tankage to the cost, complexity, and energy requirements of a watermaker. *Hawk* carries 200 gallons of water; we can go six weeks between refills without conserving and up to three months on strict passage rations.
3. **Pressure water.** We had pressure water on *Silk*, but we rarely used it once we installed foot pumps in the galley and head. We still had to maintain it, however, and we spent more time rebuilding the pumps and looking for leaks than we did using the system. Aboard *Hawk*, we have again installed foot pumps in the head and galley, and the only thing we miss is the pressure shower. We use a solar shower in the tropics, a teakettle in cold climates—and we enjoy showers ashore when we get the chance.
4. **Hot water.** We had hot water aboard *Silk* whenever we ran the engine, but we often needed it when we hadn't been running the engine, especially on passage, and a solar shower or heated teakettle offered a quick and easy solution. Aboard *Hawk*,

(continued on next page)

we use the solar shower to heat water in the tropics. When we're running our diesel heater, we keep a teakettle on the heater's hot plate for hot water on demand.

5. **SSB/ham radio.** That we left off a high-frequency radio probably surprises people more than any other item. Halfway through the last trip, we installed an SSB aboard *Silk* and found it didn't suit our style of cruising. We have a Sony all-band receiver for voice and fax weather reports, and for listening to the ham and SSB bands and the BBC. But we aren't totally out of touch. We carry an Iridium phone equipped for data transmission for doing e-mail from the boat.
6. **Generator.** We hate running the engine and have no desire to replace running an engine with running a generator to recharge our batteries. After our experiences on *Silk*, we went with a somewhat unusual solution to the electrical system equation. We installed two 400 Ah battery banks while keeping our electrical usage to a minimum. We can charge rapidly using dual alternators off the engine or slowly by a 75-watt solar panel. We can go a week without charging at anchor, but we have to charge every day on passage if we want to use the below-deck autopilot. Our electrical solution cannot be separated from many of the equipment items on our "left off" list—together they form an integrated solution that reflects our cruising priorities.
7. **Wind/tow generator.** Given our approach to the electrical system and everything we left off, we don't need the efficiency of a wind or tow generator to keep our batteries topped up. As long as we have the choice, we prefer the simplicity of solar panels. We don't like the noise of most wind generators and have been unimpressed by their output and reliability.
8. **110-volt system.** *Silk* had a 110-volt system in parallel with her 12-volt system, but once we left the States we never used it again. On *Hawk*, we installed a large, 3,000-watt inverter in the engine room for power tools; 12-volt outlets in our navigation station to run our computers and to charge small electronics such as cell phones; and small, 300-watt inverters in the navigation station and at my work desk for any other 110-volt needs.
9. **Second head.** *Hawk* has been designed and fit out as a two-person boat, which meant we needed only a single head near the companionway. By not installing a second head, we limited the number of seacocks to five (including one for our deck washdown pump) and kept all the plumbing within a 10-square-foot area, thereby minimizing hose runs and greatly simplifying the plumbing system. We substituted a sail locker with a large hatch opening on deck for the forward head.
10. **Shoreside creature comforts.** We have no microwave, VCR, TV, washer/dryer, dishwasher, air conditioner . . . and we don't miss them. We do, however, have a toaster and a coffee grinder, and we enjoy those luxuries almost daily. We also have two laptop computers, three cameras, lots of fans, a dozen shelves of books, a CD player, and a satellite radio.

We do carry lots of sophisticated navigation and communications equipment. In addition to e-mail, our Iridium phone allows us to download weather information and make occasional calls to our families. We have a chartplotter, charting and routing software on the laptop computer, Inmarsat-C, and tide and celestial programs. We have invested heavily in knowing where we are and staying in touch with the outside world.

The main thing we tried to leave off the boat was complexity. We can always make our simple boat more complex, but it can be almost impossible to simplify a complex boat. By leaving off the things on the list above, we saved at least $15,000—more than one year's living expenses—and a lot of time fixing things. We've also saved thousands of dollars per year on maintenance. And we've found that in leaving off the complexity, we also left off a lot of the stress. *Hawk* proves that a large, sophisticated boat need not be complex.

PART III
Liveaboard Skills

NOW THAT YOU'VE bought, refit, and equipped your boat, the time has come to transition from living ashore to living aboard. In doing so, you will need to learn a variety of skills that have nothing to do with passagemaking and living in foreign countries and everything to do with managing life from your floating home and keeping that home livable, seaworthy, and safe.

These skills range from learning to live within a space the size of a small studio apartment to managing long-term health issues. To master these skills, your crew must include, among other things, a communications officer, engineer, cook, doctor, and cruise director. Most of these skills can be "learned as you go"; however, the necessary equipment and arrangements must be put in place before you untie the docklines and leave your home port behind for the last time. The chapters in this part discuss the skills and equipment you will need and, where appropriate, offer suggestions on where you can go for more information.

CHAPTER 11

Liveaboard Essentials: What to Bring and How to Stow It

Some of the hardest choices about outfitting your boat come after you've decided on your basic gear and equipment. As an offshore voyager, you have to carry everything you need to be self-sufficient for months at a time, yet you must do so in a tiny fraction of the space to be found in the average house. It can be very difficult—and at times heart wrenching—to squeeze your life into something as small as a boat. But it can also be tremendously liberating.

Before you leave the dock, you will need to find stowage space where each item is accessible yet secure enough to stay in place during a severe knockdown. The process doesn't end once you sail away. Living in a small space requires continual trade-offs. You will need to actively manage your stowage by reviewing your belongings, getting rid of items not being used, and reorganizing regularly.

MANAGING SPACE

Before you can decide how much of your personal belongings you can bring with you, you have to know how much and what types of storage spaces the boat has. The first step in moving aboard, then, involves inventorying all the stowage spaces on the boat. Once you know what room you have, you'll need to organize those spaces. That includes turning the large, unpartitioned storage spaces that make up the bulk of the stowage areas on most sailboats into well-organized, manageable stowage areas, organizing the various areas that will be used for food stowage, getting control of the cockpit locker, and keeping track of the little things that tend to get lost in large lockers.

Maximizing Stowage Space

To find room for all the things necessary for liveaboard cruising, most crews create new stowage areas and make use of what had been inaccessible spaces. They also look for ways to make better use of the space they have. Modifications to increase stowage range from moderately expensive interior renovations to small changes that cost next to nothing. If you are making modifications, flexibility matters. You don't want to redesign your boat to such an extent that adding any new equipment entails a costly, time-consuming refit. All the ideas that follow are flexible and easily reversed.

Creating Space

Your boat's stowage depends on her overall size, age, hull shape, depth of the bilge, and the designer's ingenuity. While boats between 35 and 40 feet can carry everything a cruising couple needs, stowing those items for offshore passagemaking often requires compromises and modifications to the existing boat. The crews on boats smaller than 35 feet will have to make more difficult decisions. By trading some of the interior space for stowage, they may not have to leave anything behind.

Several spaces considered standard on a production boat may not be essential for an offshore voyager. For example, the majority of boats under 35 feet have a good-sized saloon area with a large table that can seat four or more for entertaining. But on a liveaboard boat that size, this space will need to serve as a lounge in port and a primary bedroom offshore. A large, fixed table only restricts traffic flow and access to stowage spaces. Replacing the table with one that seats two and folds up on a bulkhead when not in use can open up the whole saloon while creating space for additional lockers.

Aboard many medium-sized boats, the shower area is often wasted space. In the tropics, most people shower in the cockpit. If your boat includes a standup shower, consider modifying it for stowage. In the small stall shower on *Silk*, we installed a removable rack and collapsible milk crates where we stowed fruits and vegetables at sea. On larger boats regularly crewed by only two people, a second head can be turned into passage stowage or a sail locker.

Most boats between 35 and 40 feet long have either a quarter berth or a pilot berth. In port, that space becomes a catchall for large items that don't fit anywhere else, such as spare sails, dinghy or windsurfer parts, cold-weather blankets and clothes, and so on. At sea, these areas need to be cleared so they can serve as sea berths. On *Silk*, we transferred the contents of the quarter berth to the forepeak berth. Pad eyes under V-berth cushions or strategically positioned lee cloths can be used to hold everything in place. Good sea berths should be no more than 24 inches wide, but many quarter berths are as wide as 48 inches. Fitting lockers against the hull side increases stowage space while improving the usefulness of the quarter berth at sea. We have seen cleverly designed lockers for stowing foldable bikes or charts installed in oversized quarter berths. Make sure these lockers have no sharp edges and put some padding on the side facing the bunk.

Many boats with U-shaped galleys, including the Crealock 37 and Shannon 37, have unused space over the galley island. An overhead locker can be installed on any boat with this configuration. A feature common in Scandinavian homes and used by Swan—an integral dish rack and plate stowage—can be incorporated into an overhead locker of this type. Washed and put in the rack, the dishes drip-dry into the sink (Figure 11-1).

Other areas can also be enclosed to create additional stowage space. Add a spice rack in the galley or a shelf for flashlights and suntan lotion by the companionway. Consider adding a shelf, locker, or netting at the foot of a quarter berth or pilot berth, hammocks or lockers at the foot of a V-berth (refer back to Figure 10-13), and eye hooks for hanging ditty bags in useful places. If you use hammocks or netting, don't use cotton. Nylon will not mold or mildew and can be washed frequently without rotting.

On boats where the companionway steps are mounted semipermanently, and the engine is accessible without removing them, the space under the companionway stairs can be turned into useful stowage. Options range from fully enclosed drawers under each step to Velcro strips attached to the underside of a step to hold small items.

Figure 11-1.
An integral dish stowage area doubles as a drying rack and drains into the sink on this Swan 47.

Using Dead Space

Many boats have usable stowage spaces that are totally inaccessible or wasted space that can be accessed through other stowage areas. By seeking these out on your boat, you can add several more cubic feet of long-term storage space.

In hanging lockers, the space along the curved hull behind the hanging clothes is often wasted. A bracket or a shelf installed in these areas can be used to stow anything from shoes to a sextant. Going one step further, shelves are a more efficient use of space than hanging lockers. While you can get along without any area for hanging clothes, a foot of hanging space per person will provide plenty of room for a few nice clothes. On smaller boats where stowage space is at a premium, convert the rest of the hanging space to shelves.

Areas under or behind drawers can be usable space. Pull out all your drawers and remove any trim pieces until you reach the hull or cabin sole. The space behind a

Figure 11-2.
On *Ginny*, the Cal 39 described in Chapter 10, Walker Vought increased stowage by replacing the drawers on the right with those on the left. (Walker Vought photo)

drawer along the curved hull can be used to stow line or sailcloth. A few cans will often fit beneath a drawer. Drawers often don't extend as far as they could, and sometimes have 6 inches of wasted space between them. Installing longer, larger drawers (Figure 11-2) or replacing the drawers with a locker can increase the stowage in a given area by 20 percent. Make sure that the new stowage areas are dry or use the new space for items that won't be damaged by moisture.

Large stowage areas under settees or V-berths are often enclosed with marine plywood, leaving dead space between the ply and the hull. See if you can unscrew and remove the bottom or sides of each locker to reach the hull. By cutting an access hole in the bottom of a locker like this, you can often add another cubic foot of space for long-term stowage. But before you cut, check the position of water and fuel tanks and check with the manufacturer to be sure you're not cutting into a box beam or structural reinforcement.

After your stowage survey, you should be able to diagram every square inch of space in your hull. Although all this space is not equal in terms of dryness or accessibility, you will eventually find uses for most of it.

Increasing Space Visually

The racks and hammocks and extra lockers that increase your stowage space will reduce your visual space. But you can use visual tricks to keep the boat from feeling claustrophobic.

Light makes a boat feel bigger. Covering dark wood paneling on the sides of the cabin trunk with white paint or paneling and replacing dark headliners with lighter ones will increase the sense of space below (compare Figures 10-3 and 10-4). Light-colored upholstery (patterned so as not to show dirt) also enhances the sense of space. Increasing visual space by removing doors makes a boat feel larger. For privacy when guests are aboard, you can use curtains where the doors used to be.

Reducing the size of trim pieces, turning a full (nonstructural) bulkhead into a half bulkhead, or cutting away the corners of bulkheads can all increase visual space. Figures 10-7 to 10-9 illustrate how much relatively minor changes can increase the feel of space in an enclosed area.

Mirrors extend the visual plane while increasing the available light. *Silk*'s new owners installed a large mirror in her head that appeared to double the space. If you put mirrors aboard, use shatterproof Lexan rather than glass for safety reasons. (You'll like how thin you look in these mirrors!)

Organizing Stowage Areas

"A place for everything and everything in its place" is nowhere more pertinent—and necessary—than on a boat. But how do you set about figuring out where to stow everything?

Weight is your first priority in deciding what goes where. Heavy things should be stowed low and near the center of the boat. Canned goods, spare anchors, chain, heavy tools, and spare parts all need to go in the bilge or in the bottom of lockers under settee berths. Lighter spare parts, spare sails, charts, bulky galley equipment, and other items of medium weight can be stowed higher: on top of heavier items in settee berths, behind settees against the hull, or forward in V-berths. Paper goods, clothing, blankets, lightweight foodstuffs, and other light items should go in the highest stowage areas such as under pilot berths and in the lockers just beneath the deck.

It is one thing to stow everything away, but quite another to retrieve exactly what you need when you need it. The best stowage arrangements allow you to retrieve an impeller for the cooling-water pump at sea without letting loose a dozen spare parts to roll across the boat with every wave. The following sections offer solutions for maximizing the efficiency and accessibility of stowage spaces.

Bulk Stowage: Divide and Conquer

Bulk stowage areas like those found under settees, under a large V-berth, along the hull, or in the bilge make the most efficient use of the space but are difficult to organize and access. Some of these areas communicate with the bilge and cannot be counted on to stay dry. To improve your bulk stowage, divide the contents into useful compartments that are as watertight as possible. Some ideas that have worked well for us are:

- **Line, wire, hose.** Heavy-duty plastic lawn and garden bags can be used to stow spare hose, electrical wire, 1 × 19 rigging wire, and similar items.

Figure 11-3.
Small-item stowage in our head.

These conform to the odd spaces in the bottom of lockers or along the hull. Label them with indelible ink markers on masking tape. Spare line will fit any odd-shaped niche and can get wet occasionally.

- **Tools and spares.** We use large, plastic stowage containers—the heavy-duty type with clear plastic covers made for organizing garages and workbenches—for stowing tools and spares. We separate our spares into clear zip-top bags labeled with indelible ink to minimize rummaging.
- **Shoes, cleaning supplies, and toiletries.** Plastic milk crates can be used to contain items and compartmentalize stowage on the floor of a hanging locker, in large settee or V-berth stowage areas, or under the galley sink. We use them to stow extra shoes, canning jars (see Figure 14-3), toiletries, and other bulky, hard-to-organize items. To make this stowage temporary, use collapsible milk crates that fold down to an inch or so high.
- **Miscellany.** Stackable, hard-plastic food storage containers (such as Tupperware) work well for smaller spaces and smaller items. Square containers stow more efficiently than round ones. Label them with a label gun or indelible ink marker so that you can pick out what you want without removing everything (Figure 11-3).

Beyond the horizontal bulk stowage areas under berths and in the bilge, most stowage is vertical. If you open a locker door or remove a fiddle, the contents of the locker will end up in your lap if the boat is rolling (Figure 11-4). Canvas or mesh can be fitted to decrease the size of the opening and restrain locker contents (Figure 11-5). Settee back lockers should have moderately small openings with a tall lip that will hold contents while you rummage for what you need (Figure 11-6). If the openings are too large on your boat, mesh or canvas can be fitted over the locker openings to reduce the size. Horizontal sliding doors with a large fiddle across the front are the best solution for galley lockers that will be accessed many times a day (Figure 11-7).

In large lockers the space will need to be compartmentalized. Zippered heavy-duty plastic storage bags work very well for clothing, towels, and bedding. To keep things smelling fresh, interleave a fabric softener sheet between items. Ditty bags in a variety of sizes can be used to stow everything from batteries to clothespins.

For long-term storage, vacuum bagging saves space and ensures that things stay dry and mold free. Vacuum bags can be purchased from a variety of retailers including QVC and Wal-Mart. Some come with one-way valves that let the air out when the bag is rolled; others require the use of a vacuum cleaner. The latter compress by a third more and have a more robust valve. Both tend to decompress slowly over a period of several months, so stowing these tightly packed inside a large plastic or mesh stowage cube will keep them from opening up the locker over time. At a cost of around $2 per bag, these are an economical and effective way to stow clothing, bedding, and other items for the long term.

Long shelves for CDs or books with a single fiddle should be designed so that one item can be removed without removing the fiddle. Otherwise, the contents will all end up on the cabin sole when you try to get one out in a rolly sea. Dowels can be inserted into holes drilled into the shelf to create an adjustable bookend that will keep items from slipping under the fiddle rail (Figure 11-8).

The canvas pockets used to store shoes can be hung inside a hanging locker or in other out-of-the-way wall space. Besides organizing shoes, these can also be used to stow a variety of small items that would be lost in a large locker. They can be fit on the inside of head or locker doors as well, as long as they don't interfere with ventilation through caning or louvers.

Zippered pillowcases meant for throw pillows can stow a variety of bulky items while providing color and com-

Figure 11-4.
The contents will not stay in this locker if it is opened when the boat is heeled over or rolling.

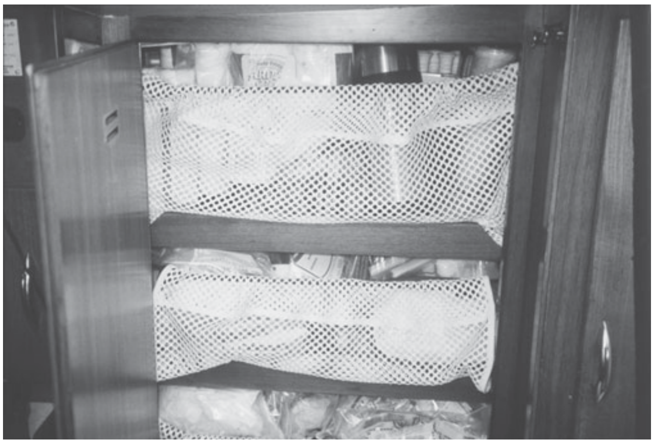


Figure 11-5.
The same locker fitted with netting to hold the contents in place.

fort on bunks. Clothes for cold weather, including wool sweaters, thermal underwear, and foul-weather gear stow well in these pillowcases. On some boats, the bedding for each bunk is stowed in pillowcases during the day (Figure 11-9).

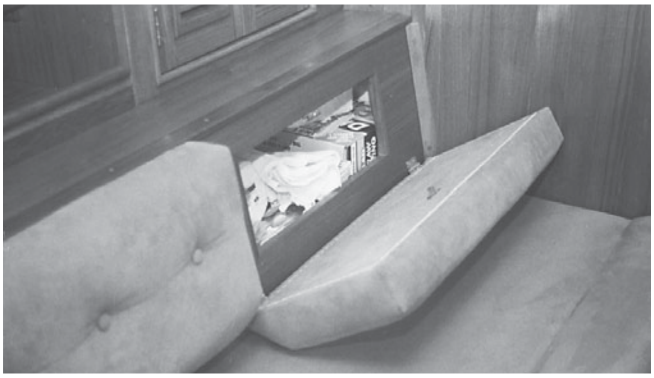


Figure 11-6.
These settee back lockers have relatively small openings that will hold most of the contents in place even if the boat is rolling.

Figure 11-7.
Horizontal sliding doors and a large fiddle offer the best solution for accessing galley lockers.

Food Stowage Areas: Galley, Bulk, and Fresh

Food takes up more than half the available stowage areas on most boats. Generally, there are three types of food stowage areas. Food for immediate consumption—including condiments, spices, and baking supplies as well as refrigerated and frozen food—is kept in the galley or in lockers over the settees that are readily accessible from the galley. Bulk supplies of dried, bottled, and canned items—what you would stow in a pantry in a house—are stowed in less accessible bulk stowage areas, usually under settees in the main saloon. Fresh fruits and vegetables must be stowed in an area that is well ventilated and accessible, so stowage solutions will vary from boat to boat.

To avoid cockroaches and limit garbage while on passage, remove all packaging and stow foods in heavy-duty plastic containers. You will need to find a selection of these containers that fit each of your food storage lockers. Visit a large store that specializes in space-management solutions to get a feel for the type of containers available.

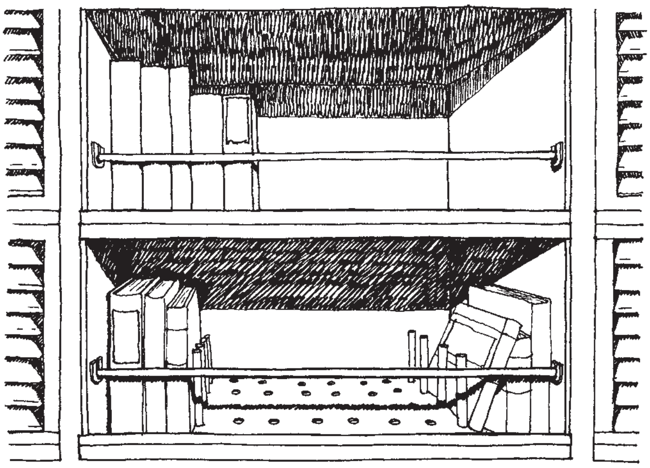


Figure 11-8.
Dowels can be used to create an adjustable bookend to hold contents in place. (Lyanne Schuster illustration)

Figure 11-9.
Gaily colored pillowcases can also serve as storage spaces for bedding and bulky clothing.

Figure 11-10.
We use large, heavy-duty plastic containers in our bulk food stowage area to compartmentalize stowage and keep things dry and organized.

Figure 11-11.
We stow glass containers and plastic containers with liquid contents in this heavy-duty plastic crate with a lid to contain the mess in the event of breakage. The crate is bolted to the bottom of the locker and the bungee cord would keep the lid on in a knockdown.

Ask your favorite restaurant to save you some 2-gallon mayonnaise containers, which make wonderful stowage containers for bulk foods.

In the galley, small containers will be needed to carry a week's supply of everything from cereal to sugar. In bulk stowage areas, large, heavy-duty plastic containers should be used for stowage of cookies, cereal, pasta, flour, rice, crackers, and just about everything else (Figure 11-10). Labels from a label gun or in indelible ink that are visible when the locker door is open will help you find what you need without emptying the locker.

In addition to dried goods, bulk stowage areas for canned goods and for breakables need to be organized. Canned goods fit well into oddly shaped lockers along the hull side that are too small for large storage containers. We store all glass containers and any plastic containers with liquid contents in heavy-duty plastic crates (Figure 11-11) or milk crates lined with heavy-duty trash bags to contain the mess in case of breakage. We have never had any glass packaging break on either boat, though we have had cheap plastic containers rupture.

To keep fruits and vegetables for as long as possible, they must be stowed in an area with adequate ventilation that can be thoroughly cleaned, disinfected, and aired out when not

Figure 11-12.

On *Hawk*, plastic crates installed on tracks in a mesh-covered storage unit also used for clothes provide plenty of ventilation and help keep produce fresh.

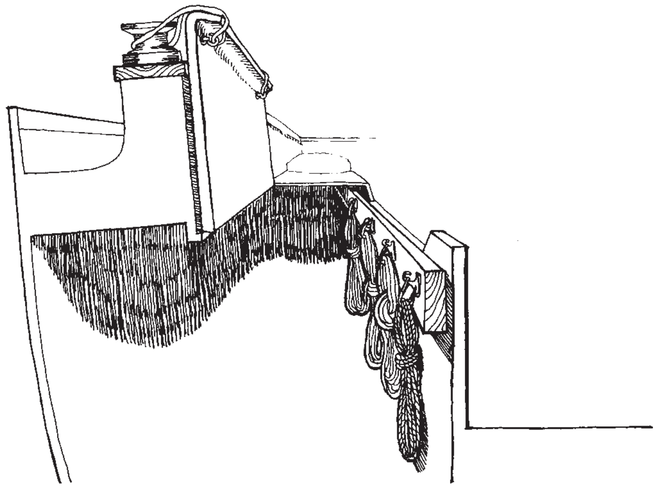


Figure 11-13.

A board with shock cord installed below the lip of the cockpit locker will organize lines and keep them free of the storage space so it can be used for other items. (Lyanne Schuster illustration)

in use. Plastic crates stored in a temporary rack in a shower stall, in a large bilge, or in a special stowage rack (Figure 11-12) work best. Crews on smaller boats often store fruits and vegetables in nets strung along the coach roof. Make sure these cannot swing their contents into the bulkhead in rough weather. Avoid stowing produce in damp, poorly ventilated lockers in the bilge or along the hull side.

The Cockpit Locker: Organize and Prioritize

On many boats between 35 and 45 feet long, the cockpit locker is the biggest organizational challenge. This locker holds the largest, bulkiest items, many of which must be accessible for emergency use. The batteries, engine transmission, and electric autopilot ram may be accessed through this locker. Some of the items that may be stowed in this area require special care, such as fuel, batteries, and spare anchors.

The first step toward taming the cockpit locker is to set up a hands-free way for the locker lid to be held open while you work. We know several people who have gotten hit in the head or trapped in their cockpit lockers when the lid fell down. Shock cord attached to the lid of the cockpit locker with a loop that can be flipped over a winch or onto a cleat can prevent an uncomfortable few hours in a confined space or, at sea, a broken finger or even a head injury.

Docklines and spare anchor lines need to be accessible at a moment's notice. But unless they are well organized, they will turn the cockpit locker into a nightmare. A board installed under the lip of the opening and fitted with shock cord for hanging lines prevents "cruisers' spaghetti" from forming in the bottom of the locker (Figure 11-13).

Chocks should be installed to hold spare anchors securely in place within the cockpit locker. The stern anchor rode can be stowed in a tall, narrow, drawstring mesh bag. These bags do not rot like canvas, drain water, and the line will run from them cleanly, unlike from a duffel-shaped bag. Because they are tall and thin, they can also be stowed so they can be easily reached without climbing into the locker.

To stow an outboard engine and gasoline, partition off an area of the locker without electrical equipment and install an overboard drain. On most boats under 40 feet, the cockpit locker is too small to make this feasible. The outboard engine is then stowed on the stern pulpit. Gasoline is lashed on deck, preferably in a shady area. Extra diesel, being less volatile than gasoline, can be stowed in a plastic container in the bottom of the cockpit locker.

Electrical cords and hoses get much less use when cruising full-time than they do when the boat is kept in a marina. They can be stowed below in the bottom of a settee or V-berth locker. On passage, whatever equipment you intend to use in heavy weather will need to be readily accessible. Most people store drogues, warps, and parachutes in the cockpit locker.

Sail ties need to be easily retrieved, but left loose in the cockpit they seem to disappear like socks in the dryer. A net bag attached to the underside of the cockpit locker hatch offers dry and accessible stowage.

The Little Things: Ready at Hand

The smallest items on board are often appropriated by the ship's gremlins and found months later under a cushion or in the bilge. Items such as sunglasses, suntan lotion, and seasickness medications need to be accessible, but their size makes them difficult to find if stowed in a large locker. To keep track of these things, dedicate some space to organizing them—even at the cost of stowage efficiency.

Suntan lotion, binoculars, and flashlights should be accessible from the cockpit or the bottom of the companionway. A bracket or shelf installed along the bulkhead next to the companionway will keep these items within reach, as will ditty bags hung from pad eyes on either side of the companionway. Stow flashlights and more delicate equipment in a drawer or dedicated racks (see Figure 20-5) at the base of the companionway.

Do not leave port without a full range of seasickness medicines within reach from the bottom of the companionway. On our first offshore passage, we made the mistake of leaving our seasickness medications in our medical kit, stowed at the bottom of a hanging locker near the bow. When we got into a storm, we were too seasick to get to the medications. Thereafter we stowed our seasickness remedies in a zip-top bag in the navigation station.

Sunglasses and eyeglasses can pose a real challenge. If you have several people aboard who wear both, you will quickly end up with a half-dozen or more pairs that require an accessible but safe stowage place. A dedicated sunglass drawer near the base of the companionway or a labeled canvas or mesh eyeglass holder mounted on a bulkhead near the companionway (Figure 11-14) will keep eyeglasses organized.

Ditty bags from camping stores offer an all-purpose solution for keeping track of small items. We ordered several dozen of these nylon bags in a variety of sizes and use them for everything from our sewing kit to spare toothbrushes. We prefer the fine-weave mesh ones; they offer ventilation in case the contents get damp, and we can see into them well enough to figure out what is inside without opening them.

Finally, zip-top bags in all available sizes are indispensable. We use zip-top bags for everything from stowing flour and sugar within larger plastic containers to keeping sweaters smelling sweet for several months in the tropics. The heavy-duty freezer bags hold up best for boat duty, and the 2-gallon size is large enough to hold a bulky sweater or towel.

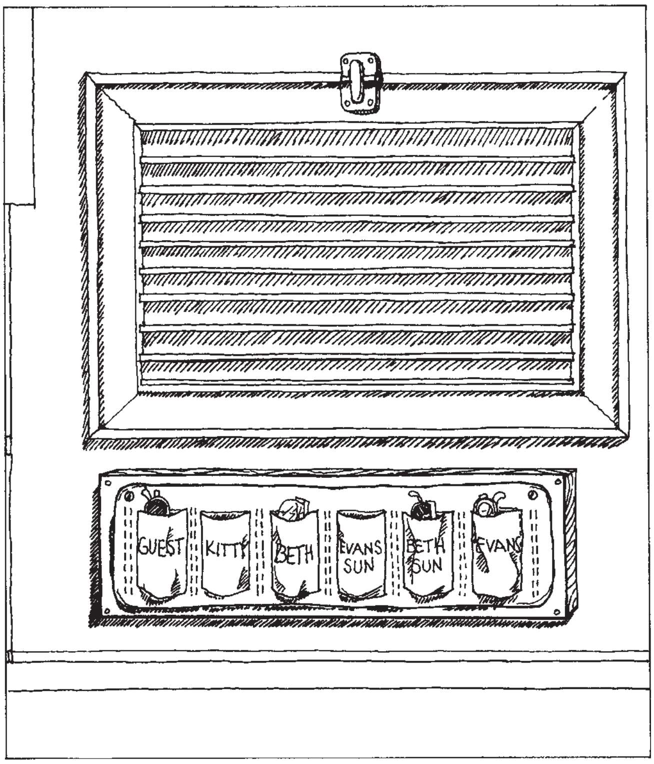


Figure 11-14.
A bulkhead-mounted canvas holder keeps eyeglasses organized and accessible. (Lyanne Schuster illustration)

ALLOCATING SPACE: THE ESSENTIALS FOR LIFE ABOARD

What should you bring along and what should you leave behind? In part the answer to that will depend upon your individual preferences and the things that define you, such as your interests and your hobbies. But when it comes to the basics—from deck gear to cooking utensils—even the smallest boats carry a standard selection of items. This section covers this list of essentials along with stowage suggestions for large and bulky items. Larger boats will be able to carry a great deal in addition to these basics, but if you get these aboard first, you'll rarely find yourself without what you need at a crucial moment.

Later chapters discuss four other areas with some major stowage requirements. Tools and spares take up from a quarter to a third of the large stowage spaces on most cruising boats. Chapter 13 provides a list of the tools and spares you'll need to bring along. The medical kit also poses a stowage challenge, and on most boats it will take

THE STOWAGE PLAN

Keeping track of everything aboard is a monumental task. You may be able to remember where everything is on a 35-foot boat, but on boats over 40 feet, a stowage plan will help tremendously.

Silk had many small stowage areas rather than a few large ones. We could separate things by area, so we did not feel the need for a formal stowage plan. Based on the layout shown in Figure 11-15, we always knew where to start looking for something. Most crews on boats under 40 feet use this approach. We have followed the same procedure on *Hawk*, though she is much larger and has much more stowage. Her stowage is divided into several large areas, and we have been able to group things into those areas in a logical fashion.

Larger boats that carry extra crew may require more formal stowage plans. Steve and Dorothy Darden have the most comprehensive stowage plan imaginable on their 52-foot catamaran, *Adagio*. Every locker and drawer has a number, and in some areas (such as the workshop) the stowage containers within a locker will be numbered. A spreadsheet lists every item aboard with its location by locker number. From this spreadsheet the Dardens can generate two lists: a list of each locker's contents, and an alphabetical list of all the items aboard. Of course, keeping the list updated requires a commitment to record every change. But they can locate anything aboard in a few minutes and it's easy to put together lists of necessary supplies when provisioning or restocking parts.

Your own plan may fall somewhere between our approach and the Dardens' and will depend on how organized you tend to be. At the very least, most cruisers agree on names for each stowage space ("middle settee back," for example). When asked where an item is, a crewmember can name a specific location and be understood by everyone aboard.

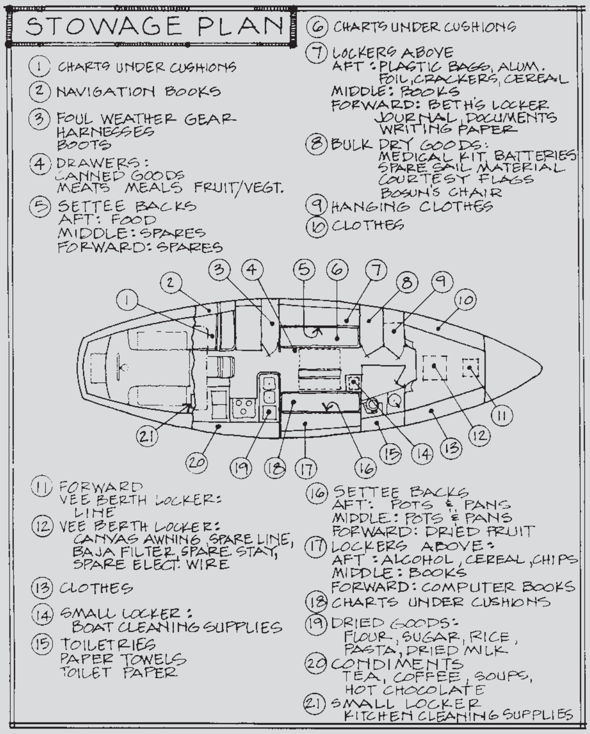


Figure 11-15.

Silk's stowage areas were compartmentalized so we could stow by area and not risk losing track of things. (Lyanne Schuster illustration)

up a significant portion of a large locker. To get some idea of how much space is required, see the list in Appendix 6. Hobbies such as scuba diving, oil painting, jewelry making, and others discussed in Chapter 17 can take up a good deal of space. If they are important enough to you, you will figure out a way to bring the necessary materials along. Finally, drag devices used in heavy weather such as drogues or parachute sea anchors and their rodes pose a significant stowage challenge (see Chapter 22). These need to be easily accessible only on passage.

After reading this chapter, the laundry list of what to bring may seem overwhelming. Yet on most boats over 35 feet, crews find room for all of this and more. On smaller boats, many of the bulkiest items are also smaller, such as fenders, lines, awnings, and so on, which means that with a bit of ingenuity and persistence most of what follows will fit aboard.

Deck Gear

Deck equipment is bulky and difficult to stow, but it needs to be accessible. In addition to the suggestions for organizing the cockpit locker, the following ideas will help you stow the items in Table 11-1.

Hatchboards are cumbersome and difficult to stow. Most boats come with wooden hatchboards, which main-

TABLE 11-1. DECK GEAR FOR THE OFFSHORE VOYAGER

Stowage Challenges	Other	Special Stowage Requirements
Hatchboards	Snorkels, masks, fins	Outboard engine
Cockpit table	Two buckets with lanyards	Gasoline
Harbor awning	Swim ladder/dinghy step	Spare anchors
Fenders	Cockpit cushions	
Stern anchor rode	Boathooks	
Dinghy oars (and spares)	Solar shower/ garden sprayer	
Docklines/shorelines/other line	Freshwater hose	
Water and fuel containers	Shore-power cord	
Baja filter	Sail covers	
Barbecue	Dinghy pump[1]	

[1]For inflatable dinghy.

tain privacy and prevent thieves from seeing high-value items below. Lexan hatchboards increase light below and allow the off-watch to maintain visual contact with the on-watch without removing the boards, but at the expense of privacy. Some boats carry both, doubling the stowage challenge. A plastic or fabric "door" (refer back to Figure 4-28) can be closed over Lexan hatchboards to ensure privacy when tied stern-to a dock or when leaving the boat, eliminating the need to carry a second set of wooden hatchboards. Ideas for stowing hatchboards include a specially designed horizontal slide-in shelf over the engine box, a flat canvas bag that snaps to a bulkhead, or a vertical slide-in stowage space in a cockpit locker (Figure 11-16).

A **cockpit table** makes it possible to entertain in the cockpit, the coolest place in the tropics. Most tables can be folded down against the binnacle. Their life will be greatly extended if they are removed for passagemaking, which means finding a place to stow them below. On smaller boats that lack the space for a full-sized cockpit table, a nicely varnished board set athwartships with its ends slid under the cockpit cushion on either cockpit seat works almost as well as a real table. It can be stowed under a cushion in the cockpit or below when not in use.

Figure 11-16.
Hatchboards (top) slide into a rack alongside the hull in this well-organized cockpit locker.

On boats under 40 feet, four to six properly sized **fenders** will be almost impossible to stow below when inflated. We carried them on the stern pulpit aboard *Silk* (refer back to Figure 4-15), which is a fairly common solution. A dedicated area to stow fenders and lines becomes possible on boats over 40 feet. On *Hawk*, fenders are secured to a rod above the chain box and are accessible from the deck through the anchor locker hatch (refer back to Figure 4-23).

A hard dinghy needs long, wooden **oars** to row well. The best place to store these is lashed inside the dinghy when it is stowed upside down on deck for passagemaking. If the dinghy is not equipped with an outboard, a spare set of oars should be carried as well. Aluminum oars that can be taken apart are much easier to stow than wooden ones and will serve until a new set of wooden oars can be obtained.

A 35-foot boat needs to carry at least 500 feet of **line**: four 30- to 60-foot docklines, one 150-foot stern line, one 100-foot spare halyard, one 40-foot spare sheet, one 40-foot spinnaker sheet, and a few additional lines for running rigging. Adding four 125-foot lines for transiting the Panama Canal will bring the total to around 1,000 feet. Storing all this line consumes a considerable amount of space, but it will fit in almost any nook or cranny left after other major items have been stowed.

As discussed in the Airflow Challenges section in Chapter 4, a large **harbor awning** that covers not only the cockpit but also the cabin trunk right to the mast will improve ventilation and help keep the boat's interior cool in the tropics (refer back to Figure 4-15). On *Silk*, the quarter berth was the only place where we could stow this large piece of canvas and the aluminum tube that held it rigid.

Every boat needs to carry several heavy-duty **plastic containers** for stowing water and diesel fuel, as well as for gasoline if the dinghy is equipped with an outboard engine. In a few places, the only way to refill fuel or water tanks will be by making repeated trips with these plastic containers. Two 5-gallon water containers and two 5-gallon diesel containers should be considered the minimum. These should be color coded (blue for water, red for gasoline, and yellow for diesel) and never interchanged. Storing them presents one of the greatest challenges on boats under 40 feet, and all too often they end up lashed to the lifelines where they could be a hazard if hit by a large wave at sea. If plastic containers must be stowed on deck, lash them to the binnacle in the cockpit. Better solutions include installing chocks in the cockpit locker, stowing containers in a shower stall on passage, and using 5-gallon collapsible water carriers made from polyethylene that stow flat when empty.

A **Baja filter** contains several increasingly fine-mesh screens and is used to remove particles and water from diesel fuel. The filter's odd shape and large size make it troublesome to stow, but on a few occasions it will prove invaluable for protecting the engine from contaminated fuel. On smaller boats, you will probably need to stow it in the bilge; on larger boats, you should be able to find room for it in a cockpit or stern locker.

Aside from providing endless entertainment in tropical waters, **snorkel gear** allows you to check the anchor and free it if it gets fouled. Snorkels and masks are prone to mold and should be rinsed with fresh water with a bit of chlorine in it at least once a month when not in regular use. Stow snorkel equipment in nylon net bags available from marine or diving stores or heavy-duty polypropylene bags purchased from stores specializing in space-management solutions.

Buckets are used for everything from washing the deck to laundering clothes. A bucket meets offshore specifications if it can be dragged through the water behind the boat at 7 knots without breaking. Plastic buckets with small wire handles do not pass this test. Black rubber horse buckets and 5-gallon wallboard compound buckets are strong enough to survive the rigors of boat life.

For boats without a stern platform, there must be a fast and easy way to get a person back aboard after swimming or in a crew-overboard situation. A fixed **swim ladder** will always be there when needed but can be difficult to mount on a boat with a wind vane. A detachable swim ladder needs to be stowed in an accessible place to be of any use in an emergency, which means that most crews keep it in the cockpit locker. Ladders can be awkward to climb onto and off of from a dinghy. A **dinghy step** (Figure 11-17), a single step attached to the toe rail or stanchion bases, allows the dinghy to be brought hard alongside the boat and lets crew step up without levering the stanchion gates. It can also be used in marinas with low, floating piers.

Figure 11-17.
Our dinghy step makes it easy to get on and off the boat from a dinghy or floating pier.

A good **boathook** can be used to fend the boat off a dock, to pick up a line from a mooring buoy, to swing the anchor around so it comes into the bow roller right side up, to free a line wrapped around something in the rigging, to flake the sail as it comes down, to retrieve a hat that has gone overboard, and for a huge variety of other purposes. Boathooks should be strong and long. One that telescopes to at least 8 feet but doesn't flex when put over your knee fully extended is ideal. Most boats have no sensible place to stow boathooks, so they end up tied to handgrips on the coach roof.

A **solar shower** in the tropics provides hot water on demand, not just when the engine is running. If you prefer a pressurized shower, you will also want to buy one of the **garden sprayers** used for spraying pesticides. These can be pumped up to create pressure and provide a forceful shower jet. When heading for colder climes, clean out both the solar shower and the garden sprayer with a bit of chlorine to discourage mold.

You will spend hours sitting in the cockpit on watch. Good **cockpit cushions** will be essential to the well-being of your derriere. The closed-cell-foam type last much longer if covered with a tough, breathable mesh.

Figure 11-18.
Evans reads in the sunshine in front of the mast in the comfort of our Sport-a-Seat.

Buoyant cushions that meet Coast Guard regulations for a throwable Type IV PFD make good backrests. For real luxury, the adjustable Sport-a-Seat offers back support and can be placed anywhere on the boat (Figure 11-18).

Many cruisers consider a **barbecue** to be one of the most essential pieces of deck gear, though some crews do manage to get along without them! If you choose to carry one, a propane barbecue makes much more sense than charcoal. Charcoal is dirty and difficult to stow, and gets saturated with water when stored aboard and will not light. To work well, a good propane barbecue will use a good deal of propane, so be sure to install large tanks. Buy a high-quality stainless barbecue and, if at all possible, stow it below on passage.

Navigation Needs and Ship's References

While navigation has become increasingly computerized, we must still carry an amazing array of books and papers in and around the navigation station (Table 11-2). These range from our ship's papers through cruising guides and tide tables for the areas we intend to cruise.

Chapter 12 discusses the various papers you will need to handle the bureaucratic red tape worldwide. We keep these important documents in plastic page protectors that we carry in zippered portfolio bags made out of plastic or nylon labeled on the outside for easy retrieval (Figure 11-19). If you plan to leave the boat for more than a few days, take this portfolio along with you or find a safe place to hide it somewhere aboard.

We also use these zippered portfolios for current bills, financial statements, and files of work in progress. These portfolios can be purchased at office supply stores or from outlets specializing in space management solutions. For storing bank statements, tax documents, and other financial papers, we use plastic accordion folders (Figure 11-19), which can store a great deal without taking up too much room.

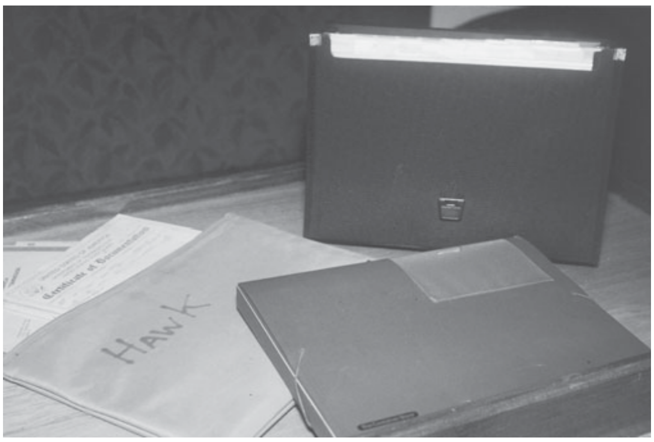
TABLE 11-2. NAVIGATION NEEDS

The Nav Table	Books/Guides/ References	Stowage Challenges
Ship's papers	Passage-routing book	Paper charts
Ship's log	Cruising guides/coast pilots	Sextant
Other papers	Tide tables	Courtesy flags
Chart chips	Sight reduction tables	
Celestial calculator	Nautical almanac	
Dividers/plotter	Owner's manuals	
Pens/pencils/erasers	Reference books	
Calculator		

Your ship's library will take up a large shelf and should include the following books:

- ***Admiralty Ocean Passages for the World* or *World Cruising Routes.*** You will need one of these books to plan your route for each passage. *Admiralty Ocean Passages for the World*, issued by the British Admiralty, originally gave information and recommended routes for clipper ships. It has been updated for engine-driven vessels, which makes it less useful for sailors. The latest edition of *World*

Figure 11-19.
Our ship's papers and other important documents are kept in plastic page protectors carried in a zippered portfolio; the accordion portfolio in the back can hold a large number of papers and takes up relatively little space.



Cruising Routes by Jimmy Cornell covers just about every conceivable ocean passage you might consider making and offers advice suitable for modern sailing vessels.

- **Cruising guides and coast pilots.** Cruising guides to local areas offer detailed harbor sketches and valuable information on facilities and customs procedures. These guides change constantly. Coast pilots offer detailed information on coastal features. Both the National Geospatial-Intelligence Agency (NGA; formerly the Defense Mapping Agency) and the British Admiralty create volumes that cover the world. They are especially useful in areas no cruising guide covers.
- **Tide tables.** Tide programs now exist that cover every port worldwide. The best we've found is available as freeware over the Internet (see the Onboard Software section in the resources for Chapter 8 in Appendix 1). Most chartplotters will also have tide tables. Unless you have two independent sources of tide information, carry paper tide tables for the areas you intend to visit. These are available by ocean through marine book retailers. Four books cover the world.
- ***Sight Reduction Tables for Air Navigation,* volumes 1–3.** To use your sextant, you need to carry the tables to reduce the sights and find your position. The Air Tables are the easiest. Carry something you are familiar with and comfortable using, even if you also have a celestial calculator.
- **Nautical almanac.** In addition to the sight reduction tables, you will also need current astronomical tables to calculate your position using a sextant. This information can be obtained from a nautical almanac. *Reed's Nautical Almanac* also meets U.S. Coast Guard requirements for carrying something that provides information on the rules of the road for seagoing vessels. In addition, it provides a wealth of information on everything from weather fax times and frequencies to buoyage to distress and emergency procedures.

The last two resources can be replaced by *The Complete On-Board Celestial Navigator* for celestial navigation. See the resources for this chapter in Appendix 1 for how to obtain these references. In addition to books related to navigation, most crews have a shelf of reference books for troubleshooting, repairs, and emergencies, including the following:

- **Owner's manuals.** Every piece of equipment installed on the boat should have come with an owner's manual. These provide maintenance schedules and troubleshooting suggestions as well as contact information for spares and warranty work. Hopefully your boat came with a complete, reasonably organized set. If not, you should contact the manufacturers and get replacement manuals. All our small manuals are kept in a three-ring binder organized by system—electrical, plumbing, propulsion, and so on.
- ***Boatowner's Mechanical and Electrical Manual.*** Nigel Calder's classic book, now in its third edition, provides the best overview available of installation, maintenance, and troubleshooting for marine systems. The more complicated your boat, the more you will benefit from carrying this book with you. See the Refit Resources section in the resources for Chapter 4 in Appendix 1.
- **Knot/splicing book.** Most cruisers carry one or several books that cover knots and splicing for different types of line. While splicing instructions usually come with fids, *The Splicing Handbook* by Barbara Merry provides a good overview for many types of line.
- **Medical references.** You will also need several reference books for handling medical emergencies on board. The Onboard Medical References section in the resources for Chapter 16 in Appendix 1 lists some titles we have found helpful.

Quite a few reference books can now be found on searchable CDs or DVDs, reducing space, increasing longevity, and making it much easier to find needed information. We carry CD versions of *The American Practical Navigator* by Bowditch, *The Merck Manual*, and multiple years of the Seven Seas Cruising Association *Commodores' Bulletins*, among others.

Paper charts take up a tremendous amount of space. A stack of charts for a year of offshore voyaging may be an inch thick. They must be kept dry, and if stowed flat, they need to be kept somewhere where they will not get wrinkled or ripped. Most offshore voyagers stow their charts under the cushions on settees or V-berths. To keep them dry, we put ours in "chart slickers"—large plastic envelopes meant to protect charts from spray when used in the cockpit, available from marine retailers. We can stow as many as a dozen charts in one slicker under a settee cushion. Charts can also be stowed rolled in specially made lockers.

After entering a new country and clearing customs, you must fly the country's flag from your starboard spreader for as long as you remain in the nation's waters. Most countries take courtesy flags very seriously. Large marine retailers sell courtesy flags, as do smaller retailers who advertise in the back of sailing magazines. They are expensive; many people bring material and hand-paint or sew their own flags. We stow our courtesy flags in a large ditty bag in a locker near the navigation station.

Galley Equipment

While crews on all but the largest boats will have to leave behind many of the kitchen gadgets they took for granted ashore, they'll still have everything necessary to cook a gourmet meal for friends. The equipment listed in Table 11-3 will easily meet the needs of a crew of two but can also be used to prepare a dinner for up to eight people. This can be considered a good base from which you can expand depending upon your own preferences and available stowage space. Only the largest boats will have room to stow all this equipment in the galley. Most cruisers dedicate a large locker in the main saloon to pots, pans, baking sheets, and other bulky galley items.

Many voyagers put a **pressure cooker** at the top of their galley list and consider it the only piece of galley equipment they cannot live without. A pressure cooker offers a quick, efficient, one-pot method for cooking meals that requires less propane and produces less heat than conventional stovetop cooking. But it also takes a good deal of stowage space and works best for a diet rich in soups, stews, and meat. For everyone we've met who left with a pressure cooker and came to swear by it, we've met someone who left with one and got rid of it.

If you have a small boat and no oven, you will want a pressure cooker to prepare meat and bake bread. If you have special dietary needs that make eating commercial canned foods problematic, you can use a pressure cooker to can soups, stews, and other meals. If your diet revolves around meat and stews, you will probably come to rely on a pressure cooker. But if your diet revolves around fresh vegetables, pasta, cheese, and egg-based dishes, you're much less likely to make use of it. If a pressure cooker sounds as if it might make sense given your diet, get on the Internet or go to a bookstore and browse through some pressure-cooker recipes to see if they sound appealing before buying one. If you may use the pressure cooker for canning, make sure to get an appropriate pressure cooker as described in the Galley Skills section in Chapter 14.

Although most of the items in Table 11-3 can be transferred directly from your kitchen ashore, there are a few

TABLE 11-3. ESSENTIAL GALLEY EQUIPMENT FOR THE OFFSHORE VOYAGER

Pots and Pans	Cooking Equipment	Dishware	Utensils
Large frying pan	Cutting board that fits in sink	Three nesting stainless steel bowls	Complete flatware set
5 qt. soup pot	Plastic sifter	Eight dinner plates	Assorted kitchen knives
2 qt. saucepan	Stainless steel grater	Eight salad bowls	Bread knife
1 qt. saucepan	Lemon juicer	Four large plastic serving bowls	Vegetable peeler
9 in. square baking dish	Pastry brush	Four large insulated mugs	Assorted wooden spoons
6 in. square baking dish	Stainless steel garlic press	Eight shatterproof glasses	Slotted serving spoon
Plastic colander/strainer	Hand beater or wire whisk	Dish-drying rack	Tongs
Two bread pans	Measuring cups		Measuring spoons
10 in. pie plate	Salt shaker and pepper mill		Stainless steel kitchen shears
Heavy-gauge aluminum baking sheet	Oven thermometer		Bottle opener and corkscrew
Cookie sheet	Meat thermometer		Ice pick
Heavy-duty, large teakettle	Flint striker		Two manual can openers
Vacuum flask/thermos	Butane barbecue lighter		Small, medium, and large funnels
Pot holders/oven mitts			

special considerations for equipping a seagoing galley. The concentrated, high-heat flames of marine stoves are hard to regulate, and they are punishing to pots and pans. Good pots stand up to the abuse better than cheap ones do. All **pots and pans** aboard should be made of high-quality stainless steel with aluminum or copper cladding on the bottom. Teflon tends to rust quickly if washed in salt water and should be avoided except on items you're willing to replace every couple of years. If space is an issue, consider buying a nesting stainless steel cookware set with removable handles and a shared lid. Cuisinart makes a high-quality set, and Magma (distributed through major marine chandlers) makes a less expensive alternative.

Metal utensils such as **graters**, **garlic presses**, **tongs**, and **kitchen shears** should be made from stainless steel. Plastic works better for items such as **colanders**, **measuring cups**, and **sifters**. Finally, heat-resistant silicone **bread pans**, **muffin tins**, and **pie plates** made by Izzo are even more nonstick than Teflon but last much longer and are flexible so they can be stowed just about anywhere. These have become our preferred solution for baking pans.

On a small boat that cannot carry much cookware, you can use a **large soup pot** to mix bread and cookie dough, boil corn or lobsters, make soup, and prepare anything else that involves large quantities of food. Five quarts is the minimum size that can be used for most of these purposes, but if you can find space for it, an 8-quart soup pot will be able to handle anything that comes along.

Many marine ovens have hot spots and cook things unevenly. A heavy-gauge (5 millimeter) **aluminum baking sheet** spreads the heat from the small flame area in the oven to cook things more evenly. Stainless steel can also be used, but it's heavier and conducts heat less efficiently than aluminum. If your oven cooks unevenly and didn't come equipped with one of these baking sheets, buy one or have one made.

Teakettles get a great deal of hard use aboard. Buy a stainless steel one with an aluminum-clad bottom that can be opened to be cleaned. The minerals in the water from various places will create scale. To remove it, let the teakettle soak with a vinegar solution for 12 hours and then scrub it out.

For some reason, the wire racks in marine stoves seem to get far hotter than those ashore and easily burn through the material of lightweight pot holders. Heavy-duty, flame-retardant, barbecue-style **pot holders** that go up to the elbow offer the best protection when removing hot things from a swinging oven at sea. You'll also want to bring a variety of smaller pot holders or trivets for use on non-flame-retardant surfaces.

No perfect solution exists for dispensing salt and pepper aboard a boat at sea. After trying many alternatives, we have found that a plastic **salt shaker** with a closable lid works best for salt. With a dozen or so grains of rice mixed in, the salt remains pourable for a minimum of several weeks. Peppercorns keep better than ground pepper, but **pepper mills** are frequently made with mild steel, which corrodes easily. Buy a high-quality pepper mill made with ceramic and stainless steel. If the pepper mill does not come with a cover for the bottom, make one from plastic or cloth to keep ground pepper from working its way into every corner of your locker.

The Piezo electric ignitions on marine stoves frequently fail. A **flint striker** can be used for lighting burners without having to constantly refill a lighter with butane. Extra-long butane **barbecue lighters** are best for lighting ovens.

Whether you choose stoneware or marine plastic **dishware**, buy stackable dishes that take up as little room as possible. Make sure that every piece of your dish set has some sort of nonskid on the bottom. A layer of dried rubber cement makes a good nonskid surface that is easy to apply to dishware. Line shelves used to store glasses or dishes with nonskid matting (like that shown in Figure 11-20) to reduce the likelihood of breakage. For heavy weather, you will use either a mug or a serving bowl for everything on the menu—make sure yours are large enough to hold a dinner. Pegboards with dowels offer flexibility when stowing dishes (see Figure 11-8).

When the boat is rolling in a big sea, knives, forks, and spoons can make a racket that will wake the dead. We installed simple wooden blocks with slots in them that fit tightly into our silverware drawer (Figure 11-20). Our **flatware** stacks in the slots and is held firmly in place, which all but eliminates noise.

Figure 11-20.
To minimize noise, our flatware stacks in slits in wooden blocks that fit tightly in the drawer; note the nonskid matting on the bottom of the drawer.

On *Silk*, we started out with top-of-the-line chef's **knives**; after a few months of being washed in salt water, the blades chipped. We replaced them with less expensive stainless steel laser knives, and these have held up remarkably well. We have had the same set aboard *Hawk* for six years, and they are still sharp and show no signs of wear. Magnetic knife holders will not restrain knives in rough weather; stowing them in drawers offers the safest solution.

Few things are standard from country to country, and can sizes are no exception. We broke three standard American **manual can openers** because the lips on European cans were wider than the lips on American cans. We finally found a solution in a European can opener that opens the can along the lip below the top. These are called Lifter Can Openers and are now available from cooking stores and some marine retailers. Even these have only a two- to three-year life span; since they can be hard to find you may want to carry more than one.

In addition to this equipment, you'll need a few more things to make your galley complete. If you are eating in the cockpit on passage, a **drink holder** on the binnacle leaves your hands free to manage your plate. Dedicate a small drawer or part of a locker to a variety of **plastic containers** for keeping leftovers. Heat and sun will greatly reduce the life of your spices, so a **spice rack** located inside a drawer or cupboard is better than one mounted on a bulkhead. **Nonskid matting** in galley lockers will keep things from sliding around, reducing noise and the possibility of breakage at sea.

Take along a dozen or so absorbent **tea towels**. We use them for cleaning spills, drying dishes, wiping hands, and a host of other tasks. A damp tea towel spread on a counter under plates and mugs keeps the dishes from sliding. On passage, I go through two to three tea towels per week.

Finally, you will want several **cookbooks** aboard. Most people find that they tend to eat much the same as they did ashore, so bring some of your favorite cookbooks and recipes along. See the Cookbooks section in the resources for Chapter 14 in Appendix 1 for a list of my favorite cruising cookbooks.

WHAT *NOT* TO BRING

A list of items we have found not useful on board may be more helpful than a list of those we continue to carry. This list reflects our choices, but the reasons why may help you develop your own list.

Bicycles sound like a terrific way to reach grocery stores and sightsee on faraway islands. But even folding bicycles take up a great deal of stowage space and do not survive well on board. Brake and shift components are susceptible to rust from salt air. Bikes are cumbersome to get ashore, and spokes and handlebars pose a major hazard to inflatable dinghies. When you do get them ashore, you will often find rocky, overgrown trails suited only for high-performance mountain bikes. Cruisers who spend most of their time staying in marinas in developed areas in Europe, the United States, the Caribbean, New Zealand, or Australia are likely to use their bicycles the most. In any of these areas, you can purchase a bike for your stay and then sell it when you leave.

Sail repair alone does not justify the stowage space for a **sewing machine** on boats under 40 feet. Outside the United States and Europe, sail repair was our most reasonable marine expense. We had all five of our working sails reconditioned in Antigua; broken stitches were repaired, worn areas were reinforced, and patches were applied for just over $100. Most of the sail repairs we did ourselves were hand-stitching jobs that did not require a sewing machine. On the other hand, you can justify the space for a sewing machine if you plan to make your own clothes and courtesy flags and do canvas work in addition to repairing sails.

A number of materials do not do well aboard, and you should avoid them if possible. **Leather** molds quickly; if you want to have it aboard, stow it in a zip-top bag with a mildew control product. The humidity in the tropics causes **down** to clump, reducing its insulating properties. With the modern fleece materials and old-fashioned wool, down is not essential aboard unless you plan to venture into the high latitudes. There, the only thing that beats a down comforter or down sleeping bag for staying warm in bed is an electric blanket.

All but the toughest **metals** corrode from salt air and occasional exposure to salt water. Mild steel is most vulnerable to corrosion, and (naturally) it is used in the least obvious places. The contacts on many pieces of electrical equipment are made

(continued on next page)

from mild steel. We had a handheld tape recorder, a Sony Walkman, numerous flashlights, and a camera flash fail beyond repair due to corrosion on battery or switch contacts. Although corrosion is unavoidable in electrical equipment at sea, you can minimize the likelihood of failures: don't buy electrical equipment with contacts that look cheap and flimsy, don't store batteries in electrical equipment that is not used on a daily basis, and clean contacts a couple of times a year.

You will also find mild steel in a host of items that are mostly stainless: nail clippers, zippers, graters, poor-quality flatware, belt buckles, fasteners, and can openers, to name a few. The little springs in barrel bolts or flashlights are often made of mild steel. All these items will rust, and many will fail completely. Inspect everything you bring aboard. Use a magnet to test that the metal is stainless. If it isn't, beware of nasty rust stains and store these items where they won't damage something more valuable.

Aluminum works as well as stainless steel, as long as it is not in contact with other metals. Corrosion caused by mixed metals occurred in a wide variety of seemingly indestructible items. The stainless steel blades of our Swiss Army knives were hinged with an aluminum pin, which corroded within two months to the point where the knives were locked shut and totally useless. A small, nearly invisible component can prove to be aluminum and cause corrosion in eyeglasses, zippers, fasteners, and utensils. Even plastic zippers usually have a metal slide and will corrode. Even when not in contact with other metals, aluminum will oxidize. You will have to clean the white dust from the object once in a while. Beeswax will prevent corrosion and oxidation on zippers and should be applied liberally on any zippers that are not used frequently.

Linens and Bedding

All bedding needs to be drip-dry, quick-dry, easily laundered, and patterned or colored to hide dirt. A sheet will be enough of a covering most of the time in the tropics. Sheets should be patterned in moderate colors that will hide dirt but not fade too badly with multiple washings. Carry two full sets of sheets for each regularly used berth. We prefer flat sheets that can be tucked in to match the shape of any berth aboard. For cooler nights in the tropics, you will also need two light cotton blankets for each regular berth.

We carry two "luxury" towels made of heavy cotton and a half-dozen inexpensive beach towels. Beach towels work better than thick cotton ones on passage because the thinner material dries in half the time. I consider clean-smelling sheets and soft, fresh towels one of life's little luxuries. We stow both freshly laundered in a well-ventilated locker in zippered plastic bags with fabric softener sheets between them; they remain sweet smelling for several months at a time.

For temperate climates, you will need to carry some heavier blankets. Wool blankets absorb odors, tend to shed, and are difficult to stow. Fleece blankets are less bulky, do not absorb odors, and will be warm enough for the occasional colder weather during a tropical circumnavigation. One per berth can be stowed in netting at the foot of a quarter berth or pilot berth along with the cushions used to convert a single bunk into a double. For high latitudes, we carry a half-dozen wool and fleece blankets of different weights as well as a down comforter. We stow these with a generous supply of cedar balls in large polypropylene bags when not in use.

Clothing

The clothes you select for boat life should wear like iron, be practical for the climate, and be made from materials that can withstand multiple washings. Pick colors with care: white shows mold and mildew; bright colors, particularly red, fade in the sunlight.

Like most liveaboards, we have boat clothes and shore clothes. We keep newly purchased clothes in separate lockers, often in plastic, and use them for going ashore. After they become faded and stained, we relegate them to boat work and wear them on passages.

The various lightweight, breathable, quick-dry nylon fabrics (such as Supplex) work best in the tropics. Cotton is still a good material for hot weather but is less well suited to cold climates. It breathes and wicks moisture away from the body, but does not retain heat once it is wet. Wool and fleece will keep you warm even when soaked. You will need one or the other for wet watches in the temperate or high latitudes. Polypropylene stretch pants add warmth when layered under foul-weather gear or when used alone in the tropics at night. They dry quickly, are almost indestructible in the ship's laundry, and are very comfortable.

Well-ventilated lockers are the key to keeping day-to-day clothes from developing mold and odors. Don't pack lockers too full with little or no space between items; leave some room for air circulation and add softener sheets or cedar balls to keep out odors. Keeping clothes mildew free when stored for long periods of time takes practice. Traveling between the tropics and the high latitudes means always having a complete set of clothes in storage for months at a time. We stow these clothes in vacuum bags or 2-gallon zip-top bags with cedar balls. We make sure the clothes are absolutely dry before we put them in the bags; otherwise condensation forms, and mold follows. These bags then get stored in polypropylene storage cubes under the forepeak bunk.

Hanging clothes should be stored in hanging plastic bags with mildew preventer or cedar balls. Use plastic hangers, not metal. Even coated metal hangers, if damaged, will deposit rust stains on your best clothes. Keep hanging clothes from moving. If they are not packed in tightly or otherwise held in place, the constant motion of the boat can cause the hanger to chafe right through thin fabrics.

On boats where space limitations prohibit hanging clothes, a "frequent traveler" solution works just as well. Hang the clothes on plastic hangars, and then pull long dry-cleaning bags over each individual item or at most three items at a time. Tie the bottom of the bag tightly, then roll up the bag and the clothes from the bottom, leaving the hangar sticking out at the top of the roll. Tape the opening until it's tight around the hangar neck. Stow these rolls in any locker or on any shelf. When you want to wear the clothes, pull them out, shake out the roll, take off the bag and let them hang for an hour or so in the fresh air. The bags prevent wrinkles and keep the clothes fresh. To keep out odors, roll a few fabric softener sheets in with the clothes.

What clothes should you bring along? You need to carry clothes for both warm and cool weather if you intend to leave the tropics during hurricane season. On passages in the tropics you will wear only enough to protect you from the sun. In higher latitudes, you will need clothes to keep you warm and dry in a variety of conditions. The items listed in Table 11-4 can be considered the minimum for voyaging in trade wind and temperate latitudes.

TABLE 11-4. CLOTHING FOR TROPICAL AND TEMPERATE LATITUDE VOYAGING

Cooler-Weather Clothing	Tropical Clothing	Footwear
Foul-weather gear	Lightweight pants (three or four)	Seaboots
Fleece jacket	Lightweight long-sleeved shirts (three or four)	Deck shoes
Lightweight, waterproof shell	Lightweight set of dress clothes	Flip-flops (thongs)
Warm sweaters (two or three)	Shorts (six pairs)	Good walking shoes
Lightweight sweater	T-shirts/short-sleeved shirts (ten)	Hiking boots
Wool watch cap	Tank tops (four)	Sandals
Polypropylene stretch pants (two pairs)	Swimsuits (two or three)	Reef shoes
Polypropylene long underwear	Sarongs/pareus/ lavalavas	Slippers
Jeans (two pairs)	Loose cotton dresses or skirts (two)	
Long pants (two or three pairs)	Cotton ankle socks	
Long-sleeved shirts (four or five)	Cotton underwear	
Fleece or wool socks	Hats	
Fleece or wool gloves	Sailing gloves	

Although bulky and difficult to stow, **foul-weather gear** is essential. We never used ours in the tropics, but we were grateful for it when we headed into the temperate latitudes. Breathable foul-weather gear keeps you drier by allowing moisture to escape when you're working on deck. If you can afford it, it's well worth the investment. Like many women, I hate bib overalls because they don't fit my body well, and they're a hassle to get out of when I have to go to the bathroom. I prefer heavy-duty waterproof breathable women's sailing pants reinforced at the knees and seat.

A **lightweight waterproof shell** or foul-weather jacket will get used constantly. On a windy night or during a frontal passage, a lightweight shell will keep you warm and dry during a sail change. While breathable shells are more comfortable, after a year or so the seams begin to leak in tropical downpours. We prefer good-quality, nonbreathable "slickers" that are water resistant. They hold up well to frequent washings, are tough enough to get snagged on a cotter pin without ripping, and offer the versatility of layering as the weather gets cooler.

Warm **fleece** or **wool sweaters** (jumpers) are very bulky. They stow better rolled than folded. To keep wool sweaters smelling sweet, seal them in zip-top plastic or polypropylene bags with some fabric softener sheets when entering the tropics. Outside the tropics, air them out after every passage.

Although everyone has several pairs of **jeans** aboard, they get little use in the tropics and even less use in the high latitudes. Jeans are heavy and warm and absorb moisture once exposed to salt water. Most people use them only in dry weather in the temperate latitudes. **Lightweight pants** made from fast-drying microfibers are pricey but much better suited to the tropics. Some are designed to convert to comfortable shorts by zipping off the bottom two-thirds of each leg. Military combat pants are lightweight, dry quickly, last forever, and are much less expensive than designer microfiber pants. They are available in army-navy stores for reasonable prices and come in a variety of colors.

You will spend the vast majority of your time in **shorts** in the tropics. Good boat shorts are lightweight and long enough to protect the backs of your legs from hot decks or sticky cushions. Canvas or cotton shorts are the toughest, but they're hotter and take longer to dry than those made from microfibers such as Supplex.

Even once-formal yacht clubs have succumbed to the "dress down" mentality, but each crewmember should still have some **formal clothes** aboard. Men should take a jacket and two pairs of slacks. Women will need to respect local customs in some places. Throughout the South Pacific and in many Islamic countries, tradition dictates that women be covered from ankle to shoulder. In these countries, women should never wear shorts ashore outside of tourist areas. Instead, dress in the local attire: a sarong, pareu, or lavalava, depending on the country. These long rectangles of brightly colored material are wrapped around the body and secured with a knot or pin. Loose, waistless, wide-sleeved cotton dresses or cotton skirts with short-sleeved tops make acceptable alternatives.

Even when we wore little else in the tropics, we always wore a **hat**. But the perfect hat is hard to find. Canvas is too hot, and it molds or rots when exposed to salt water. Many hats have mild steel buckles or snaps that quickly rust away to nothing. A good boat hat needs a wide brim all the way around to protect your forehead, nose, and the back of your neck. The hat needs a way to be secured to your head in windy weather, and it should be a light color to reflect the sun (but not white, which quickly becomes spotted with mildew). The hat should be washable without shrinking or losing its shape.

You will need several hats because you will lose at least one overboard. We use inexpensive baseball caps made out of nylon or light cotton as "disposable" hats in windy conditions. The rest of the time we wear wide-brimmed safari hats or long-brimmed baseball caps made from quick-drying microfiber material.

You will spend a lot of time in bare feet. However, many situations require shoes, and each situation requires a different type. You will use **seaboots** and **deck shoes** on board in cold or wet weather. **Flip-flops** are handy while landing the dinghy on a sandy beach, and they will protect you from athlete's foot in communal showers. You will want good **walking shoes** or high-quality sneakers for long walks ashore. Lightweight, waterproof **hiking boots** will allow you to bushwhack up rough trails. A nice pair of **sandals** makes good tropical dress shoes. For exploring in coral you will want **reef shoes** that cover the tops and sides of your feet. Canvas tennis shoes work well, as do the French plastic sandals that cover most of the foot. The latter can be purchased just about anywhere in the South Pacific. The cabin sole will be near water temperature most of the time, which may mean between 50° and 60° in temperate latitudes. Lined slippers or slip-on shoes will keep feet warm when lounging around the boat.

Storing a couple of pairs of flip-flops, sandals, and boat shoes creates few problems, no matter how small the boat. But when the shoe inventory stretches to include everything from hiking boots to dress shoes, small piles of footwear begin to appear in every unused corner aboard. To prevent shoe chaos, we keep the current range of day-to-day footwear in a plastic crate that sits below our hanging clothes. This holds a large volume of footwear within its "footprint," and while digging through it to retrieve the flip-flops at the bottom gets old, it's the best solution we have found. Other options include canvas pockets on the back of a locker door or shelves at the back of a hanging locker. Leather shoes and boots need to be aired out once a month or so, or they will grow mold no matter how they are stowed.

Electronics

Computers, cameras, video equipment, printers, and other electronics will function for much longer if they are protected from the elements. Though expensive, bulky, and difficult to stow, dedicated waterproof safety cases provide the most complete protection for delicate electronics, preventing exposure to water, humidity, and salt while cushioning them against concussion. Use foam inserts to pad the cases. Small waterproof cases with O-rings to keep moisture out can be purchased for cell phones, satellite phones, and other small electronics.

To transport cameras in the dinghy, we transfer them to dry bags (Figure 11-21). Used by whitewater rafters and kayakers and available from camping stores or marine retailers, the triple-sealed watertight closures on these bags keep things inside absolutely dry and will allow the bag to float if lost overboard. These dry bags also offer a more versatile, less expensive—but less robust—solution for stowing electronics. The largest dry bags can

Figure 11-21.
Dry bags used by kayakers have a triple seal that keeps them watertight; trapping air in the bag when it is sealed will keep it afloat if lost overboard.

make a permanent home for an expensive camera or a laptop. Wrap equipment in several layers of soft cloth before sealing it into one of these bags. As a last resort, you can put electronics in large zip-top bags and stow them in their normal carry bag, but they will be much more vulnerable to moisture and concussion.

Smaller electronics such as tape recorders, Walkmen, iPods, point-and-shoot cameras, camera flashes, and so on can be stored in plastic containers with airtight snap-on lids. Put some padding in the container and remove the batteries from anything not used regularly. Inspect the contacts for any sign of discoloration or corrosion before putting the batteries back in, and clean them with a wire brush or fiberglass "wand"—available from camera stores—when necessary.

Miscellany

Beyond the major categories described above, you will want to bring a variety of other items, some of which have special stowage requirements in the marine environment. In the section that follows, I start with the smallest, easiest-to-stow items and work up.

Our first stop in several major ports has been the local optician's office to replace **eyeglass screws**. The screws corrode quickly because they are often made out of mild steel or aluminum. Before you leave, purchase spare screws for each pair of glasses aboard—not just for hinges, but for nose pieces as well. Stow them in a film canister with a bit of oil. Don't forget to bring a jeweler's screwdriver. If your glasses break and you don't have the right screw, use a twist of seizing wire for a temporary fix.

The boat gremlins love **clothespins**. You will lose them in the bilge and over the side. Buy several dozen and stow them in a ditty bag near the companionway. The wooden ones are more durable than the plastic variety, and, contrary to popular belief, the plastic ones do not float.

High-quality sport or dive **watches** last the longest and are the most useful. Buy a watch with two time zones to keep track of Greenwich Mean Time, a timer for cooking, an alarm for watchkeeping, and a good light for seeing the time at night. The band should be heavy-duty rubber or plastic with a stainless steel buckle. Each person aboard should have his or her own watch.

In the tropics, **sunglasses** protect your eyes from the sun's harmful rays. Polarized lenses will let you read coral water with ease. The glasses should be dark enough that it's difficult to see your eyes through them and wraparound so they keep out as much UV as possible. Every pair of glasses aboard should be fitted with something like a Croakies (eyeglass retainer) to keep them from going over the side.

Flashlights have to hold up to the marine environment. Flashlight switches and battery connections corrode and break. Halogen dive lights rated submersible to 100 feet last the longest. These are bright enough to guide us into a harbor at night and small enough to tuck into the bunk beside us when we go to sleep. Take one for each regular member of your crew and a backup for the ship.

When working on deck at night, a **headlamp** gives you the light you need while leaving both hands free. Our halogen headlamps give off a bright light, don't chew through too many batteries, and can be switched from white to red light to preserve night vision.

You will need protection from mosquitoes where malaria is a problem. Most good-quality portlights come with **mosquito screens**, or you can order screens from the portlight manufacturer. Marine chandlers sell weighted mosquito netting in a variety of sizes for use over hatches and companionways.

THE MOST PERSONAL OF DECISIONS: FIREARMS ABOARD

Carrying guns is one of the most contentious issues among offshore voyagers. About one-third of the voyagers we meet carry firearms aboard. Evans and I both enjoyed target shooting before we went sailing, but neither of us felt that guns were appropriate aboard. Before you make your own decision, consider the following points.

If you carry guns, you are supposed to declare them when you clear customs. In many countries, guns will be confiscated by customs officials and returned only when you leave. Flare guns and spearguns will be confiscated as well. You may have to return to your port of entry to retrieve your weapons, which can mean sailing several hundred miles to windward. If you do not declare your guns and they are found in a search, you have broken the law. At a minimum, you will be warned and fined. In many countries, your boat can be impounded, and you can be thrown into jail. In some countries, the penalties are even more severe: outside the port captain's office in Port Klang, Malaysia, a sign reads, "Mandatory death sentence for unlawful possession of firearms!"

Most cruisers who carry guns are worried about pirates. After more than a decade cruising, we have met only one couple who encountered pirates, and we know of only one situation where a gun helped (see the Piracy sidebar in Chapter 23). But we know of several instances where unarmed bandits got control of the ship's gun and used it on the crew. One of the most widely known incidents was when Sir Peter Blake was killed by armed boarders in the Amazon in December 2001. He came out of the companionway brandishing a gun, got off one round, and was shot dead. One of the other crewmembers was injured, but the rest were not harmed. A spokesman for the Brazilian federal police said, "If Peter did not arm himself, this maybe would not have happened." Of the dozen or so situations we have heard of involving boarders, those where the crew gave the thieves what they wanted were resolved without violence.

We have also heard of several situations where a cruiser's gun was almost used on local people who were only trying to be hospitable. When language and customs differ, intentions can be easily misinterpreted. Someone with a gun aboard might have reacted differently to this situation recounted by two-time circumnavigator Scott Kuhner:

> "We were in Indonesia. We had just dropped anchor behind a reef after an overnight sail when we were approached by one of the local fishing boats. The men on board were dressed completely in black—long-sleeved black shirts and long trousers, with black ski masks over their heads. They steamed straight to our boat, tied their boat to ours, and jumped aboard before we could react. I started screaming at them to get off my boat, and they started screaming back in their own language. They looked menacing, and I didn't know what they wanted.
>
> "Then Kitty appeared in the companionway. She held out three Coca-Colas and a pack of cigarettes. The tension was instantly broken. They removed their ski masks and accepted the gifts with big grins. We later found out that many of the fishermen in the area wore ski masks to protect themselves from the sun. These guys were just curious fishermen who had finished their night's fishing and stopped by to give us some of their catch."

Having a gun aboard is a personal decision. We know a half-dozen crews who started off with guns but got rid of them (often by throwing them overboard) during their first year of cruising, and we know other crews who wouldn't feel comfortable without them. If you do decide to carry firearms, be absolutely certain you are in danger before using them in fear or anger.

Unframed wall hangings, including photographs, calendars, and fabrics, all succumb to humidity eventually, curling up at the edges, ripping, and rotting. However, small **pictures**, properly framed with quality frames and glareproof glass, do surprisingly well aboard. Heavy-duty, double-sided tape works well for attaching lightweight pictures to bulkheads. We have yet to find a good solution for stowing either **photographs** or **slides** aboard for any length of time. Electronic images offer a far better alternative!

Books serve as the primary form of entertainment aboard most boats, and cruisers routinely trade them.

Figure 11-22.
On *Hawk*, we stow our kerosene lantern wedged into a corner with a clip to the headliner and one to the bulkhead.

Make sure you have adequate shelf space for a couple dozen novels. If you have children along, designate some space for their books and let them fill their own shelf.

Although a **kerosene lantern** makes for a romantic dinner, it gives off too much heat to use regularly in the tropics. But it will keep smaller boats warm in temperate climates. To stow it, wedge it into a corner with two clips (Figure 11-22). If your boat is small or particularly lively at sea, remove the chimney, wrap it in bubble wrap, and put it in a cloth or canvas bag. Bubble wrap is handy to have aboard for anything delicate when heading out to sea.

Most boats now carry a variety of **office supplies**, and it can be a challenge keeping these dry and in good condition. Printer ribbons, diskettes, address labels, envelopes, and accessories for the computer and printer (such as spare batteries or extra cables) take up a surprising amount of room and need to be protected from moisture and salt. After trying a variety of solutions, we finally found a large, plastic container that fits well into the area behind the settee backs in our main saloon, which we use to stow CDs, business envelopes, printer ribbons, spare laptop batteries, and small notebooks. Larger envelopes, printer labels, packaging materials, and computer programs on CD or DVD are stowed in zippered portfolios (see Figure 11-19). We stow printer paper in hard plastic portfolios that close with stretchy cords (in the foreground in Figure 11-19). These don't bend corners or edges, thus keeping the paper in usable condition for the printer.

After ending up with a snake's nest of electrical wires and accessories, we have learned to label all power cords, adapters, plugs, connectors, and chargers for cameras, cell phones, computers, and other electronics the minute they come on the boat. We use paper labels enclosed in cellophane tape and wrap them around the cords. We keep most of these items in a plastic tray in a drawer of the navigation table.

A 4-by-4-foot **canvas square** with heavy-duty grommets sewn into each corner can serve a dozen purposes. We use ours as a small, movable awning, a hatch cover for rainy weather (refer back to Figure 4-17), a tool holder when working on deck, and a rain catcher. We use a second square as a drop cloth when working on the engine, cleaning winches, greasing the windlass, or painting our wind vane blade. In an emergency, this cloth could serve as a collision mat. If space allows, carry two or three of varying sizes.

A variety of tote or **carry bags** will get constant use aboard. Canvas tote bags are bulky, hard to stow, prone to mildew, and rot after repeated exposure to saltwater. Carry bags and backpacks made from parachute material that fold up small enough to fit inside a purse are now sold by many camping stores. Though more expensive than canvas bags, these are less prone to rot and can be cleaned if they mold. The handles on the bags are often narrow, however, making them harder on the hands.

We use a heavy-duty, aluminum, **folding hand cart** to carry water, diesel, groceries, ice, batteries, and just about everything else. It folds up flat and can be hung from a bulkhead. Over the course of six years, it has held up beautifully despite much abuse and frequent exposure to salt water. These can be purchased from marine chandlers.

You will need some **luggage** when you go ashore as a tourist or head home for a visit, but the convenient rolling suitcases used by most travelers will be impossible to store on most boats. A duffel bag and a backpack for each person aboard meet most needs. To stow well, backpacks should not have frames. Inspect all luggage for mild steel closures or mixed-metal zippers. The best zippers are the all-plastic or all-stainless ones.

LIVING WITHIN YOUR SPACE

During the first year or so, there will be times when you miss something you had ashore or when you realize you made room for something you really aren't using. Managing your stowage spaces is a continual process. You will refine your arrangement after you head offshore and learn which items must be most accessible. You will also acquire things as you travel: souvenirs, line from replaced running rigging, spare parts stripped from broken gear, and so on.

Every few months during the first year, evaluate your stowage arrangements. You made most of these decisions before you left, and you will modify many of them as you adjust to life aboard. Carefully reconsider whether everything is in the most appropriate place—would it be better to have a mixing bowl in the galley instead of a colander? Even after you get the basics right, it pays to review your stowage arrangements from time to time.

Make an effort to get rid of unnecessary items. Gear expands to fill the usable space on board. The smaller your boat is, the more acute the situation will be. We use the following three rules to keep our priorities straight:

1. **Any item that has not been used in six months should be sold or sent home.** Safety equipment is an obvious exception to this rule.
2. **The stowage space for new gear must be "paid for" with other gear.** If we want to bring a new item aboard (anything larger than a bread box), something of equal size has to be taken off the boat. On our first trip aboard *Silk*, I didn't mind giving up my manual typewriter when I bought a laptop computer. But when we added a second hank-on sail, we debated for a week before we agreed to give up the sailing rig for our dinghy.
3. **Souvenirs are not allowed to live aboard.** Although I love buying baskets, tapa cloth, *molas* (complex fabric designs made by the indigenous people of Panama), and local jewelry, I mail them to my family rather than keeping them aboard. Aside from the space issue, most of these items are made from plant or animal products and create problems with customs.

These three rules, used in conjunction with rearranging your stowage spaces once or twice a year, will help you live comfortably within your space.

The process of whittling down your possessions to fit within the confines of your boat will be a difficult and time-consuming task. But in narrowing down the list of what you will bring, you will help define your new self, this person who is about to embark on a great adventure and a totally new way of life. In moving aboard and living with fewer possessions in the course of your first year at sea, you will begin to separate your many wants from your few needs. The possessions you carry will mean more, and you'll realize how little most of what you gave up mattered to you.

CHAPTER 12
Managing Life Afloat

AFTER FITTING OUT the boat and fitting your possessions into it, you're well on your way to slipping the docklines and joining the ranks of carefree cruisers. But first, you need to organize a way to take care of the mundane, day-to-day details of life when you spend most of your time abroad at no fixed address. How will you pay your bills, collect your mail, or renew your boat insurance? You will also need to put together the paperwork that will smooth your dealings with foreign bureaucracies, whether clearing into a country or dealing with an emergency.

For most people, after they have moved their possessions aboard and taken care of all the legal and logistical details of managing life afloat, the next step is to break the ties that still bind them to shore. Before you can leave, you will have to sell or rent your house, leave your job, and say good-bye to family and friends. This can be a difficult period, but one made less painful by the promise of a new life just around the corner.

BUSINESS AND BUREAUCRACY

Most people heading off on a sailboat are interested in simplifying their lives. There are many things you can—and should—leave behind when you sail away, including as many bills and business concerns as possible. But in the decade we have been voyaging, many aspects of life have become more complex. Very few cruisers can afford to leave it all behind these days. Your transition to life afloat will go much more smoothly if you put some time into organizing efficient solutions for the day-to-day demands that follow you offshore.

Some cruisers are fortunate enough to have a responsible family member or close friend who can act as a shoreside coordinator for all aspects of business and bureaucracy discussed in this section. My father has always handled our mail and finances and has managed many situations that would have been problematic without him. Although we could pay others to do much of what he does or organize solutions via the Internet, having someone "on the ground" has been very useful at times. On several occasions he has resolved disputes over bills and credit card charges. But his key role is to act as "order central," contacting suppliers when something breaks, ordering parts, and then tracking the package to make sure it reaches us. He averages a couple of hours a week managing our affairs.

Having a shoreside coordinator centralizes your affairs with a single contact person. But you need to find someone whom you trust with the details of your finances and who will be interested in your voyage and willing to commit the time. That person needs to be reliable, easily reachable from ten time zones away, and committed not just for the first year when everything is novel but two or three years down the road when your voyaging has become mundane. If you cannot find an appropriate person or if you would rather keep your financial dealings private, today's Internet and communications technologies make it possible to manage your affairs from afar.

Communications

The key to long-distance management lies in good communications. Many people go cruising to get away from ringing telephones, full e-mail inboxes, and voicemail, but in disconnecting yourself don't throw the baby out with the bathwater. You can remain in contact selectively and control your communications, minimizing their impact on your new life.

When we left aboard *Silk* in the early 1990s, our communications were pretty much limited to snail mail and faxes. We were often completely unreachable for a month or more at a time. On *Hawk*, we rarely go more than a few days without communicating with my father. He knows where we are at all times, and he can reach us within a day. Phone and e-mail have become our primary means of communication, and both are cheaper than faxes and snail mail used to be. We initiate most communications, and we choose when and how to respond to the messages we receive. While being in touch almost all the time does change the cruising experience, we have found that for the most part it changes it for the better. Our families worry about us less and share more directly in our adventures, and we almost never miss out on important financial transactions or family events.

Like most cruisers, we rely on e-mail as our primary means of staying in touch. But the telephone is also central to our communications strategy, and we use a variety of phone services depending upon which is the least expensive in a given location. A very small proportion of our communications cannot be handled by voice or by Internet connections, and these continue to come to us via snail mail.

As discussed in the High-Seas Communications section in Chapter 8, communications systems fall into two distinct categories for cruisers: inshore, or what we use when we are in port or near shore; and high seas, or what we use when we are offshore or cruising remote areas with no communications infrastructure. Some cruisers will use their high-seas communications capabilities even when anchored or coastal cruising, but most of us find these specialized systems too slow and too expensive when alternatives are available. This section takes a look at the inexpensive inshore communications options we use most frequently.

Data

Given the costs and limitations of boat-based e-mail, almost no one surfs the Internet, uses instant messaging, updates websites, or downloads large attachments over their high-seas communications systems. To enjoy the full capability of the Internet, most cruisers rely on Internet cafés or on wireless networks. To make sure they can stay in touch with family members who have no computer experience, they may also make use of simplified e-mail systems like PocketMail.

The simplest way to get connected is to search out an **Internet café**, cybercafé, or library offering Internet services. Cybercafés have sprung up almost everywhere cruising boats congregate, and most traditional providers of yacht services have added e-mail to the usual list of laundry, showers, filling gas bottles, and holding mail. We have used Internet facilities in Akureyri in Iceland just south of the Arctic Circle and in Puerto Williams on Isla Navarino 60 miles north of Cape Horn. Only in the United States and Canada, where most people have computers and Internet access in their homes, have we had difficulty in finding Internet cafés.

Internet cafés charge for the time you spend on their computers, and to access your e-mail you may also need to pay a monthly or annual fee to an Internet service provider (ISP). ISPs such as Yahoo, Google, and Hotmail offer free or very inexpensive e-mail service. Costs for accessing the Internet vary enormously. Many libraries provide Internet access for free, but the connection is often slow, and usage is limited to 15 or 30 minutes. The cost at cybercafés varies from 75 cents to $5 for 15 minutes, with $1 to $2 being about average. Internet game rooms that cater to teenagers offer the lowest prices (as low as $1 an hour) and fastest speeds—though the ambiance may leave something to be desired.

Many Internet cafés have wireless networks or dedicated phone lines for use with your own laptop computer. This eliminates the two biggest disadvantages of using an Internet café: the information is not downloaded directly to your computer, and you must compose e-mails while being charged for computer time. On the other hand, this means transporting your computer ashore in the dinghy and running the risk of damaging it or having it stolen. We prefer to handle e-mail over an Internet café's computers and forward any important messages to our boat-based e-mail system. We download large attachments and transfer them to our laptops using a flash drive through a USB port.

Most cruisers end up with at least two e-mail addresses: the address for their high-seas e-mail, and a land-based ISP address. Some will also have addresses associated with websites or a business. All these need to be accessible from an Internet café in a foreign country. SailMail and other ISPs that provide Internet service for satellite or radio-based systems can be accessed through their websites with a user name and password, making it unnecessary to download messages on the boat when in port or coastal cruising. Hotmail, Yahoo, and some other ISPs offer the capability of downloading e-mail from other addresses using POP (Post Office Protocol). Search on "POP" in the Help section of your ISP's website to find the information necessary for setting up e-mail retrieval from your other addresses.

Until recently, Internet cafés offered the only viable alternative for cruisers who wanted to download large attachments, upload photos to a website, or surf the Web. But **wireless networks** have made total Internet connectivity from a laptop possible aboard your boat—for a price. Wi-fi (short for **wi**reless **fi**delity) provides access within a "hot spot" such as a marina, an Internet café, or a coffee shop; PC connection cards connect the user through a mobile phone system.

Broadband wi-fi networks are available in many marinas in developed countries. To access them, your computer must be equipped with a wireless networking card, and you must subscribe to the network provider and pay a monthly fee. In many cruising grounds, one provider offers access to wi-fi in all major marinas in a large area, such as throughout British Columbia in Canada. Monthly fees in the areas we have cruised have averaged between $20 and $40 depending on network speed and coverage. Signing up for service is usually simple and can be done in any marina served by the network.

A **cellular phone** expands coverage from a hot spot to a cellular network. The phone can be connected to the computer through a cable or via an infrared port. Different companies have different policies on data versus voice transmission and the rates they charge for each. A cell phone can easily be used to check e-mail several times a week, but if you plan to surf the net for several hours per day, you will be better off buying a **wireless connection card** and dedicated data service from a cellular provider.

These cards insert into a PCMCIA (Personal Computer Memory Card International Association) slot on the computer and have a small antenna that picks up the cellular signal and allows Internet connection from anywhere within the cell phone coverage area. Information on the cards and on data services can be found in the business section of the cellular companies' websites under Wireless Data. In addition to purchasing the card, users must purchase a service contract and pay a monthly fee for data access. The service can be expensive, often more than the monthly charge for a cell phone. For the best connections, cruisers who use these systems advise buying a remote antenna and mounting it on the outside of the boat.

Whether using a card or a cellular phone, the speeds available depend upon the capability of the cellular network. Broadband-type connectivity can be achieved in an increasing number of metropolitan areas, with slower speeds in more rural areas served by slower networks. The cards can often pick up cellular signals 10 miles or more offshore, but they are not capable of true high-seas communications.

For any of the wireless options, transmission speeds far exceed what is available through satellite phones or high-frequency radio. Wireless services provide cruisers with full Internet access from the comfort of their navigation station. They make it possible for those trying to run a business to be in contact on a daily basis when coastal cruising in a covered area.

One of the biggest challenges in relying on e-mail as your primary means of communication comes in maintaining contact with the dwindling number of people who have never had any computer training. Luckily, an e-mail system exists that has been designed especially for the technologically challenged. PocketMail uses an acoustic coupler attached to a small keyboard and screen called a composer for writing e-mails. After the e-mails have been written, the phone is dialed by hand and then the receiver is placed against the device. Message length is restricted to the equivalent of one typed page, and no attachments can be sent. The hardware costs around $100, and the monthly service charge is similar to major ISPs. For contact information, see the resources for this chapter in Appendix 1.

The Internet offers many ways to share your experiences with others. Some cruisers have elaborate websites that chronicle the voyage day-by-day or post blogs about the politics and economics of the places they are visiting. But many of these sites get abandoned after a few months when new cruisers discover exactly how challenging it can be to find high-speed connections for uploading photographs and other materials. Most of those we know who have kept up websites for several years while cruising in remote areas rely on someone ashore to post material for them. They update the website themselves if they're in a place with fast, reasonably priced Internet connections; otherwise they send a CD with material to their shoreside coordinator for uploading.

While designing your integrated e-mail solutions, bear in mind that too much connectivity can be too much of a good thing. Although being able to stay in touch adds to the experience for both of us, we don't want it to interfere. If you start out with fewer options and add more only if you learn you're missing out on important communications, you'll be much more likely to find the things you went in search of in the first place.

Voice

Making a phone call from a foreign country used to be an iffy proposition that could easily take all day. Today there are many options for voice communication, all of them inexpensive enough that even the most budget-conscious cruisers call family members on a regular basis. As with data, if you have elected to have voice communications on the boat, they will most likely be too expensive or too unreliable to use routinely when other options are available. When coastal cruising, most cruisers use some combination of three voice options: cell phones, phone cards, and Internet calling.

PRETRIP PREPARATIONS: SETTING UP FOR REMOTE MANAGEMENT

Some things can be done only when you know what area you're going to be cruising in. The items in Table 12-1 should be done before you leave no matter where you intend to cruise.

TABLE 12-1. PRETRIP PREPARATIONS

Communications	• Develop overall communications plan: voice, data, mail • Find someone to act as a shoreside coordinator, or set up a mail-forwarding service • Change mailing address to that of forwarder • Set up e-mail with Internet café–friendly ISP • Set up POP through Internet café ISP to download mail from other e-mail addresses • Change e-mail addresses with contacts • Learn to access high-seas provider's website over the Internet to download e-mail • Set up website • Organize someone to update website with text/photos you send • If using VoIP (see the Voice section below), set up program and practice using it with those you plan to call • Obtain and organize contact information (websites, toll numbers for use from abroad, and fax numbers) for all equipment suppliers, banks, and other important contacts
Money management	• Set up online banking and bill paying • Set up direct deposit for any income • Establish a wire transfer agreement with your bank • Review foreign exchange charges on debit and credit cards (try to minimize such charges) • Extend expiration dates on all credit cards • Cancel all automatic renewals on things you'll no longer use (like a Costco card) • Hire an accountant if your tax situation is complex; otherwise consider ordering TurboTax
Preparing paperwork	• Create a "boat folder" that contains all necessary paperwork for clearing in and out • In the United States, document the boat with the Coast Guard if you haven't already done so • Register the boat with the first mate as co-owner or create a legal document for use in the event the owner is incapacitated • Renew passports (one for each family member); get the extra-thick "businessman's special" to accommodate many stamps • Make a will • Make copies of key legal documents • Get extra passport photos for every crewmember • Buy a ship's stamp
Other	• Make boat business cards • Buy a guest book

Cell phones have become widely available and inexpensive almost worldwide, and most cruisers spending more than two or three months in one location will establish phone service for the duration of their stay. Not only does having a phone on board facilitate communication with family members, but it also simplifies everything from organizing social events to managing a refit. Cruisers tend to be big fans of SMS (Short Message Service—i.e., text messaging), which is free in many countries. As described in the Data section above, cell phones can also be used with a laptop to do e-mail.

Cell phone networks in most of the world, including Europe, Australia, New Zealand, and Canada, use GSM (Global System for Mobile Communications) digital cell phone technology. Once you purchase a GSM or "world phone," you need not purchase another when moving from one of these countries to another. Instead, you replace the SIM (subscriber identity module) card, the memory card that operates the phone. SIM cards are purchased from local cellular service providers. A new SIM card changes the phone number to one for that country and sets up a payment contract of some sort. SIM cards cost $15 to $30, a fraction of the cost of buying a new phone. Rather than sign a contract for long-term service, most cruisers enter into a pay-as-you-go arrangement whereby they pay only for the minutes they use (outgoing, not incoming). This can be done through cell phone cards that work just like normal phone cards, or over the phone using a credit card to "top up" the balance when it gets below a certain amount.

In Europe it is not even necessary to purchase a new SIM card when moving from country to country. A GSM phone purchased in one country will work throughout the UK and mainland Europe, which means the phone number doesn't change with each border crossing. While roaming charges on some plans can make this an expensive option, it is very convenient when land touring around Europe for a short period of time.

Things are a bit more complicated in the United States, where GSM technology has only recently been introduced. The GSM phones that exist are "locked" so that the SIM card cannot be changed. That means that GSM phones from elsewhere do not work in the U.S. market, and U.S. GSM phones do not work outside the United States. If arriving in the States from abroad with plans to cruise the country for several months, an inexpensive pay-as-you-go phone will help you control your phone costs while avoiding all the surcharges, overcharges, and cancellation fees that come with signing up for long-term service from one of the major carriers. For those who plan to leave from the United States and who will bring along cell phones from their previous lives, take into account your cruising plans, and purchase your contract accordingly. Some companies offer North American plans with good coverage throughout the United States and Canada and limited coverage in Mexico. Others can provide coverage through much of the Caribbean, though the phone will need to be reprogrammed in each country.

Our experiences in different countries help illustrate how this works for most cruisers. In Ireland, we bought a GSM cell phone and a plan from a Europe-wide carrier. We used the phone throughout Ireland, England, Scotland, and even Iceland. Compared to the United States, there are very few gaps in coverage ashore, and we could get a signal up to 20 miles offshore.

We arrived in Australia three years later with plans to cruise Australia and New Zealand for up to three years. Our Irish phone was obsolete, so we bought an inexpensive GSM cell phone and a pay-as-you-go plan from one of the national carriers. We received an SMS message when we had used all but $10 of the airtime, and then we topped up the phone using our credit card by calling a number and going through a voicemail menu. Before we left for New Zealand, we made sure to use up the last of the Australian airtime minutes. In New Zealand, we bought a new SIM card for $20 and signed up with another carrier for a pay-as-you-go plan in New Zealand. Again, we topped up as necessary using a credit card. We used that cell phone for the next eighteen months until we left New Zealand.

In Hawaii on our way to British Columbia to spend at least two years cruising the west coast of North America from Canada to Mexico, we purchased a U.S. cell phone with a North American plan that provided coverage for all three countries. We reviewed our bill online and then charged it to our credit card.

Outside of the United States, we used our cell phones for local calls or to receive calls from family, but we rarely used them to call our family in the States because the international rates were prohibitive. **Phone cards** or calling cards offer a much lower cost alternative for calling home. In most countries there are two types of cards, local and international. Local phone cards can be used to make local and in-country calls, either through special pay phones that read the card directly or by calling a toll-free number and providing the PIN (personal identification number) on the card. These come in small denominations ($5 or $10). International phone cards come in higher denominations and can be used to call internationally from a pay phone or a private line. Costs vary by country, but we've rarely had to pay more than 10 cents a minute and usually pay less than 5 cents.

It takes persistence and research to find the best international rates on the phone cards and to avoid hidden fees. Other cruisers from your home country who have been in the area for some time can usually offer good advice. Rates tend to be best when the cards are purchased from newsstands or convenience stores and worst if purchased from the post office. Often it says right on the card what calling area it is designated for—Europe, the United States, Latin America, Australia/New Zealand—and using it for other areas will double or triple the rates. The clerk who sells you the card should be able to provide a printout of the rates by country. Check if there are connection fees or extra charges for calling from pay phones or for calling to mobile phones, which can double the effective rate per minute.

Finally, calls can be made using **Voice over Internet Protocol** (VoIP) virtually for free using a computer and some software or for a low per-minute charge using one of the VoIP providers. VoIP passes voice signals over the Internet rather than through the conventional phone system, thereby bypassing conventional phone company charges. There are quite a number of ways to make VoIP work from the caller's end and the receiver's end. At its most basic, VoIP requires an Internet connection of some sort at either end and a way to access that connection for voice.

If you and the person you wanted to talk to were both ashore with a good DSL (digital subscriber line) connection, the cheapest way to do this would be to download one of several VoIP software programs (see the resources for this chapter in Appendix 1) to both of your computers and for each of you to buy high-quality headsets. The program converts voice communications into data. If you both pay a monthly charge for your DSL line, there would be no additional charge for this data flow, so the call would, for all practical purposes, be free. Each caller has to authorize who they can call and who they can receive calls from, so there is no spam.

The system works much like instant messaging, where a box comes up on your computer when anyone else you are authorized to talk to comes online. By clicking on the box, you can initiate a call. When you receive a call, an icon shows up on your computer, and all you have to do is click on it. This means that both of you need to be on your computer to communicate, which necessitates setting a time beforehand if the person you wish to reach doesn't work on the computer for a good part of every day.

Of course, many of the people you might like to call may not be Internet-savvy. The system can be used to call a regular phone number, but then there is a charge for the connection from the VoIP's server to the person you are calling. In most cases, this will convert a long-distance call into a local one for a significant savings.

All this assumes some sort of good Internet connection to your computer, but as has been discussed, cruisers are rarely connected. Some Internet cafés now offer VoIP calling and have computers loaded with VoIP software and headsets. Or, you can take your computer into an Internet café and plug into their network to make the call. In either case, you will be conducting your business in public, for very few Internet cafés have gone to the trouble of creating soundproof booths for this kind of calling.

Alternatively, you can use VoIP to call from the comfort of your own boat using wi-fi or a cell phone as the Internet connection. If using wi-fi in a marina, then you are once again in the situation of paying nothing additional for the call. If using a cell phone in an area with a local VoIP server, you will incur charges for a local call.

The technology is still developing, and as of this writing there are still some disadvantages to VoIP calling. First, sound quality varies with the quality of the connection, which can be poor over wi-fi or cell phones. Second, digitizing can create some breaks and interruptions in the data flow. This results in gaps and pauses that do not occur at the end of sentences, making conversation awkward. Third, the microphones and speakers on many laptop computers are not high enough quality to transmit voices well. It pays to purchase a high-quality headset to improve the quality of the audio signal.

These technologies have made it possible for cruisers to stay in phone contact for a reasonable price. Most talk to family at least weekly.

A final word on phones and phone calls: One of the most frustrating things when calling from overseas are all those lovely toll-free numbers that make life at home so convenient. Many of these toll-free numbers do not work when dialed from outside the country, and some phone cards and cell phones won't let you dial them. In all too many cases no alternative number is given on a catalog or repair manual. So before you go, make sure you have a website, toll phone number, and fax number for each manufacturer of equipment aboard as well as for your credit card company and bank.

Mail

The amount of snail mail the average cruiser receives has declined radically with the advent of digital communications. But it cannot be eliminated completely. Renewals for driver's licenses, boat registrations, health insurance, and boat insurance have to be received and responded to in a timely fashion.

As with so many other things, the best solution to the snail mail challenge is a shore-based coordinator who sorts all your mail and forwards only the absolute essentials. Make sure to give this person precise guidelines on what needs to be forwarded and what doesn't. The information content from most snail mail can be summarized and sent by e-mail. If you fully trust your forwarder, consider granting them a limited power of attorney so he or she can sign important documents for you rather than sending them on.

Alternatively, a number of professional mail-forwarding services advertise in yachting magazines and expatriate publications as well as on the Internet. The best sort out all the junk mail and courier special items such as insurance renewals or credit cards. Some will even pay bills, take phone messages, and inform people where you are and when you can next be reached. Ask for a complete list of services and charges from each agent for comparison purposes and check some references before signing up with one.

Once you have determined who is going to handle your mail, give that address to every person, organization, or business that might try to contact you. That way you will have only one person to inform of your next address, not several dozen.

Mail does end up where it was meant to go, though it might take a roundabout route to get there. The following tricks ensure that our mail finds us at the end of its journey:

- **Use a distinctive envelope.** Something distinctive will help you pick out your mail in a bin of dozens of packages. Agree on a standard marking with your forwarding agent, one that is easy to see but not so bright and appealing as to encourage theft. White or colored 10-by-13-inch envelopes stand out, as does addressing the envelope in green or red ink, or decorating it with a distinctive logo. Avoid sailboats, though!
- **Address mail to last name and boat name.** Tell your forwarding agent to bundle the mail into large envelopes and address them to one last name followed by the boat name, in our case "Starzinger, S/V *Hawk*." In almost every yacht club, post office, American Express office, and hotel around the world, mail is sorted into large bins by the first letter of the last name or the boat name. Using only one name for all your correspondence will reduce the chances of some of it being misfiled.
- **Include a legible return address.** On the only two occasions when we didn't receive something that was mailed, the packages were returned to the return

address on the package. In one case it was three years later . . . but we did get it back!

- **Number the envelopes.** Every envelope should be numbered consecutively, and your forwarding agent should keep a list of the numbers and the dates the envelopes were sent. When we arrived in port, we could immediately tell if any envelopes were missing from the middle of the group. In our first communication we would ask how many had been sent. If a group of envelopes get sent at the same time, the envelopes should be numbered "1 of 5," "2 of 5," and so on.
- **Write "Hold for pickup" and "Yacht in transit" in large letters on each envelope.** "Hold for pickup" will keep the mail from being sent back, even if you don't show up for a month or so after the package is received. Yachts that are only passing through a country and not being imported are exempt from most duties. "Yacht in transit" should, therefore, keep packages from getting trapped in customs.
- **If there's time, send mail first class.** Mail sent first class almost never goes astray or gets caught in customs and rarely takes more than ten days anywhere in the world. Don't believe the post office's estimate of the time it takes to deliver something by its different methods. The post office can only tell you when an item will enter the country, not how long it will take to wend its way through customs and the local postal system. Priority mail services only save time when sent to addresses in medium to large cities in developed countries.
- **For time-sensitive or valuable material, find the right courier service.** Sending mail through a courier service can be faster than by first-class mail, though in many places getting something overnight is out of the question. A good courier service can have packages in your hands within two to three days as long as they don't get held up in customs. Packages sent this way can also be tracked door to door, whereas most postal services can only track to the point when the package enters the country of destination. Sending something by courier service makes it more likely customs will take an interest, however, which can hold it up by several days. Picking the wrong courier can result in long delays, high fees, and punishing duties. Other cruisers will be able to offer advice on the right courier service for a particular location.

Money Matters

One of the areas where life has gotten markedly easier aboard a cruising boat is in managing money in all its many aspects: income, cash, bill payments, taxes, and so on. Almost all these things can now be handled internationally with little more hassle than it would take to handle them while traveling in your home country. There are quite a few things you can do to ensure that your money management is worry free. For the most part, these do not require the help of paid professionals. You can get cash, pay your bills, collect your income, and pay your taxes electronically. But if you are leaving behind a business, real estate, or complex financial affairs, entrust the details to someone reliable even if you have to hire their services. One round-trip ticket from Fiji pays for a lot of professional assistance, so the trade-off makes sense if managing your affairs will take more than a few hours each week.

Cash and Credit Card Management

If we were to list the things that have made cruising easier for us over the course of more than a decade on two boats, ATM machines and debit cards would be somewhere near the top. Cruisers used to carry large quantities of cash and traveler's checks on board, enough for at least six months of cruising. That money had to be exchanged for local currency at a bank or foreign exchange kiosk. A couple of times a year we had to get hold of a large quantity of U.S. dollars. Today we go ashore, find an ATM, pull out our debit card, and draw cash in the local currency directly from our bank account.

However, we have started to pay a steep price for this convenience. In 2005 most U.S. banks began charging a foreign exchange fee on every international transaction using a debit or a credit card. These fees range from 2 to 4 percent of the transaction amount, so they add up very quickly. When organizing for offshore, then, read the fine print on your bank cards carefully. Try to find a bank that charges less or negotiate a break on these fees based on your other balances. If you can't find a way around them, make sure to factor in the extra costs you will incur.

If you plan to spend six months or more in one country, one way to avoid the foreign exchange fees is to open a local account and get a local debit card. Setting up the account can be challenging. The least expensive way to do it is to write a check or wire-transfer the funds, though either way you will incur fees. To transfer funds electronically, you will need to establish a wire-transfer agreement with your bank before you leave. Then all you should need to do is to fax the foreign bank's routing information to your bank along with a signed authorization. But don't leave it at that. Find out how long the transfer should take and then follow up. Several times we have had money make it as far as a correspondent bank and then get "lost" in transit. Using a check is often easier;

however, the fees for collecting on a foreign check are usually higher than for a wire transfer.

We try to use debit cards for all major purchases, preferring them to credit cards because we do not have to pay a credit card bill. But we do carry and use credit cards in certain situations. Visa and MasterCard have become equally acceptable worldwide; American Express is accepted in far fewer places but continues to be valuable for the traveler because of its network of international offices that offer services ranging from mail holding and forwarding to foreign exchange.

By the time most credit card statements reach you, the thirty-day grace period for disputing charges will have passed. Although charges can still be protested, it will take months to get your money back. Similarly, by the time you become aware that a mistake caused an overdraft in your bank statement, it will take weeks of persistent communications to get the bank to reverse the charges. Credit cards can be set up for online review of the charges and authorization of the payment. Once approved, the outstanding amount can be paid by an automatic electronic transfer on the due date.

Deposits and Bill Paying

Direct deposit is another convenience for vagabond sailors. Any regular income you will be receiving while you are out of the country should be set up for direct deposit into one of your bank accounts, and automatic procedures should be established to move the money from one account to another to cover your regular outflows.

Online banking allows cruisers to keep track of their checking, savings, and investment accounts without having to receive paper statements. It also offers the most convenient solution for handling bills. Most banks now have good online banking services that allow their clients to review monthly bills and authorize payment over the Internet. If your bank's capabilities are limited, or if your finances are complex and you need to pay bills using accounts with different banks, check out the bill-paying services advertised on the Internet. These consolidate all your bills into a single place, allow you to review them before payment, and then pay them on the due dates. The best of these services are very flexible: bills can be paid from different accounts; one-time bills can be handled as well as regular payments; and you can designate certain bills to be paid automatically and others to be paid only with authorization.

No matter what your method for paying your bills is, make sure that bills get paid on time. The consequences of a missed or late payment on certain bills can be devastating. Credit card companies now have the right to charge punitive interest rates to anyone who is "in default," which includes being late on just one payment. Missing a single payment for your employer's health insurance plan under COBRA results in forfeiting the right to that insurance. Missing a single payment on a storage unit gives the storage company the right to auction the contents.

Handling Taxes

Depending on your income while you are voyaging, you may not need to file an income tax return. However, if you are earning income from investments, real estate, or an ongoing business, chances are you will have to file. If you reside in the United States and want to income-average when you return, you should also file. U.S. citizens residing outside of the country can request an automatic extension that will allow them to delay filing until August.

U.S. citizens may also have to file state taxes depending upon the laws in their state of residence. As many states have faced budget crises in the last few years, they have used voter registration rolls and driver's license information to track down state residents who have not paid taxes. Proving you are not resident in the state, which would remove any tax obligation, can also mean losing your right to vote or hold a driver's license. Some high-net-worth cruisers set up residency in low- or no-tax states before heading offshore, but for most of us simply filing in our state of residence won't result in a serious tax burden and will ensure that we maintain residency.

Filing taxes has become much simpler with electronic filing and programs like TurboTax that not only help you calculate your taxes but also provide all the tax forms you need for both state and local taxes. American embassies and consulates also provide tax forms, including extension forms.

If your tax situation is the least bit complex, hire an accountant to manage your taxes while you are away. Tell your forwarding agent to send any tax documents directly to your accountant. Once completed, the forms can be sent as an e-mail attachmant for your signature.

Managing Real Estate or a Business

The decision of whether or not to sell your home will be one of the biggest you face as you get ready to make the break from shore. If you need the equity in the house to fund the boat purchase, the decision will be straightforward. Otherwise, it will depend upon many factors including, among other things, the current value of your house versus the purchase price, the tax implications of a sale, your attachment to the house and community, your feelings about having someone else live in your home, and your ability to manage a rental situation from halfway around the world.

If your mortgage is paid off, rental income can contribute significantly to the cruising kitty. Otherwise, don't depend on rental income to fund your voyaging—an unexpected six-month vacancy could end your trip prematurely. Most cruisers with mortgages are satisfied if the rent covers the monthly payment, taxes, insurance, and upkeep. They treat additional money as a windfall rather than an integral part of their cruising budget.

If you have a property in a "hot" market, it makes sense to hold on to it, especially if you plan to return to the same area after you finish your voyage. In a growth market, you are more likely to earn enough to cover all the costs associated with the house and have some left over to supplement the cruising kitty. It can also be close to impossible to buy back in to the same quality house in a strong market after an absence of several years. If you do choose to keep your house and rent it out, consider this advice from our friends Scott and Kitty Kuhner, who kept their house in Connecticut during their second circumnavigation and subsequent voyaging:

- **Get a handle on the rental market.** Have a real estate agent take you around to view houses for rent in your area. This will give you a good idea of the rental rates for houses similar to yours. Bear in mind that the prices you will be quoted are asking prices, not the final rental rate.
- **Don't get greedy.** Keep the asking price below the market to ensure the house doesn't stand vacant for months on end. Consider giving a discount if tenants sign a two-year lease. If you get renters you really like, keep the rent the same when they renew the lease.
- **Be selective.** When someone expresses an interest, tell them that another party has already expressed a desire to rent the house but that you will let them know if that falls through. This gives you time to check out the potential renters and an excuse to turn them down if there are any problems.
- **Hire an agent to manage the property.** Don't ask relatives to take on the responsibility of managing a house unless they are real estate professionals. A professional manager is well worth the money. Have the manager deposit the rent in a special house account and use that to pay any house expenses, from the mortgage to the groundskeeper. If there are excess funds, these can be transferred to you on a regular basis.
- **Provide the agent with all necessary contacts.** Give the agent a list of all the people who have done work on the house, including the tree surgeon, the plumber, the oil company, the furnace repair person, the carpenter, and the handyman. The agent will then know whom to call if any repairs need to be done on the house while you are gone. Hire a groundskeeper to mow the lawn and take care of the property so that you can be sure the grounds will be properly maintained.

Like many couples we know, the Kuhners rented their house unfurnished and stowed their furniture in an unused part of the house. They have a detached garage with an apartment over it that they have kept for their own use. On several occasions they have had to return home unexpectedly for medical reasons, and they have been grateful to have this home base from which to operate. Others we know added a small "in-law" apartment in the basement or attic before leaving, which they left unoccupied and used if the need arose.

Quite a few cruisers we have met have owned commercial rental properties, and this seems to be one business that lends itself to the cruising life. It's not difficult to find a professional manager to take care of the property, and if you're in a growing area, the property usually stays rented. All the above advice for renting your own home applies equally to commercial properties.

Managing other types of business from abroad is a good deal more difficult than managing real estate. We know several entrepreneurs who tried, only to have the business languish in their absence. Cyclical businesses lend themselves to the cruising lifestyle better than others; you can cruise during the slow part of the year and be back to manage the business during the busiest season. Those we've met who have managed a successful business from their boat shared three key attributes:

1. **Trusted lieutenant.** As with real estate, a business will be successful only if it is managed professionally in your absence. But in most businesses there are plenty of opportunities for a dishonest employee to make the most of your absence. To manage a business, then, you need not just a professional, but someone you trust implicitly.
2. **Excellent communications.** Those we met successfully managing businesses from their boats—including some executives of midsize, family-owned companies—often spent an hour a day communicating with their management team. At a minimum, that means having a satellite phone aboard. Even better is full Internet capability (not just e-mail) from the boat so you can review important documents.
3. **Early-warning systems.** Having some sort of board or oversight committee in place and establishing reports that will alert you to early signs of declining performance will allow you to return and intervene before the situation can no longer be salvaged. Key customers, other trusted managers, or large suppliers can all provide you with occasional updates that will help you accurately evaluate the health of the business.

Communications are the key to management. As communications have improved, it has become possible to go sailing without giving up a business or key assets. If the choice is between going cruising now but having to deal with some business along the way or risking the chance of never going cruising at all, then work out the details and set off while you still can.

Ship's Papers and Other Documents

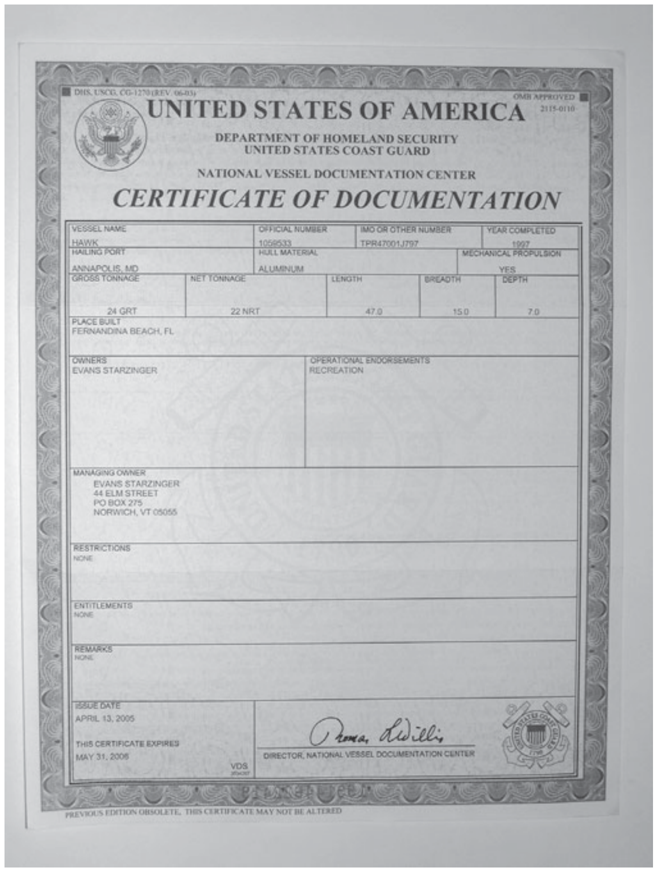
Like everything else, cruising has become more bureaucratic in the last decade, yet with very few exceptions the many countries we've visited have wanted only a few simple documents. Ship's papers (boat registration) and passports are required to enter any country on the face of the earth, and you will want to make sure you have both in perfect order before you leave. In most countries, these are the only documents required. Although an increasing number of countries require visas, these must be obtained just before arrival or upon arrival in the country and will be considered in the Prepassage Bureaucracy sidebar in Chapter 20.

We have been asked for a captain's license in a few countries, and there has been increasing discussion of licensing requirements in the EU. It is still not a requirement, and we have never had any difficulty if we say that the United States does not require us to be licensed. However, this seems likely to change in the future, so check the regulations and get whatever documents you need for the countries you intend to visit.

Ship's Papers

The boat's documentation, registration, or ship's papers legally establish your ownership. Technically speaking, the original document must be aboard whenever the vessel is in operation—photocopies are not acceptable if you are challenged. In most of the world, boats are documented through a federal agency, and ship's papers are standardized.

U.S. citizens, however, have two options for registering their vessel: a state registration certificate, or a U.S. Coast Guard certificate of documentation (Figure 12-1). The federally issued Coast Guard documentation costs a bit more to obtain, but it is more respected and accepted internationally. In the late 1990s, there were a few incidents in the Caribbean where U.S. vessels with legal state registrations were fined hundreds of dollars for being "undocumented." Although such fines are almost certainly illegal, you can avoid the hassle altogether with federal documentation. Whether your boat is state registered or federally documented, you must renew your registration annually, which entails filing a form, paying a fee, and receiving the new document.


DHS, USCG, CG-1270 (REV. 06-03)
OMB APPROVED 2115-0110
UNITED STATES OF AMERICA
DEPARTMENT OF HOMELAND SECURITY
UNITED STATES COAST GUARD
NATIONAL VESSEL DOCUMENTATION CENTER
CERTIFICATE OF DOCUMENTATION

VESSEL NAME	OFFICIAL NUMBER	IMO OR OTHER NUMBER	YEAR COMPLETED
HAWK	1059533	TPR47001J797	1997

HAILING PORT	HULL MATERIAL	MECHANICAL PROPULSION
ANNAPOLIS, MD	ALUMINUM	YES

GROSS TONNAGE	NET TONNAGE	LENGTH	BREADTH	DEPTH
24 GRT	22 NRT	47.0	15.0	7.0

PLACE BUILT
FERNANDINA BEACH, FL

OWNERS
EVANS STARZINGER

OPERATIONAL ENDORSEMENTS
RECREATION

MANAGING OWNER
EVANS STARZINGER
44 ELM STREET
PO BOX 275
NORWICH, VT 05055

RESTRICTIONS
NONE

ENTITLEMENTS
NONE

REMARKS
NONE

ISSUE DATE
APRIL 13, 2005

THIS CERTIFICATE EXPIRES
MAY 31, 2006

VDS

DIRECTOR, NATIONAL VESSEL DOCUMENTATION CENTER

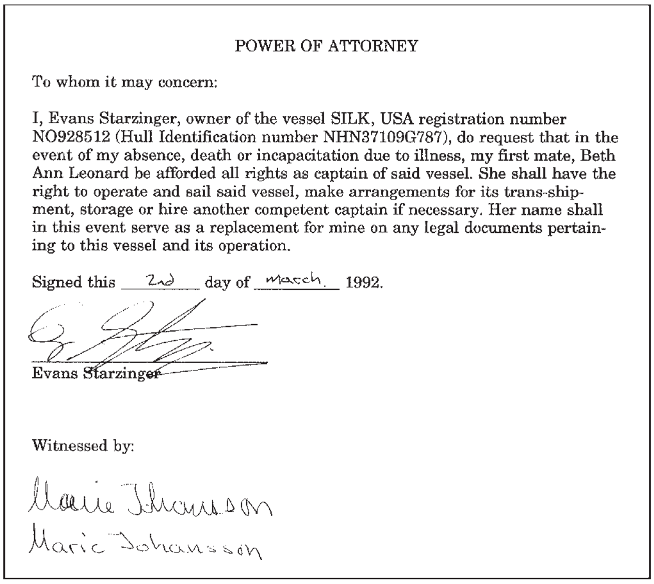
PREVIOUS EDITION OBSOLETE. THIS CERTIFICATE MAY NOT BE ALTERED

Figure 12-1.
Coast Guard documentation for *Hawk*.

Be very wary about turning your ship's papers over to anyone. In our only serious experience of bribery, the harbormaster in the Galápagos took our ship's papers and refused to return them until we paid him a certain amount of money. After that incident, we carried a double-sided, color photocopy on card stock of our ship's papers that we handed to officials; we secreted the original aboard the boat in case anyone insisted upon it. In almost all cases, the duplicate was accepted without comment.

If the vessel is registered in only the owner's name and the owner is incapacitated or dies, the boat's legal status may be tied up pending execution of a will. In such a situation, a distraught crewmember will be in no condition to deal with the mountain of bureaucracy in a foreign country. Ship's papers should designate a co-owner who has legal authority in the event of the death or absence of the owner. If you would prefer not to register the boat in more than one name, carry a legal document designating another crewmember as the captain in these situations. The document we carried aboard *Silk* is shown in Figure 12-2.

If you are acting as delivery skipper of a boat you don't own, you will need documents to satisfy port authorities that you have not stolen the vessel. A letter written by



POWER OF ATTORNEY

To whom it may concern:

I, Evans Starzinger, owner of the vessel SILK, USA registration number NO928512 (Hull Identification number NHN37109G787), do request that in the event of my absence, death or incapacitation due to illness, my first mate, Beth Ann Leonard be afforded all rights as captain of said vessel. She shall have the right to operate and sail said vessel, make arrangements for its trans-shipment, storage or hire another competent captain if necessary. Her name shall in this event serve as a replacement for mine on any legal documents pertaining to this vessel and its operation.

Signed this 2nd day of March 1992.

Evans Starzinger

Witnessed by:

Marie Johansson
Marie Johansson

Figure 12-2.

A power of attorney such as the one shown here for *Silk* should allow the first mate to take charge of the boat if the owner is incapacitated.

the owner naming you as skipper and stating the approximate route and duration of the voyage usually suffices. The letter must be accompanied by the original ship's papers. Although there won't usually be any issue, the owner should be prepared to receive a phone call if you run into problems.

Passports

Don't leave home without them! If traveling with children, get individual passports for them rather than using a family passport. These will allow family members to travel separately in the event of an emergency. Before you leave, make sure the passports are valid for the period you plan to be out of the country. You can get new passports issued at your home country's embassies (often the same day) in developed countries. But the consulates on most small island nations will take many weeks to replace a passport. As with your ship's papers, keep a good-quality copy on board, which will be useful when replacing a lost or stolen passport. The copy can also be used when traveling ashore in places such as Europe that require you to leave your passport with the concierge at a hotel for the duration of your stay.

Make sure you have enough passport pages for all the stamps and visas you will acquire. Allow one page per country you plan to visit. A consulate or embassy can insert new pages in an existing passport. If you are having a new passport issued, you can request the "businessman's special," which is extra thick. Passports from more-developed countries are a valuable and desirable commodity everywhere in the world. If your passport is up to date and has adequate pages before you depart, you'll minimize the amount of time it is on your person or in a stranger's hands in a foreign country.

Legal Documents

In addition to the documents needed to clear into and out of a foreign country, you will also want to carry copies of several legal documents. To be prepared for any contingency, carry copies of the following:

- **Bank account and/or credit card statements.** When you apply for a visa at a consulate, you will usually be required to show proof of financial resources sufficient to maintain you while you are in the country. Generally speaking, that means showing proof of funds on the order of $1,000 per month for a couple. The easiest way to fulfill this requirement is to bring copies of bank statements. For some countries, a credit card with a high credit limit ($5,000 to $10,000) meets the requirement, and a credit card statement showing that limit suffices as proof.
- **Boat insurance certificate.** To avoid having to repatriate indigent, shipwrecked sailors, some countries require proof of boat insurance. Additional financial resources sufficient to buy an airplane ticket back to your country of origin may be accepted in lieu of insurance. In Europe, Australia, New Zealand, and Canada we were required to show proof of liability insurance in order to get a berth in a marina. This seems to be becoming the norm worldwide.
- **Birth certificate.** These can be obtained from the county where you were born. These are normally required only when requesting temporary residency.
- **Marriage certificate.** These can be obtained from the county where you were married. Again, these are required when requesting temporary residency or to get a spouse a long-term visa (for example, an EU national married to an American will need the marriage certificate to get a long-stay visa for the American spouse in Polynesia).

Finally, prepare a will before you go. Leave the original in the hands of a lawyer or a family member and keep a copy on the boat. The chances of its being needed are slight. But if the situation arises, things will be difficult enough in a foreign country without adding the complexity of dying intestate.

Miscellaneous

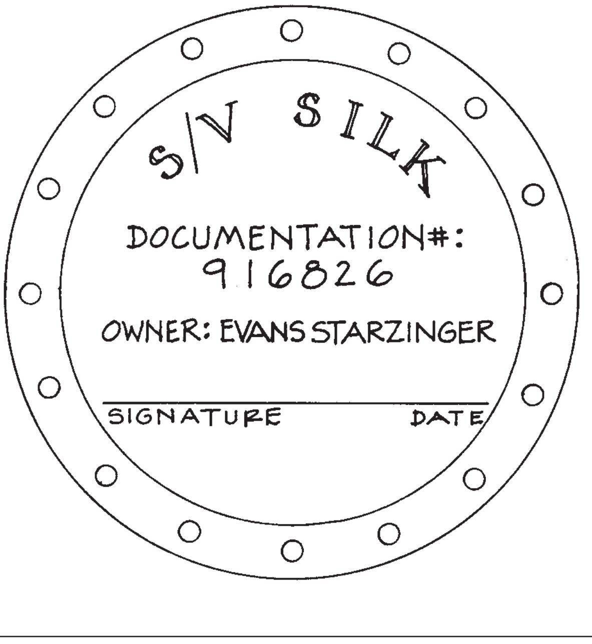
With ship's papers and your passports, you can go almost anywhere in the world today. Unfortunately, bureaucracy is becoming more complicated. As discussed above, many countries now require proof of financial resources to be sure they don't end up having to support destitute yachties. The European Union continues to discuss licensing requirements for offshore sailors, and some countries now require their own citizens to show proof of instruction in handling a boat. For the time being, the following documents are rarely required but may prove helpful a few times on your voyage:

- **International Certificate of Vaccination.** We were never asked to show our International Certificates of Vaccination from the World Health Organization, even after visiting parts of Africa (see the Know Thyself section in Chapter 16). However, the card and the vaccines that go with it are cheap insurance. Having a record of your vaccinations also makes it easier to keep track of which need to be renewed when preparing to travel to countries with health issues.
- **Radio license.** Even if the boat carries only a VHF, you will be asked for your call sign. The radio license proves that the call sign has been legally assigned to you. If the vessel carries an SSB or a ham radio, you may be required to show these licenses as well or, in a few countries, to obtain a local license.
- **Passport photos.** You'll often need passport photos when applying for visas, so you may want to bring along a dozen or so for each crewmember.
- **Ship's stamp.** We got our stamp for *Silk* (Figure 12-3) on a lark when we were leaving, and it served mostly to decorate our friends' guest books. But we used it several times when receiving bonded goods aboard and applying for visas. The stamp should include the boat's name, documentation number, captain/owner's name, and a place for a signature.

We were asked to show prescriptions for the drugs in our medical kit only once, but it pays to have them aboard to prevent problems.

You will want to bring along two other things. Business cards for your boat are very useful for keeping in touch with friends whether ashore or on other boats. Include your contact information as well as your boat call sign and a general purpose e-mail address. Finally, buy a guest book to record your visitors (Figure 12-4). Guest books tend to be very elaborate affairs on boats, and the business cards, stamps, photographs, and inscriptions bring back memories of long nights spent laughing and talking over a bottle of wine.

Figure 12-3.
Our ship's stamp for *Silk* got used most often to decorate logbooks and occasionally to impress officials. (Lyanne Schuster illustration)



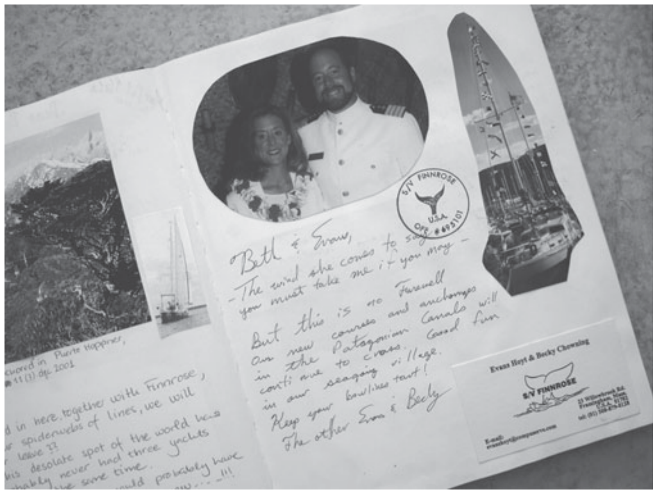


Figure 12-4.
Our guest book brings back many happy memories when we glance through its pages.

TRANSITIONING TO LIFE AFLOAT

You've worked together to become a cruising team. You've purchased your boat, fitted her out, and sailed her in everything from flat calms to gales. You've taken courses in engine repair and first aid, dusted off your French, and gotten a ham radio license. You're close to your goal for your cruising kitty, and you can leave this season or next. How do you make the final break?

If you've reached this stage, you are ready to cut the ties that bind you to shore. The first step is to **move aboard**. Rent your house or put it on the market. Sell your furniture or put it into storage. Have a massive garage sale for those "treasures" that have sat for years or even decades in your attic, basement, and garage.

This can be a traumatic time, but you can ease the transition by making it reversible. If certain possessions mean a great deal to you, don't give them up completely. Invite your friends and family to temporarily adopt your pottery, paintings, and books. If you are not ready to sell your house, rent it. But make an honest effort to simplify your life and move from a shore mind-set to a sea mind-set.

Once aboard, continue to **simplify your life**. Make do with one car instead of two. Declare it taboo to hire outside help for routine boat maintenance. Eat aboard, sleep aboard, live aboard—just as you will in foreign ports all over the world. Anchor out on a weekend when it is blowing 30 knots, and listen to the wind whistling in the rigging. Sail the boat as often as possible. Start to live the life.

Exactly when you will **quit your job** depends primarily on how much money you are earning. You have to weigh the income lost from quitting early against the expenses saved from working on the boat yourself. It often makes sense for one person to quit and begin working full-time on the boat while the other continues to earn money to fill the cruising kitty.

A point will come when you will know it is time. The boat won't be quite ready and you won't have quite as much money as you want, but you'll realize you need to **set a departure date** or risk losing another year to the cycle of tropical storms and winter seasons. No matter how thorough your preparations, you will be overwhelmed by the list of provisions to stow, gear to install, and small chores to complete. But you will get there, because the time has come and you are ready.

All crewmembers will need to **work full-time on trip preparations** for at least a month before you depart. You may be fixing the refrigeration, installing the life raft, or putting your medical kit together. Someone will need to buy all the plastic stowage containers and fill them with provisions; someone will need to make a list of all necessary spares, order them, and then stow them when they arrive. You will also need to organize your passports and visas, have physical and dental checkups, get vaccinations, arrange your finances and mail forwarding, and update your will. All this takes time.

Right before you leave, take a week or two to **say good-bye to family and close friends**. Though you may have to travel to do it, this is money well spent. Seeing those closest to you for a concentrated period of time keeps the pain of departure from cutting too deep. Talk through any lingering concerns they may have about your new life. Tell them how and when you will communicate. Make sure they understand the limitations of your e-mail system and set their expectations for how often you will be in touch. Plan when you will get together again—whether it will be a rendezvous somewhere in paradise or your first visit home.

Do not tie yourself to a schedule. Schedules only cause anxiety for all of you. Stick to your one-step-at-a-time philosophy. Tell them when you plan to leave and where your first landfall will be. The day you leave, call and confirm that you are on your way. If you will be out of touch while you're at sea, offer a generous range of dates for your landfall. Reassure them that you will call or e-mail when you arrive—and make certain to do so.

After years of planning, saving, and scheming, it is **time to leave**. The moment of tearful good-byes you have been dreading is upon you, and you must make the final break and say your farewells. But by the time you make this final round of visits, your sadness at leaving should be overshadowed by excitement over your new venture. Those close to you will feel this energy, and they will become enthused.

You have long since given up the conveniences you thought you could never do without: the dishwasher and clothes dryer, the television and movies, the plumber and your personal trainer. As you gradually moved toward your new life, you were slowly uprooting yourself. Now, the hard fact of leaving makes almost no difference at all. In that moment of realization, you are ready to step into your new life and begin the transition from shore life to sea life, from landlubber to salty liveaboard.

The **transition to offshore voyager** often takes a year or more as you build the skills you need for the cruising life and learn to work together as partners within the intimate confines of the boat (see The First Year section in Chapter 27). It is marked by all the firsts you will experience: your first perfect offshore sailing day, your first gale at sea, your first landfall, the first time you shop for groceries in a foreign country where you don't speak the language, the first time you are invited to dinner by a total stranger, the first time you try to find an electrician or a welder or a refrigeration mechanic, the first time you see the green flash or a perfect tropical sunset. Some people get overwhelmed by always being in a strange place having to learn new things and find new solutions; others thrive on it. But most people who make it through the first year of ups and downs find satisfaction and joy in the constant challenges and intense rewards of the cruising life.

CHAPTER 13
Better Boatkeeping

After our first passage, when we were trying to sort out a failed autopilot, a seasoned cruiser told us, "Sailing around the world means fixing your boat in a series of exotic ports." We took it as a joke. But after 90,000 nautical miles, we have come to view maintenance and working on the boat as the undercurrent to our cruising life, the woof to the warp of sailing to and seeing new places.

When we left aboard *Silk*, we had little sailing experience and almost no experience with our boat. *Silk* had never been used for offshore voyaging. We despaired at each new problem and ignored some in the hope they would go away. After a year, our attitude had changed radically. Our shift in thinking began with a willingness to work on the boat ourselves—to tackle any job, no matter how daunting, and to make a few mistakes along the way. By the end of our first circumnavigation, 90 percent of our maintenance was preventive.

Based on what we learned on that voyage, we designed and built *Hawk* to be as simple and to require as little maintenance as possible. Rather than resenting the work that needs to be done, Evans derives a great deal of intellectual satisfaction from developing new approaches to old problems on board, and feels a strong sense of accomplishment when his solutions prove themselves over several thousands of miles of cruising. We still get frustrated when things break, particularly expensive equipment such as the instrument system and the autopilot, but we no longer resent it or expect otherwise.

Good boatkeeping starts by developing a maintenance mind-set, a willingness to go looking for trouble in order to uncover and correct problems before they become serious. But to fix what you find, you'll need the right spare parts and tools. A key part of equipping your boat for offshore voyaging involves allocating a part of your limited stowage space to the tools and spare parts you will be most likely to need.

MAINTENANCE MIND-SET

Over the course of a decade, we have developed a three-pronged approach to maintenance. Our day-to-day maintenance is proactive—we go looking for trouble. Any problem areas we uncover in our routine inspections of the boat get dealt with immediately in order to forestall more serious complications. Our preventive maintenance schedules have been developed over the years to eliminate problems we have experienced and to prevent other, larger problems from developing. Finally, we have learned to fine-tune the boat to eliminate troublesome areas and reduce the preventive maintenance required to keep the boat up to the exacting standards of the sea.

Day-to-Day Proactive Maintenance: Looking for Trouble

We have developed a keen sensitivity to the condition of our boat and gear and a willingness to see things that are not quite right. When we board someone else's boat, we often see little problems the owners have not yet noticed, such as the beginnings of chafe on a sheet where the lead is not quite fair to the genoa track block, or water marks on the teak below a hatch that indicate the beginnings of a leak. Like these owners, we used to prefer not to know about potential problems. But the "If it's not broke, don't fix it" attitude can be dangerous offshore.

TABLE 13-1. DAY-TO-DAY PROACTIVE MAINTENANCE		
System	**Look/Listen For**	**To Fix It**
Hull	• Water in bilge • Water anywhere else down below • Salt-encrusted decks, brightwork, deck hardware, standing rigging • Battered, dry, worn, or scratched teak • Damp, moldy-smelling lockers; weeping deck fittings	• Inspect stuffing box, hawsepipe plug, seacocks, hose connections, etc., to locate source; correct problem • Inspect hatches, ports, and other likely sources; correct problem • Rinse with fresh water as often as practical, including blocks, genoa tracks, windlass, furling drums, wind vane, chainplates, and terminal ends • Touch up as needed • Rebed deck fittings
Running rigging	• Chafe on running rigging • Loose shackle pin • Slipping rope clutch • Squeaky blocks/sheaves	• Find and eliminate source of chafe; end-for-end or replace line if needed • Tighten and wire-tie closed • Lubricate with soapy water • Lubricate with soapy water
Standing rigging	• Bent or damaged cotter or clevis pins • Cracks in welds around gooseneck or vang • Loose stay • Jib furling drum not turning smoothly	• Find and fix cause; replace pin if needed • Reduce load on any fitting showing cracks and mark crack ends to see if they are growing • Inspect stay and chainplate; fix if possible, reinforce with halyard if not • Lubricate with soapy water
Sails	• Chafe on any sail • Broken or loose battens	• Repair damaged area and cover with chafe patch; find and eliminate source of chafe • Replace batten, repair sail, reinforce stitching and chafe protection on batten pocket
Wind vane	• Lost nuts, loose bolts, loose or chafed control lines • Squeaky blocks, wheel lock hard to engage	• Tighten or replace • Lubricate with soapy water
Steering	• Autopilot squeaking/groaning • Rudder bearings squeaking/groaning • Any other unusual steering noises	• Inspect for leaking fluid; top up fluid and rebuild autopilot at first opportunity • Inspect for damage; if none, lubricate with soapy water • Locate and eliminate source
On-deck safety	• Loose or damaged lifelines • Chafed, stretched, or frayed jacklines • Anchor tie loose or chafed	• Tighten or repair • Replace jacklines • Tighten or replace tie lines
Engine	• Low fluid levels • Hard starting • High engine temperature	• Top up fluids; inspect for leaks • Check oil; change if any sign of water in it (see the Troubleshooting sidebar below) • Check starter motor • Check that water is coming out of exhaust • Check seawater intake for clogs and clear • Check and tighten fan belt • Change impeller
Plumbing	• "Rotten egg" odor in head • Leaking head pump • Pressure pump running	• Clean out head with marine cleaner or baking soda solution • Remove hoses and clean or replace at first opportunity • Replace stuffing • Rebuild pump • Look for loose hose clamps • Rebuild/replace accumulator • Rebuild pump
Electrical	• Poor charging of batteries • Burned-out bulbs • Intermittent electrical problems in fixtures or equipment	• Inspect and tighten alternator belt • Inspect battery terminals for corrosion or loose connections and clean thoroughly • Check regulator function • Replace bulbs • Inspect wiring for corrosion or loose connections

What do we look for when we wander around the boat each day on passage and every few days at anchor? What do we do when we find something? Table 13-1 summarizes our day-to-day maintenance activities. We work on some of these things every few days in addition to the preventive maintenance discussed in the next section. Many crews take the approach of "a job a day" to keep their boats in offshore-capable condition.

Salt water and motion cause almost all the problems listed in Table 13-1. Most coastal boats get very little exposure to either—perhaps a few hours a week before the boat is returned to its berth, hosed down with fresh water, and left to rest quietly for another week. Offshore, a boat is in motion 24 hours a day and subjected to salt spray in the air and salt water washing down the decks for weeks on end. The following sections offer suggestions for combating the most common enemies aboard a pounding, rolling, flexing boat.

Chafe

During the first six months of passagemaking, we thought we'd never see the end of chafed-through mizzen and main boom topping lifts, broken stitches on the mainsail, and split batten pockets. Even metal can chafe; the stainless shackle holding up a spinnaker halyard block chafed right through in 2 hours when we were flying the spinnaker in rolly, light-air conditions. By our third major passage, we had eliminated 90 percent of our chafe problems. Following are a few of our lessons learned:

- **Headsail chafe.** As discussed in the Additional Pretrip Preparations sidebar in Chapter 5, a tack pendant should be used to raise the foot and tack of a headsail above the pulpit (Figure 13-1) to eliminate chafe. On a full-hoist headsail that chafes, use extra sun-cover material or Dacron sticky-back cloth as a sacrificial patch where the sail goes over the pulpit. On a roller furler, regularly reinforce the stitching around the tack and head grommets if they get twisted when the sail is furled.
- **Shroud and spreader chafe.** On many boats, an eased mainsail chafes against the shrouds during downwind sailing. The best way to prevent this chafe is to put large spreader patches on the sail where it hits the spreader for every reef position (Figure 13-2). We use a circle of very thin ultra-high-molecular-weight polyethylene (UHMWPE) where the spreader tip comes into contact with the sail, and we cover this with two circles of lightweight Spectra sticky-back sail tape, each circle being larger than the one it covers. We also use the sail tape to make large, horizontal patches where the spreader comes in contact with the sail. It is strong but slippery, which makes it extremely chafe resistant. We inspect the sail regularly and add new tape whenever it starts to wear through.
- **Batten chafe.** As discussed in the Working Sails and Sail Handling section in Chapter 5, cover the ends of partial batten pockets with two or three layers of sail tape and tape over the batten ends before putting them in the pocket. For full battens, have the sailmaker sew Spectra webbing along the outside of the pocket.

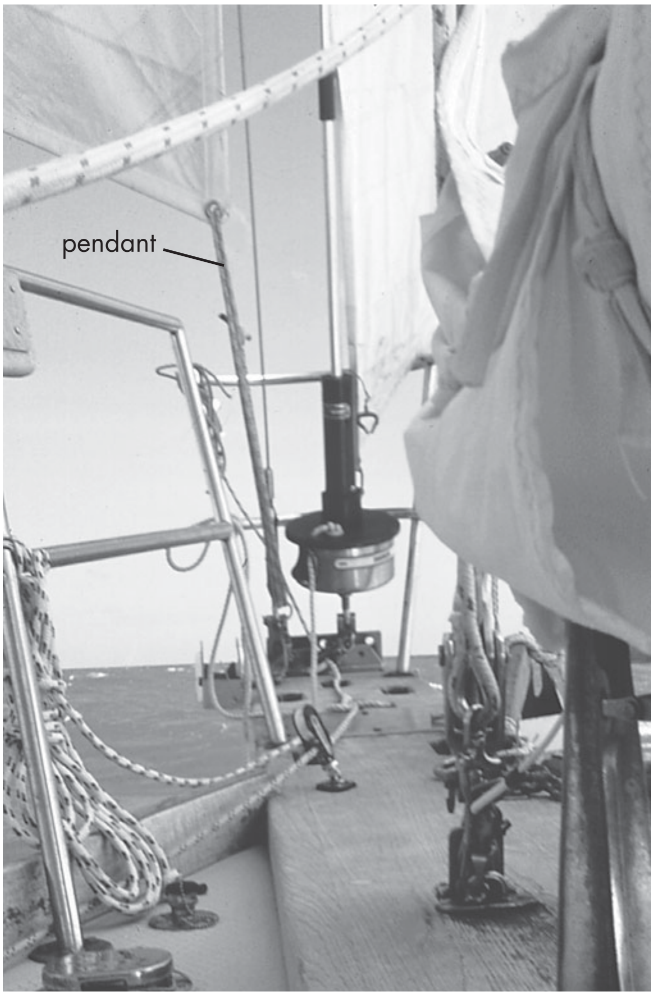


Figure 13-1.
On *Silk*, we reduced chafe and wear on our Yankee sail by using a pendant so that the tack and foot of the sail cleared the pulpit at full hoist.

- **Topping lift and running backstay chafe.** The best way to avoid topping lift chafe is to eliminate the topping lift altogether by using a rigid vang, which is what we've done on *Hawk*. We stowed our dinghy under the boom on *Silk*, which prevented us from installing a rigid vang on that boat. Taping over any blocks in the topping lift will stop them from chafing the sail and prevent lost pins. Replacing Dacron line in topping lifts and running backstays with single-braid Spectra line will also reduce chafe. On a cutter, shock cord attached to the backstay will hold the topping lift off the sail when not in use. You can use a similar solution to keep running backstays safely out of the way of the mainsail (Figure 13-3).

Frozen and Loose Fasteners

One of Murphy's Laws of Offshore Voyaging states that any fastener that needs to stay tight will work loose, and

Figure 13-2.
On *Hawk*, we use Spectra sticky-back sail tape and circular UHMWPE patches under the spreader tip to protect the sail where it hits the spreaders at each reef position.

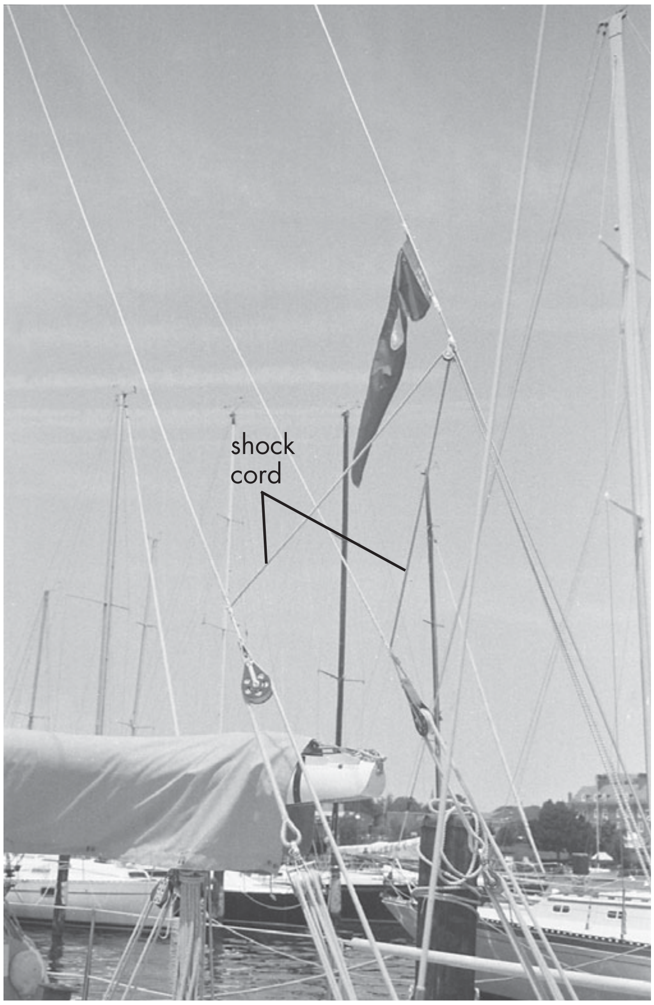


Figure 13-3.
An arrangement like this pulls the lazy running backstay against the wire backstay to prevent chafe. A similar approach can be used to hold the topping lift off the mainsail on a cutter.

any fastener that needs to be removed will be frozen solid. Machine screws for pump covers, wood screws in trim pieces, and metal screws on the faceplates of electrical and mechanical equipment should be quick and easy to remove. Unfortunately, fasteners that join metal to metal frequently corrode, especially in water pumps and around the engine. Where access is more important than an unbreakable bond, use an antiseizing compound when reassembling to make the job easier next time around.

On the other hand, we are always astonished at how hard it is to keep bolts we want to stay in place from loosening over the course of a passage. There are four practical options for keeping nuts and bolts tight in areas of constant movement. A product such as Loctite or a dab of silicone caulk provides a simple and often effective solution. If you are going to use such a product, be sure the bonding surfaces are absolutely clean and the appropriate adhesive is used. Note that there are several grades of Loctite. With the strongest grade, you may need a blowtorch to break the bolt loose. A lock washer and torque from a wrench offer another inexpensive solution. If that fails to hold the fastener, the next step is an aircraft locking nut or a Nylok (Figure 13-4). Drilling and wiring the bolts in place takes the most effort but ensures that they will stay put.

Don't rely on spring rings (better known as ring-dings among sailors). These have an uncanny ability to work loose. When they tinkle onto the deck, you are left wondering what is about to fall down on your head. Replace these with cotter or clevis pins. Where that is not possible (for example, on batten cars), replace the bolts and spring rings with bolts and aircraft locking nuts.

There are four common places where bolts work loose on many boats. Make sure that these bolts are properly secured before you go to sea:

1. **Engine bolts.** When we arrived in New Zealand aboard *Silk*, we had so much engine noise that

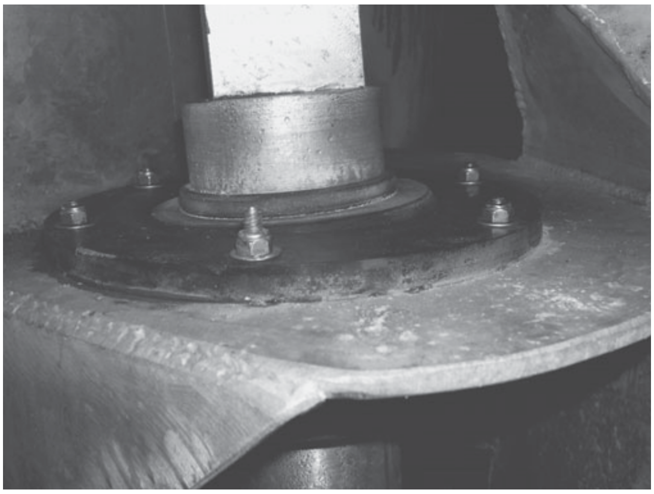


Figure 13-4.

We use Nyloks or aircraft locking nuts on the top bearing for our rudder where the motion has caused bolts with normal locking nuts to work off over the course of a passage.

we feared the engine exhaust manifold needed to be replaced. But an inspection revealed that three of the four bolts that secured the manifold were gone. Engine vibration always plays havoc with engine bolts, so use heat-resistant Loctite and inspect them regularly.

2. **Wind vane.** The wind vane is in constant motion when in use. Its position over the stern makes it particularly vulnerable to lost fasteners. We have cruising friends with older vanes who have had to tighten bolts several times during a passage. Our Monitor came with stainless lock washers for most bolts, and drilled bolts and seizing wire for critical areas. If your wind vane is not so equipped, make modifications before you leave.
3. **Roller furling gear.** In our first gale at sea, the bolts that held the roller furling drum in place vibrated loose. Luckily, we saw what had happened when we tried to unfurl the sail. On another occasion, the bolts that held the drum to the foil vibrated off. In both cases, we ended up using lock washers and Loctite, and taping over the bolts to minimize motion. No matter how well secured they are, bring plenty of replacements for these bolts!
4. **Steering system.** Given the constant motion in this area, bolts should be replaced with a system using cotter pins or secured using one of the above methods.

Salt and Corrosion

The saltwater environment creates its own special challenges. Salt increases friction in blocks, mast tracks, batten cars, and other hardware. Over the long run, it can damage expensive equipment. Racers know that regularly cleaning and lubricating the mast track eases sail handling. Cruisers may not care how quickly a sail goes up, but extra lubrication will save you time and effort when you bring a sail down. It may even allow you to get a sail off in extreme conditions when you cannot turn head to wind.

Before leaving on passage, wash the track thoroughly with soap and water while aloft and then lubricate it. Silicone tends to attract dirt and collect on the sail slides, turning your lovely white sail black along the luff. Liquid soap works well as a lubricant and cleans as it greases. Of course, it must be applied more frequently. Dry lubricant products last longer but are hard to find in remote areas.

No matter how well you clean it before you leave, the mast track will be coated with salt after a week at sea. To clean an internal mast track, tie a damp, soapy piece of cloth securely to a spare sail slide. Attach the halyard to the top of the slide and a downhaul to the bottom, and use the two controls to pull the slide up and down in the track until the cloth does not pick up any more dirt and salt. On external mast tracks with batten cars, the problem is usually in the ball bearings of the cars. When the sail is down, pour hot, soapy water over the cars. We use a large dishwashing liquid squirt bottle for this purpose, as well as to lubricate the rudder bearings, wash salt out of blocks, and rinse the furling drum.

Probably 90 percent of marine electrical problems are due to corroded connections or improper wire. Whether you solder or crimp, the motion of the boat and the conductivity of the salt air will ultimately undo your best work. But you can slow the process by using multistrand, tinned wire and well-made connections. Secure all wires firmly with wire ties. Make sure there are no leaks or spray reaching bus bars or switch panels.

Water and Mold in the Boat

If you have water in the bilge, the first thing to do is determine if it is salt or fresh. Fresh water in the bilge almost always means a loose hose clamp or cracked plastic fitting somewhere nearby. Salt water in the bilge rarely signals a catastrophic breach in the hull. Unless the water is up to the level of the floorboards and still rising, it's unlikely the problem is a seacock, though it can never hurt to check these first. Most often the cause will be traced to the following areas:

- **Stuffing box.** Tighten the stuffing box if it is dripping more than one drip every 6 seconds when the shaft is turning. A drip per second could fill the shallow bilge in our centerboard boat within half a day. If you tighten the stuffing box one week and it is leaking again the next, your stuffing box needs to be repacked, your Cutless bearing needs to be replaced, or your engine needs to be realigned.

- **Plug for chain hawsepipe.** If you are taking green water over the bow on passage, check the deck pipe for the chain. Various solutions for sealing the deck pipe were discussed in the Make Your Boat Watertight section in Chapter 4.
- **Deck leaks.** A damp or moldy locker almost always signals a deck leak. But by using the techniques outlined in Chapter 4, you should be able to identify the leaking deck fitting and rebed it so that it is watertight.

Even if the boat is perfectly watertight, condensation and humidity will lead to mold in certain areas. Mold and mildew flourish in cushions, especially between the cushion's bottom and the bunk. Cushions should be aired frequently, even if they are just propped up in the cabin for an hour or so every few days. If your cushions can be flipped over, do so regularly. Marine retailers sell an absorbent material called Dry Bunk for use between the cushion and the bunk. We found that it drew moisture away from the cushion and decreased mold and mildew in the tropics, though it didn't help much in the dampness of the high latitudes.

UV Deterioration

In tropical latitudes, you will notice the sun's effects on your sails, lines, plastic, webbing, and wood. Your best defense is preventive: minimize exposure and replace important items before wear becomes obvious. A few tips for minimizing UV damage to various items are:

- **Teak.** Make sure that whatever teak treatment you select (see the Hull section below) offers excellent UV protection. Otherwise, the varnish will turn cloudy, the oil will turn black, and other treatments will peel or strip away during a single passage.
- **Sails.** You will extend the life of your sails if you cover them when they are not in use. Roller furling headsails must be equipped with sun covers. The sail cover should be used on the mainsail if you are running under headsails for several days (or weeks) on end. Sun protection materials lose their UV resistance before they show signs of wear. Many need to be replaced every two years in the tropics. Follow the manufacturer's recommendations.
- **Jacklines.** If your jacklines are nylon webbing, they will degrade with exposure to UV radiation and should be replaced every one to two years. Dacron webbing is more UV-resistant, and threading low-stretch cord (such as Spectra) through hollow webbing increases its strength, making the jacklines much less susceptible to failure from UV degradation.
- **Dinghy.** UV radiation will gradually degrade any of the polymers used to build dinghies. Hypalon lasts the longest but commands a premium price. Covering dinghy tubes with canvas will extend their life.

Preventive Maintenance Schedules: Preventing Trouble

To be successful at both preventive maintenance and troubleshooting, you need complete manuals for every piece of gear on board. You may also need separate parts manuals that list part numbers. Survey your manuals and obtain any you don't have. Most manufacturers provide manuals as downloadable PDFs; you may need to pay postage or a small fee for printed replacements. For the engine, the owner's manual covers only routine maintenance and troubleshooting. Contact the manufacturer and order or download the complete shop manual. This will be your primary resource should you ever have to rebuild your raw-water pump or take apart your transmission. Buy a good do-it-yourself book for your outboard, which usually provides step-by-step instructions and greater detail than the shop manuals.

Equipment manuals provide preventive maintenance schedules. Our own maintenance schedules are shown in Tables 13-2 and 13-3. In some areas, we do more frequent maintenance than recommended by the manuals, reflecting both our circumspect attitudes and the rigorous demands of voyaging. Our maintenance schedules will help you develop your own approach and keep you from missing anything important.

No matter how thorough your maintenance program, at some point you will be faced with malfunctioning equipment in a deserted anchorage hundreds of miles from the nearest chandlery. Even if you are not particularly mechanical, you can do a surprising amount with the shop manual and your own two hands. Our lack of confidence was often our biggest impediment to getting the job done. When you approach a serious problem, keep the following four points in mind:

1. **Don't be afraid to tackle a job.** Most things are simpler than they appear. Frustration is far more likely than failure.
2. **Check the simplest things first.** The Troubleshooting: 90 Percent Solutions sidebar below offers ideas on where to start.
3. **Take your time.** Sleep on it before you disassemble a critical piece of gear. With the exception of frozen bolts, most things come apart easily when approached the right way. If you think

something needs to be forced, back off and rethink it. Consider contacting the manufacturer via e-mail or over the high-seas radio before proceeding.

4. **If you take something major apart, stay organized.** Keep all screws and parts in separate, labeled containers so you can put it back together again. If you have a video or digital camera aboard, you may want to record key steps in the process.

Major repairs will come along periodically. But a regular approach to proactive and preventive maintenance will keep your boat functioning smoothly most of the time.

Engines/Generators

Go over the engine (or generator) every few days. Check belt tension, oil level, and coolant level. Make sure the primary fuel filter does not have any water or dirt in its glass bottom. Check the oil level each time you start your engine—or as near to that as possible. Don't start and stop your engine without letting it warm up and letting the oil pressure come up to normal range. Immediately after starting the engine, check the oil pressure and the raw-water flow from the exhaust.

To maximize engine life, don't run heavy-load compressor motors before the engine is warm. Don't run the engine at idle for long periods (the daily 2-hour battery charge while at anchor is one of the fastest ways to shorten engine life). Try to keep a load on the engine once it is warmed up. While charging at anchor, run the engine in gentle reverse. Feed your diesel clean fuel and oil, change the oil frequently, and follow the preventive maintenance schedule shown in Table 13-2. These simple precautions should forestall any major problems.

Most engine problems result from dirty fuel. The following suggestions will help keep your fuel contaminant-free and your engine happy and healthy:

- **Put only the cleanest fuel in your tank.** We buy diesel from automotive pumps rather than fuel docks wherever possible. The fuel there tends to be cleaner because the turnover is higher and cars are fussier. When automotive fuel isn't available, and we are concerned about fuel quality, we use a Baja filter (see the Deck Gear section in Chapter 11). Fuel from drums is often very dirty, but sometimes there is no choice. If you have to take on diesel from a drum, attach a rag to a long stick, dip it into the drum, and scrape it along the bottom. If it comes up with rust and debris, insist on using a Baja filter even if slows the process down.
- **Filter fuel between the tank and the engine.** Inspect the bowl of the primary filter for water or dirt every time you check the oil. Change the filter regularly.
- **Keep tanks topped up.** Water in fuel tanks can become a breeding ground for bacteria that clog filters and damage the engine. Even if the fuel enters your tanks water-free, condensation in cooler climates can lead to water formation. Keeping the tanks full reduces the amount of condensation.
- **Drain the diesel tank sump regularly.** If you are getting a lot of dirt or water in the prefilter, drain or pump out the sump of the fuel tank. To remove all debris, let the boat sit quietly at anchor for at least 12 hours. If you do not have a stopcock attached to a drain on your diesel tank sump, you will need a hand pump and a rod or wire to tape to the hose to keep the hose rigid. If the boat has been left sitting for a winter, drain the sump of condensate and debris before moving the boat and stirring up the sediment.
- **Carry at least 5 gallons of spare diesel in a plastic jug.** You should carry some diesel outside your fuel tanks. You may need several quarts of clean fuel to change the fuel or Racor filter, flush the fuel lines, or bleed the engine. If the fuel in your tank becomes contaminated, you can still maneuver into harbor after a passage.

We have never used biocide, but many experienced sailors swear by it. Biocide often creates a large amount

TABLE 13-2. ENGINE AND GENERATOR PREVENTIVE MAINTENANCE SCHEDULE

Engine Hours	Activity
Every 50 hours	• Tighten belts and check pulleys • Clean raw-water strainer • Check electrical connections • Check antisiphon loops and make sure vents are clean of salt and debris
Every 100 hours	• Change oil and oil filter (including oil filter on turbocharger) • Change fuel filters • Check all hoses and tighten hose clamps • Tighten fuel lines • Clean air filter
Every 300 hours	• Change transmission oil (engine only) • Replace cooling-system anode • Touch up paint
Every 500 hours	• Check engine alignment; replace engine bolts if necessary (engine only) • Replace cooling-water impeller • Replace coolant system hoses if they show signs of softening, cracking, or bulging • Replace raw-water injection elbow on the exhaust if it shows signs of corrosion • Repack stuffing box (engine only)

of sediment the first time it is used. When starting with biocide, be prepared to pump out the tank sump or to change your primary filters several times. If you do use a biocide, buy one that does not include alcohol, which can damage O-rings and seals.

The regular engine-maintenance task that must be done the most frequently is an oil change. To speed the process and minimize the mess, change the oil when it is warm but not hot. Keep old oil containers to store the dirty oil and make sure to dispose of it in designated receptacles. If you really want to make life simple, install a dedicated electric pump to empty the oil pan as described in the Problem-Proof the Engine and Propulsion System section in Chapter 4.

Following are a few final hints and tips on engine maintenance:

- **Air filters.** Washable filter elements for the air intake last forever. They also eliminate the need to find, buy, and stow paper cartridges.
- **Belt wear.** Black dust or fuzz on engine accessories or pulleys signals belt wear. Check and adjust pulley alignment and belt tension. Change the belt if it is worn. Buy the highest-quality belts you can find and make sure they fit perfectly. Belts that slip because they are too narrow or too thin can lead to inefficient charging or an overheated engine. Belts need to be tight but not too tight; otherwise they will wear bearings and pulleys. Follow your engine manual precisely.
- **Engine mounts.** Engine mounts reduce vibration and keep the engine in alignment. But they are made from rubber, which eventually breaks down when exposed to oil and diesel. Inspect them annually and replace them as needed.
- **Stuffing boxes.** On most boats, the stuffing box can be repacked without hauling. To seal the outside of the stern tube, dive down and wrap a large piece of plastic wrap around the stern tube and shaft. Repack the stuffing and then remove the plastic wrap.
- **Transmission.** The drivetrain between the engine and the propeller differs tremendously from boat to boat. Learn your own system and be able to take it apart and take out the prop shaft. You may need special keys, a prop puller, or other dedicated tools. Find out what you need before you go and carry what you can. When the transmission oil needs to be changed, the transmission becomes less positive. Change it when it is warm.

TROUBLESHOOTING: 90 PERCENT SOLUTIONS

The first time our engine wouldn't start or our batteries wouldn't charge, we were frustrated and a bit frightened. The second time, we knew where to begin looking for the problem. The third time, we were 90 percent certain how to fix the problem based on the symptoms. A major failure is always possible, but many times the problem is a basic one. If you experience any of the following symptoms, save yourself time and effort by checking the basics first.

- **Engine cranks but won't start.** Make sure your batteries are charged and the battery switch is set to the appropriate battery bank. If your gearshift has to be in neutral, check that. Make sure the engine stop knob is not pulled out. Check to see that there is fuel in the tank and that no dirt or water lurks in the glass bowl at the bottom of the Racor filter. If these are all fine and you hear the engine cranking but not starting, then you probably need to bleed the fuel line.

  Your manual will provide specific instructions on bleeding your engine, which, on most engines, includes the following steps: Unscrew the air-vent bolt on top of the fuel strainer. Pump the small fuel-feed pump if your engine has one, or crank the engine until the fuel coming out around the bolt is clear and without obvious air bubbles. Tighten the bolt firmly and try the engine again. Most of the time, the engine will start.

  If the engine still won't start, or if it starts and runs rough, bleed the injectors: Unscrew the nut on the first injector. Crank the engine until the fuel flow is clear (not frothy). Tighten the nut. Repeat the process with the next injector until the engine starts and runs smoothly.

  If you have to bleed the engine repeatedly, then air is getting into the fuel system. The only part of the fuel system under pressure is the area between the tank and the fuel pump, so carefully inspect all these connections. If you have more than one tank, the problem may lie in the tank selector knob.

(continued on next page)

- **Engine won't crank.** If the starter clicks, and the battery bank monitor shows a large electrical draw but the engine won't crank, the chances are you have water in the cylinders. To check, pull some oil out of the oil pan sump and put it in a plastic bottle. Look for froth or discoloration. Let the oil settle for 10 minutes and look for a layer of water under the oil.

  If you find water, don't despair. The engine will not seize up if you can get the water out and flush the engine with clean oil. First, close the intake seacock on the engine and drain the entire water system, including the water muffler. Clean the antisiphon valve.

  If the oil you pulled out of the sump is frothy, or there is a very small amount of water in the bottom of the container, then there is not much water in the engine. Use a large wrench on the crankshaft to turn the engine over. Be gentle and don't force it; just apply steady pressure through what will likely be one very hard spot in the cycle. Turn it through at least two complete revolutions until it frees up and can be turned easily. If a significant part of the fluid you pulled out is water, you'll have to remove the injectors to avoid damaging the engine. Once the injectors are off, use the wrench to turn the crankshaft.

  Once the crankshaft turns freely, remove all the oil from the engine. Put in clean oil, start the engine, and run it for 20 seconds; then shut it down and change the oil again. If there still seems to be water in the oil, repeat this step. Run the engine for an hour or so to heat it up and dry it out. Then check the sump. If there is any sign of water, change the oil one more time. Otherwise, run the engine for 25 hours and change the oil again.
- **Engine overheating.** Check for blockage to the raw-water intake. Plastic bags are the usual culprit. Check belt tension on the water pump. Change the water pump impeller. Check coolant levels in the freshwater side of the cooling system.
- **Electrical system not charging.** Clean and tighten the connections at the alternator, regulator, and batteries. Check the alternator belt for wear, and adjust the tension.
- **Electrical equipment not functioning.** Make sure your batteries are charged and the battery switch is set to the appropriate battery bank. Use a multimeter to check whether electricity is reaching the equipment. If not, check the battery terminals and the electrical connection to the equipment for corrosion. Trace the wires between the batteries and equipment and look for a loose, wet, or dirty connection. If electricity is reaching the equipment, check the On/Off switch for corrosion. If all of this is working, the most likely problem is a bad circuit board. Contact the manufacturer.
- **Electrical bilge pump with float switch running constantly or not at all.** Check the float switch—the electrical connections always get corroded. Make sure the float switch and the pump are getting electricity. Make sure the hose isn't clogged. Clean any dirt out of the bilge pump.
- **Pressure water system running constantly.** Look for leaking faucets, particularly the handset on a cockpit or head shower. Check for a loose hose clamp. Otherwise, the discharge check valve or valves on the pump are leaking and will need to be cleaned or rebuilt.
- **Outboard engine hard to start, runs rough.** Check the fuel and make sure it is clean. On a two-stroke outboard, drain the carburetor (most older outboards have a drain bolt into the carburetor that can be accessed without removing the cover). Spray WD-40 into the carburetor and try to start it again. If it still runs rough, try new fuel.

Hull

Table 13-3 shows the periodic maintenance schedule for the rest of the boat's systems. We try to time the annual and biannual tasks to coincide with our haulout.

Preventive maintenance for the hull starts with keeping deck fittings, ports, and hatches watertight. Having achieved a watertight hull as described in the Make Your Boat Watertight section in Chapter 4, you will need to regularly rebed all fittings that pass through the deck to keep it that way.

Clean and wax the topsides on fiberglass boats regularly. Wax protects the gelcoat from UV radiation, oil and diesel in the water, dirty rubber fenders, and a host of other hazards.

Most experienced voyagers prefer to minimize a boat's exterior wood, but your boat most likely came with some

TABLE 13-3. PREVENTIVE MAINTENANCE SCHEDULES

System	Monthly	Quarterly	Annually	Every Five Years or as Needed
Hull	• Dive and inspect zincs, prop, through-hulls, and bottom paint • Use mild liquid abrasive to polish stainless • Touch up any exterior varnish	• Inspect and rebed deck fittings on a regular rotation • Inspect prop for pitting, corrosion; replace prop zinc as needed	• Polish and wax hull • Paint bottom with antifouling • Grease folding prop • Clean and grease winches	• Replace hull zincs • Varnish/paint cabin sole • Varnish interior teak • Clean fuel tanks
Ground tackle			• End-for-end chain and rope rodes • Service windlass • Replace marks on chain and rode	• Regalvanize anchors and chain
Rigging		• Check rig tune, fittings, welds, and terminal ends • Clean and lubricate mast track	• Complete mast and rig inspection, retune rig • Clean foil on roller furling • Inspect every halyard and sheet over its entire length; replace or end-for-end as needed	• Pull mast and refit rig: replace corroded wiring, fix any cracked welds, replace any suspect terminals • Remove mast boot, inspect mast partners, clean and reseal mast boot
Sails		• Inspect every sail for chafe and pulled stitches; repair as needed • Fix any chafe on sail covers		• Replace sail covers
Plumbing		• Inspect, open, and close all seacocks to be sure they are not frozen • Inspect all hose clamps; replace or lubricate as needed	• Inspect all through-hulls above and below waterline; polish and lubricate as needed • Rebuild head • Rebuild hand/foot pumps • Rebuild electric pumps for bilge, fresh water, and deck wash	• Steam-clean water tanks
Steering and self-steering	• Inspect wind vane; tighten bolts	• Tighten wind vane control lines; end-for-end as needed • Inspect steering; lubricate if needed • Inspect below-deck autopilot; top up oil	• Inspect rudder bearings for leaking, binding • Inspect steering system and replace any worn wire rope, sheaves, or other components	• Repack or replace rudder bearings
Electrical	• Check battery fluid (flooded batteries only) • Clean battery terminals • Check all major charging system connections, battery terminals, and bus bars for corrosion or loose wires	• Equalize flooded batteries • Check all navigation and deck lightbulbs and connections		
Refrigeration/ air-conditioning		• Check belt tension and alignment on belt-driven compressors • Clean air filters on AC units	• Inspect brushes and commutator in DC motor • Top up refrigerant in compressor • If condenser uses seawater, flush with muriatic acid in the tropics; replace zinc anode	• Replace brushes
Watermaker	• Clean raw-water strainer	• Clean/replace prefilters and charcoal filter as necessary	• Clean membrane (annually on some models, biannually on others) • Change oil on high-pressure pump (oil-filled crankcase–type only)	• Replace membrane • Rebuild high-pressure pump
Propane		• Check all propane connections	• Clean connections and refit with aluminum tape • Sand and repaint tanks	

(continued on next page)

TABLE 13-3. PREVENTIVE MAINTENANCE SCHEDULES *(CONTINUED)*				
System	**Monthly**	**Quarterly**	**Annually**	**Every Five Years or as Needed**
Safety gear		• Check EPIRB battery • Replace materials in ditch kit; be sure everything works properly	• Have life raft inspected and serviced[1] • Have fire extinguishers serviced • Test EPIRB • Inspect jacklines and replace if frayed or worn, or if made from non-UV-resistant webbing • Re-pickle membranes in handheld watermaker if carried in ditch kit	• Replace EPIRB battery • Replace cartridges on self-inflating life vests
Dinghy and outboard	• Clean dinghy of sand, barnacles, dirt	• Inspect dinghy painter for chafe	• Replace dinghy painter • Service outboard	

[1]Some models may be able to go 2 years between services.

teak on deck, and you will need to decide how to maintain it. Those who love the traditional teak look will opt for a different solution from those who want to minimize maintenance. Following are the pros and cons of the standard solutions for maintaining exterior teak:

- **Silvered teak.** Scrubbing bare teak with salt water, sometimes mixed with mild dishwashing liquid, silvers it. Silvered teak looks good when clean but needs to be scrubbed once a week. Such regular scrubbing does remove wood. Teak decks should be scrubbed across the grain to limit wood loss. After many years of scrubbing, teak will have to be replaced. If your primary concern is convenience, bare teak requires the least maintenance. If your primary concern is the aesthetics of the teak or the resale value of the boat, you will want to find a different solution.
- **Teak oil.** After a passage or two, teak oil turns black unless treated with an antifungal agent. It doesn't hold up to offshore passagemaking and will be scrubbed off after a few months of exposure to the sea and sun. Don't consider oil an option for exterior teak, though it can be a workable solution for the interior.
- **Synthetic finishes.** Products such as Sikkens Cetol and Epifanes have become increasingly popular. They are less fussy to apply than varnish and do a good job protecting the wood. To stand up to offshore passages, they will require frequent touch-ups. They don't look quite as good as properly maintained varnish, so they may not satisfy the traditionalist.
- **Varnishing.** Perfect varnishing conditions rarely exist in the tropics. An afternoon rain shower can spoil a day's work, and varnish applied in the sun will dry wavy or cloudy. Once applied, however, a limited amount of varnish is easily maintained and looks better than most other options. Many people choose varnish if their boat has a small amount of exterior teak, or they varnish 3 or 4 square feet and leave the rest bare. Polyurethane varnishes last longer and are more abrasion resistant than traditional tung oil varnishes. Some cruisers put several coats of tung oil varnish on and then seal it with polyurethane.

Here are a few more hints and suggestions for maintaining the hull:

- **Floorboards.** Wood swells in the tropics, causing problems in accessing the bilge. Before you leave, plane the edges of the floorboards until they fit somewhat loosely. Otherwise, you'll need a crowbar to get them up. Each time we returned to the tropics from more temperate latitudes, we had to plane the floorboards again. We never figured out how that could be possible, but it was a common experience.
- **Zincs (anodes).** Marina waters often carry stray electrical currents that can destroy your zincs in no time. The zinc on the propeller is most susceptible. After an extended period in a marina, we stop at an anchorage and dive to check our propeller zinc before heading out on passage. If it is loose or has lost more than half its mass, we replace it. A spare zinc that can be hung over the side of the boat in a marina will provide additional protection. Consider installing one of the various AC isolation systems if you have an ongoing problem with electrolysis.
- **Cosmetics.** Keeping stainless steel bright helps prevent difficult-to-remove rust marks from developing on the hull. Soft Scrub or some other mild liq-

uid abrasive will remove rust from stainless and small rust stains from the hull. Silicone spray on a rag also protects stainless for short periods of time. Diluted oxalic acid applied every few months will remove all rust from stainless. It will also remove sealants and caulk, so apply it judiciously.

- **Hardware.** Machine shops will custom-build just about anything at reasonable rates. If you need a stainless steel sheave or an aluminum gooseneck, get a quote from a machine shop before heading for the chandlery. On several occasions, we have had top-quality machine work done for a fraction of the chandlery price.
- **Hard dodger and pilothouse windows.** Those large windows that provide such excellent visibility will get covered with salt spray and become hard to see through over the course of a passage. If they are made from glass, a product like Rain-X applied every month or so will cause the water to sheet off the window, sweeping the salt away with the water. If your hard dodger or pilothouse windows are made from plastic, check compatibility before using these products.

Ground Tackle

Ground tackle takes a great deal of punishment and requires almost no maintenance. Inspect the rode and shackles for chafe and wear. Replace worn shackles and end-for-end rodes regularly. Make sure that the shank or flukes of the anchor are not bent.

After hundreds of nights at anchor, the zinc galvanizing that protects the underlying steel will wear away, and your chain and anchor will start to rust. You should then consider regalvanizing to extend the life of your ground tackle. Regalvanizing does not replace lost metal or restore original strength, so don't let ground tackle deteriorate long before taking action. Regalvanizing anchors requires far less skill than regalvanizing chain—and the price of an anchor versus the price of galvanizing makes the decision academic.

On the other hand, regalvanize chain only if you can find a reputable shop that others have used with good success. When improperly done, regalvanizing can stretch or distort chain so that it no longer fits the chain gypsy. When you call for a quote, ask the shop how they clean the chain beforehand and how they remove the excess zinc afterward. The price is usually quoted by weight, and many shops have a minimum weight requirement. Pooling the ground tackle of several boats will help keep costs down.

Rigging

Passagemaking puts tremendous wear and tear on spars and standing and running rigging. The shock loads from a suddenly backed headsail or a small spinnaker filling with a crack can easily damage a weakened rig. To be sure your rig is up to offshore standards, inspect it regularly. That means a half-hour check before and after every passage and an annual inspection that lasts several hours (as described in the Revitalize the Rig section in Chapter 4). Don't forget to inspect the bobstay and its fittings when you inspect the rest of the rigging. A bobstay failure under full sail can pull a bowsprit out of a deck or bring down the mast.

Do not use WD-40 on rigging components except as a degreaser and cleaner. It is not a lubricant and will remove any residual oils or grease protecting the part. Many cases of stripped turnbuckle threads can be traced to the use of WD-40. Use lubricants such as Tri-Flow or Boeshield T-9 instead.

Following are some additional tips for keeping your standing and running rigging in offshore condition:

- **Avoid rigging tape.** Tape traps salt water and accelerates corrosion, especially where stainless steel rigging comes in contact with an aluminum mast. Where you can't avoid taping or covering your rigging, inspect beneath the tape regularly.
- **Get rid of clevis or cotter pins.** Uncovered split pins can snag lines, slice sails, and gash the crew's skin. Racers tend to cover the pins with masses of tape, but this does not allow you to see what's happening under the tape, where trapped moisture can quickly lead to corrosion. We use stainless welding rod rather than split pins on most of our stays. A short piece of rod is bent into a C shape and threaded through the two pinholes in the turnbuckle; then the ends are bent in so they don't snag anything (Figure 13-5). The rod would be easy to remove in a dismasting. On the backstay, which we need to remove when we haul the boat, and in other places where split pins are normally used, such as on the mainsail luff hardware, we use stainless machine screws with Nylok nuts to replace cotter or split pins. Where split pins are the only solution, we cover the sharp ends with a dab of silicone caulk.
- **Reduce mast track friction.** If you are having a problem dousing the main, take a single sail slide and attach a halyard to the top and a downhaul to the bottom. Run the sail slide up and down the track to find the problem area. If the track is burred or distorted, file it down. Then fix whatever is causing the chafe.
- **Wire-tie shackle pins closed.** Continuous vibration during passagemaking can loosen and eventually open screw shackles. On shackles we won't need to open, such as on the jib halyard, we wire-tie the

THE ANNUAL HAULOUT

The annual haulout offers the opportunity to put all your systems in working order. Inspect everything and fix as much as you can afford to. The only things that really have to be done on the hard are bottom paint, greasing and polishing seacocks, rebedding underwater through-hulls, repacking rudder bearings, and maintaining a below-waterline centerboard. But while the boat is out of the water, take the opportunity to replace worn zincs, rebuild the head, repack the stuffing box, grease a folding prop, and so on.

Before choosing a particular yard, take a good look at their haulout equipment. Make sure the belts and wires are free of chafe and the pulleys look well oiled. Make sure your insurance or the yard's insurance will cover any damage if your boat is mishandled. Before the boat is hauled, check the slings on the Travelift or pads on the trolley for dirt and grime. Whether the boat is being hauled on a marine railway or a Travelift, make sure the trolley or straps are properly aligned with the hull. Sling markers on the toe rail can help you position the boat, but you should also carry a diagram of your underwater profile to show to the machine operator.

Once your boat is out of the water, have the yard pressure-wash the bottom before blocking her in place. Most grass and dirt will come off easily if it is pressure-washed before it dries. When the yard blocks up the boat, be sure the bow is well supported to prevent the hull from flexing and damaging interior bulkheads. Many yards we were in neglected to do this unless we requested it.

Tropical water is a richer environment for marine life than more temperate seas, so most cruisers haul annually to repaint the bottom. Cruisers who do one or two passages per year tend to prefer hard bottom paints, which can be scrubbed to remove marine growth. We do enough passagemaking every year that we prefer the ablative (or soft) antifouling paints. If anything takes hold, it will be shed along with the paint on passage. We use one coat of a hard antifouling paint of one color (for example, red) on the bottom followed by three coats of a compatible soft antifouling paint of another color (such as blue). When we see red paint, it's time to repaint. Ablative paints should never be scrubbed, as this only thins the effective layer of paint.

While the boat is on the hard, check the following items:

- **Inspect and service through-hulls.** Look for cracked caulk and rebed if necessary. Remove all hoses and check the hose and the hose ends. Replace worn hoses. Replace hose clamps. Polish any leaking seacocks. Grease all seacocks.
- **Inspect the propeller.** Make sure the prop turns freely. Check that the crown nut is snug and the cotter pin is well secured and not worn. Change the propeller zinc. If your prop is one of the folding or feathering varieties, make sure it changes position smoothly, and lubricate it generously.
- **Check the Cutless bearing.** If you can move the prop shaft by hand more than 1⁄16 inch to either side (1⁄8 inch in total), the Cutless bearing needs to be replaced.
- **Inspect the rudder.** Make sure the rudder moves freely, without binding. Repack the rudder stuffing box if necessary. Clean barnacles out from between the rudder and skeg and the top edge of the rudder and the boat. Use a dental pick to remove barnacles from tight crevices.
- **Inspect and replace zincs (anodes).** Inspect all zincs. Replace any that are more than 60 percent worn.
- **Clean the transducer paddle wheel.** Make sure it spins freely. Use a dental tool to remove barnacles and other growth. Some antifouling paints can attack the transducer material, so use a specialty paint or leave it bare.
- **Inspect the keel bolts.** If your boat has keel bolts, tap them with a ball-peen hammer. If you hear anything but a satisfying "chunk," you will need to investigate further.
- **Open and inspect below-waterline centerboards.** If you have a centerboard, open it and inspect the pendant and pulleys for wear or chafe. Replace any zincs in the centerboard trunk.

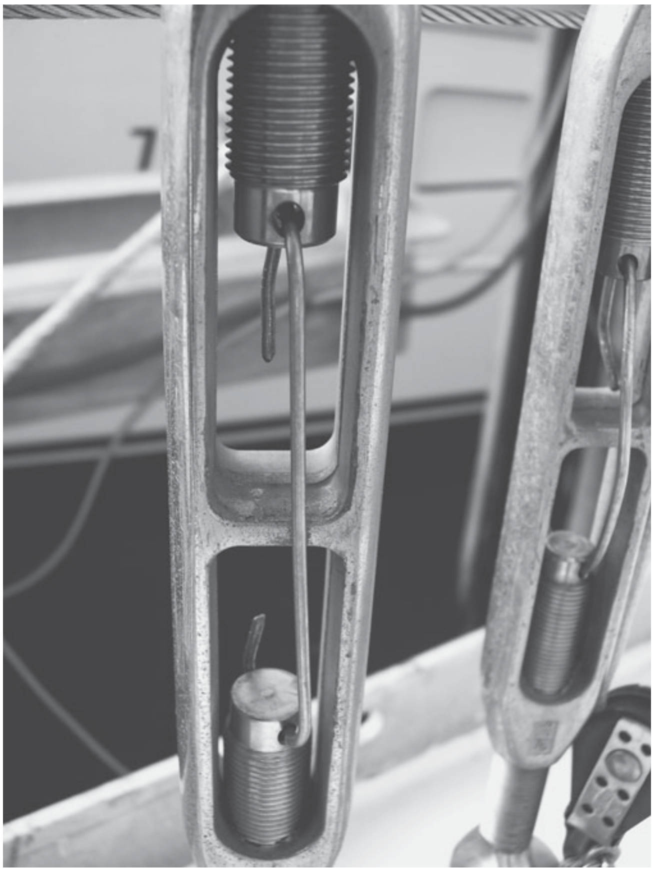


Figure 13-5.
We use stainless steel welding rod in place of split pins on our terminal ends.

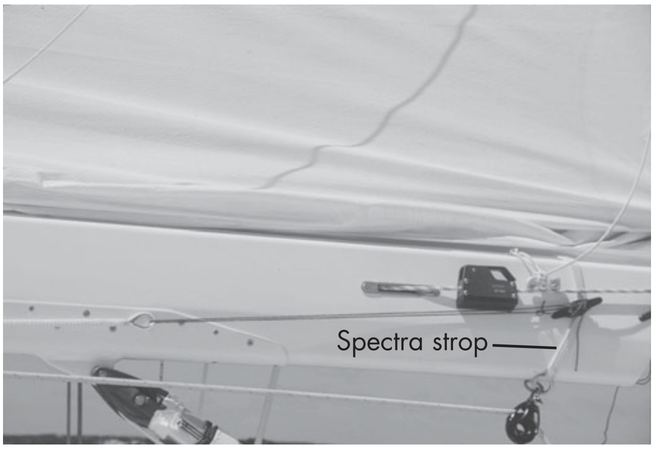


Figure 13-6.
Spectra strops can be used in lieu of shackles to make strong, light, chafe-free attachment points to the boom.

shackle pin to the shackle to prevent the pin from coming loose. The wire tie can be quickly removed with a sail knife. Black wire ties seem to be more UV-resistant than clear or white ones.

- **Finish off line ends with heat-shrink tubing.** The bitter ends of lines tend to come unraveled after a few months even when properly whipped. Putting heat-shrink tubing over the whipped end protects it and keeps the line intact for a year or more.
- **Use Spectra strops as attachment points.** Instead of using bails and shackles, which are heavy, expensive, and subject to crevice corrosion, follow the lead of single-handed round-the-world racers and use Spectra strops as attachment points on the boom. On our boom, the mainsheet blocks are attached to the boom by strops (Figure 13-6).

Sails

Sails and running rigging should be inspected daily on passage to find any chafe before it becomes a serious problem. In port, take tension off the genoa halyard and release leech and luff lines. This will prevent the sail from stretching and losing its shape prematurely. Every six months, follow each seam from leech to luff and fix any broken stitches. Use sail tape to protect areas prone to chafe.

To make repairs on laminate sails, use sticky-back Spectra sail tape for small rips or chafed areas. For large areas, all you need is a piece of sail material about 30 percent larger than the damaged area and 3M seam tape. Cover the sail material and the area to be patched with the seam tape, strip off the backing from the tape, and press the two together. Rub vigorously outward from the center until the whole patch adheres. We find that the patches last longer if we sew down the edges to keep them from lifting.

Self-Steering

Wind vanes require remarkably little attention. Auxiliary rudders should be removed during extended periods of coastal sailing to minimize wear and tear from prop wash. Before every passage, clean the wind vane thoroughly to remove any grease or dirt in the bearings, gears, and pulleys. This will make the action as smooth and friction free as possible.

On passage, wash the wind vane with fresh water once a week or so if possible. Check servo-pendulum gears frequently to be sure the control lines are properly tensioned and not chafing, rinse the drum mechanism with fresh water regularly, and lubricate the pin that locks the drum with dishwashing liquid to prevent it from sticking. Lubricate blocks and gears regularly with a water-dispersing spray. Finally, clean off any gooseneck barnacles or grass that collect on the oar or the auxiliary rudder. To prevent unwanted growth, some cruisers put antifouling paint on their water oars. Auxiliary rudders should always be antifouled with three or four coats of paint.

Aside from failures due to wear and tear, only two things can go wrong with a wind vane under normal conditions: either the vane or the oar can be damaged. The vane can be broken by a large wave or can be lost overboard. Carry at least two spares. Most wind vanes are designed so the tube that connects the oar to the self-steering unit will break if the oar hits something. This protects the rest of the components from damage. Tie a line to the oar and attach it to one of the supports on the wind vane so the oar will not be lost if this tube breaks. Carry at least one spare tube.

Inspect the unit carefully at least once a month. Look for tiny cracks in the welds. Check that no bolts have worked loose or lost their nuts. Make sure the unit still works smoothly, without excess friction but also without excessive play. As the gear ages, the bearings and teeth will wear, resulting in sloppiness in the steering. These may need to be replaced after 20,000 or 30,000 miles. At around the same age, welds may begin to fail. A good aluminum or stainless steel welder should be able to patch up any problem areas.

Plumbing

Check valves tend to stick in pipes that carry wastewater, so avoid using them where possible. Otherwise, clean them once a year and use a rubber mallet or ball-peen hammer to break them loose when they stick. Replace the head hose every twelve to eighteen months to minimize odors. Make sure every seacock has a wooden bung of the proper diameter located within reach that can be used in an emergency.

For all the abuse they get, marine heads have become quite reliable. A little attention will keep them functioning well for years. To keep your head in good condition, be sure that nothing goes into it other than human waste and toilet paper. If it discharges overboard, flush the entire system with clean salt water after every use. On most boats, several feet of hose must be flushed, which means ten to twelve strokes after the bowl looks clean. Failure to clear the exhaust hose will leave an unpleasant odor and clog the head after several successive uses. Only after the system has been thoroughly flushed should the bowl be pumped dry.

Rebuilding your head annually will keep you from ever having to do this nasty job at sea. Most spare parts kits or owner's manuals provide complete instructions. To minimize the mess, rebuild the head when you are in a marina or during haulout. Unbolt the whole unit from its base and take it to running water so you can clean it as you go. Once it is clean, smear grease liberally on all moving parts.

Lavac heads are the simplest to maintain. The pump is a standard manual bilge pump that needs to be rebuilt annually. The vacuum seal on the seat needs to be replaced every couple of years.

Other head pumps have a packing gland around the pump shaft. If this starts to leak, gently tighten the packing nut about half a turn until the leaking stops. If it starts leaking again within a week or so, loosen the packing nut and add some waterproof grease. This will often stop the leaking for a month or more. The packing gland itself will need to be repacked every few years.

Bronze seacocks will start to weep and become difficult to open and close as the grease in them gradually wears away. Grease them annually when the boat is hauled out.

Electrical

If you have wet-cell batteries, you can extend battery life by *equalizing* them about once a year. This means highly charging the batteries to remove any buildup of sulfur, which is accomplished by running the battery voltage up to 16 volts at a very low charge rate. If you have a smart regulator that is not set up for this type of charging, you will need to find a way to bypass it. While batteries are being equalized, they must be isolated from electrical equipment that could be damaged by this high voltage. Get professional advice the first time you do this, or you may end up with dead batteries.

Regularly clean corrosion from the battery terminals. Almost everything else in the electrical system can be resolved with a multimeter and some patience.

Watermaker

The best way to maintain a watermaker is to use it regularly. Don't fill your tanks and then shut down the watermaker for two weeks. Rather, run it a bit each day and keep your tanks topped up. But never run it where the water is contaminated by oil, diesel, or sewage. Many of our friends with watermakers leave the marina or harbor on a weekly basis just to make water.

The prefilters need to be changed regularly. Most watermakers have a seawater strainer, a 20-micron filter, and a 50-micron filter. The owner's manual will indicate how often these need to be cleaned or changed based on running time, but it can be as frequently as once a month if you are using the watermaker a lot. Watermaker production will drop when the filters start to get clogged, and the pressure gauge will show that the watermaker is getting less feed water. Some units will shut down if they don't get enough water.

If you are not going to use the watermaker for more than a week, it will need to be flushed regularly or pickled to prevent bacteria from infiltrating the membrane. Most watermakers use between 5 and 7 gallons of fresh water from your tanks for flushing. Units that can be set up to flush themselves automatically allow you to leave the boat without pickling, as long as there is adequate water for flushing. Even trace amounts of chlorine can damage the membrane, however, so if the water is coming from the main tanks and not from a special tank dedicated to flushing the system, it will need to be passed through an active charcoal filter. These filters need to be changed about every six months.

To pickle the watermaker, a biocide from the manufacturer is diluted with water and pumped into the membrane, and the membrane is left full of solution. After the system has been pickled, it needs to be flushed to remove the biocide. To do that, the system must be run for 15 to 20 minutes in an unpressurized state; once pressurized, the first 5 gallons or so of water produced must be discarded. Make sure to use only the pickling agent recommended by the manufacturer, as others may damage the membrane.

When the membrane begins to clog, the unit will operate at higher-than-normal pressures and produce less water than normal. Membranes generally need to be cleaned every two years and replaced every five years. Two cleaning solutions are used on the membranes: an alkali solution to remove biofouling, and an acid solution to remove mineral fouling. The owner's manual will come with complete instructions.

The high-pressure pump that powers the system will need to be rebuilt at around 2,000 hours of operation. If the pump has an oil-filled crankcase, the oil will need to be changed every 500 hours. Use high-pressure, detergent-free oil as specified in the owner's manual.

Minimizing Maintenance: Avoiding Trouble

Preventive maintenance requires much more time on a liveaboard cruising boat than on a coastal boat. We spend an average of 20 hours per week on maintenance and 80 hours at haulout time. In addition, we usually undertake one or two major projects each year that keep us both occupied full-time for a couple of weeks, and that's on a relatively simple boat with little in the way of modern conveniences: no generator, watermaker, refrigerator/freezer, pressure water, or hot water. Many of our friends on more complex boats spend double the time on maintenance. Refer back to Table 10-11 for a rough idea of the maintenance load for our three offshore voyagers, *Simplicity*, *Moderation*, and *Highlife*.

After most cruisers have been out for a year or two, they have mastered the proactive and preventive maintenance described in the last two sections. At that point, most move into the third phase of the maintenance mind-set, where they begin to find ways to minimize maintenance and even to enjoy the challenge of making their boat operate more efficiently with fewer breakages. For many, that means simplifying the boat as we did when we went from *Silk* to *Hawk*. Others, who are better at engineering and more interested in tinkering than we are, work on ways to eliminate weaknesses in complex systems. At the same time, most cruisers also move away from patronizing chandleries and boatyards and become more and more self-sufficient.

In the end, a maintenance mind-set means accepting that keeping the boat running is indeed a major part of this life and makes the rest possible. It also means building skills so that you have the self-confidence to undertake projects and the self-sufficiency to see them through with a minimum of outside assistance. At that point, sailing around the world comes to mean fixing your boat in a series of exotic ports—and enjoying it.

ESSENTIAL TOOLS AND SPARES

To properly maintain a voyaging boat in remote anchorages or underway, you have to have the right tools and the necessary spares. Yet every boat has a limit as to how much it can carry, and tools and spares are both bulky and heavy. Aboard *Silk*, we carried a single toolbox and two small lockers of spares. Aboard *Hawk*, we carry six toolboxes and a half-dozen crates of spares. The differences reflect *Hawk*'s larger size and our more remote cruising agenda, as well as our increasing self-reliance and our awareness that although people the world over eat, they don't all use electric autopilots and automatic bilge pumps.

No matter how large your boat is, you can't carry everything. This section is designed to help you figure out what you *must* have, and then prioritize additional items.

The Voyager's Toolbox

Salt water and damp air easily damage tools. Only high-quality tools can stand up to the constant use and abuse of life aboard. Stainless steel tools cost two to three times as much as regular tools and may break your heart when they go over the side (which they will). We buy high-quality non-stainless tools and care for them well.

After using a tool, we lightly rinse it with fresh water, wipe it down thoroughly, and then spray it with water-dispersing spray. About once every six months, we go through the toolbox and clean off any rust or corrosion from each tool.

Table 13-4 shows the basic hand tools for the voyager's toolbox—both those you will want to keep handy for everyday use and additional tools you won't need immediate access to but will use often. The last column highlights tools for those infrequent but critical special jobs.

Screwdrivers need to be made from high-quality materials. Bring one with a 4-inch handle and a ¼-inch tip

TABLE 13-4. HAND TOOLS FOR THE SELF-SUFFICIENT VOYAGER

Equipment	Everyday	Additional	Special Needs
Screwdrivers	• Medium and small slotted-head screwdrivers • Medium and small Phillips-head screwdrivers	• Large slotted-head screwdriver with oversize handle • Large Phillips-head screwdriver • Stub-sized slotted-head and Phillips-head screwdrivers • Small jewelry screwdrivers	
Wrenches	• 6 and 10 in. adjustable wrenches	• 20 in. adjustable wrench • Set of open and box wrenches in metric and SAE Standard • Full set of Allen (hex) wrenches in metric and SAE Standard • Chain wrench • 3/8 in. drive socket set, 1/4–1 in. with 3–4 in. socket extension	• Box or open wrench large enough to service through-hulls and to fit shaft packing nut • Extension long enough for hard-to-reach engine bolts • Torque wrench
Pliers	• Needle-nose pliers • Slip-joint pliers • Wire cutters	• 6 and 10 in. locking pliers (Vise-Grips) • Large slip-joint pliers	• Hacksaw, hydraulic wire cutters, or bolt cutters that will cut through damaged rigging
Paint and polish tools		• Putty knife • Paintbrushes of various sizes • 3 and 6 in. scrapers	• Brass brush • Stainless steel wire brush
Other	• Small metal file • Small ball-peen hammer • 6 ft. tape measure in metric and U.S. Standard • 30 ft. tape measure in metric and U.S. Standard	• Set of metal files (flat, half-round, and round) from small to large • Rubber mallet • Pry bar • Aligning (tapered) punches • Straight punches • Cold chisels, wood chisels • Set of feeler gauges • Dental mirror, picks • Mirror with extension handle • Heavy-duty scissors • Hacksaw with a variety of blades	• Metalworking tools • Something that can be used as a lever to tighten V-belt on engine
Electric tools and specialty items	• Stainless steel rigging knife or Leatherman • Small 12 V wet-dry shop vacuum cleaner	• Grease gun • Caulk gun (professional model made from heavy-gauge steel) • Three small hand or drill-driven pumps • Cordless hand drill (1/2 in. chuck) • Digital multimeter • 12 V or butane hotknife/soldering iron • Nicopress or swaging press kit • Set of taps and dies in U.S. Standard, metric, or both	• Hydrometer to test wet-cell batteries • Fids for splicing lines

for tight places. This proved to be one of our most useful screwdrivers, often the only solution for unscrewing trim pieces in the far corners of lockers. Slotted screwdriver blades need to be thick enough for a number 10 screwhead.

On many American-made boats, the diesel engine is metric, and all other hardware (nuts, bolts, screws) is Standard. To work on such a boat, you will need a complete set of both metric and SAE (Society of Automotive Engineers) Standard wrenches and sockets.

Small hand pumps serve many purposes aboard, including removing dirt and water from the sump in the diesel tank, emptying a blocked sink or head, and removing water from the bilge due to clogged limber holes. Carry three or four of various sizes.

You'll find a dozen uses for a commercial-quality drill on the boat. Bring along two sets of high-quality titanium or carbide drill bits, because you will lose some over time. The drill will be used on teak, fiberglass, aluminum, and stainless, so buy the most powerful one you can afford. It needs to run on 12 volts or be rechargeable using an inverter and battery packs.

You will need a good digital multimeter for electrical troubleshooting. A proper ratchet crimper and a 12-volt or butane hotknife/soldering iron with rosin-core solder will reduce the number of times you have to redo the major electrical connections on your boat. The hotknife is also useful for line and sail work. If you do not have sealed batteries, you will need a hydrometer to test the batteries occasionally.

A hacksaw with a variety of blades (18-, 24-, and 32-tooth) will handle most cutting problems. Wire cutters strong enough to cut rigging will be too large to store on smaller boats unless you can afford the hydraulic type. To remove clevis pins when the rig is loaded (if the mast is overboard, for example) will require a mallet and tapered punch. If you intend to use bolt cutters, make sure to try them on a scrap piece of rigging wire to see how much effort is required and whether you can really cut it.

You will use a good stainless steel rigging knife with marlinspike daily. A Nicopress kit, taps, and dies are good for metal, wire, and rigging work. You will want taps for the most common types of machine screws: 10 to 24 and 44 to 20. If you plan to splice cored line, you will also want hollow fids.

If you have the space, you may want to add a vise and C-clamps, a riveting tool and rivets, a 4-pound sledge, and a small wheel puller. A small grinder and a small palm sander make fiberglass work much easier. On *Hawk* we also carry and have frequently used a set of holesaws, a jigsaw, a circular saw, and a Dremel tool.

Additionally, although not properly hand tools, no crew should try to do without a good bosun's chair for long trips up the mast and a climbing harness for use at sea. An inexpensive, comfortable bosun's chair can be made from a teak plank, some carabiners, and the remnants of an old sail; the climbing harness can be purchased from a climbing store.

Organizing and stowing all these tools pose a real challenge on a boat without an engine room or workshop. On *Silk*, we divided tools into five categories for storage purposes, as follows:

1. **Basic tools and spares.** Most boats carry a set of frequently used tools in a navigation station drawer or in a bracket near the companionway. These include an adjustable wrench, a few of the most commonly used box wrenches, slotted-head and Phillips-head screwdrivers, and a pair of adjustable pliers. Having these few tools available will save you dozens of trips into the main tool chest. You may also want to store a few frequently used supplies with these basic tools: silicone or Teflon spray, sail tape, lightbulbs, spare batteries, duct tape, and electrical tape.
2. **Electrical troubleshooting kit.** You will use this kit several times a month; stowing it in an accessible place will save you time and frustration. The kit should include an electrical multimeter, a ratchet crimper, heat-shrink tubing, and electrical connectors.
3. **Sewing kit.** Needles, palm, sail thread, dental floss, and fids stow well in a small ditty bag and should also be kept in an easily accessible place.
4. **Emergency tools and supplies.** If you experience a dismasting, you will need immediate access to a hacksaw or good wire cutters (hydraulic, if you can afford them). Stow these somewhere near the companionway in a relatively dry place where you can reach them in a few seconds. Carry a length of Spectra or Vectran line the length of your longest stay. Underwater epoxy and hull repair materials should be also readily accessible.
5. **Heavy-duty toolbox and long-term spares.** The toolbox can be stowed in a less accessible place, but it must be low in the boat. You will need to be able to reach it on passage, in case a major repair needs to be done underway.

On *Hawk*, we have a small canvas tool bag with basic tools, the electrical troubleshooting kit, and a sewing kit. We can handle 80 percent of our proactive and preventive maintenance with the items in this bag, and it's portable so we can take it to wherever the problem is.

The Spares Locker

Table 13-5 shows the spares necessary when going several months at a time between yachting centers and chandleries.

If your boat is energy intensive and you depend on a generator or the engine for power, you will want to carry doubles of some of the engine spares and supplies. If you have the space, consider carrying a spare hydraulic ram for the electric autopilot, an exhaust elbow, and a spare propeller that can be fitted to the existing prop shaft without machining.

Your spares need to reflect your emergency preparations. Consider how you would construct a jury rig if you lost your mast, how you would get water out of your tanks if your pump broke, and how you would stop a leak after a collision. Make sure you have the equipment to carry out the emergency procedures you develop after reading Chapter 23.

Table 13-6 shows some additional useful supplies. We use tongue depressors for everything from stirring paint to applying epoxy to scraping excess sealant off newly rebedded deck fittings. We use surgical gloves for working with epoxy and other hazardous materials. Large syringes can be used to mix two-part epoxies or to baste the turkey for Thanksgiving dinner. Bronze wool pads don't rust like steel wool.

TABLE 13-5. SPARES AND MAINTENANCE SUPPLIES FOR THE SELF-SUFFICIENT VOYAGER

System	Recommended Spares	Supplies	Other
Engine	• Several oil and fuel filters • Cooling-water pump impeller and rebuild kit • Starter solenoid • Several belts of each type • Full manufacturer's replacement gasket set • Regulator • Thermostat and gasket • Alternator bearings • Brushes and diodes • Starter motor bearings and brushes • Set of injectors • Diaphragm for lift pump	• Enough engine oil for three oil changes[1] • Enough transmission oil for one oil change • Engine coolant • Biocide for diesel (if you use it)	• Flax packing • Engine-cooling hose • High-pressure fuel line • Gasket material and gasket sealant
Hull	• Spare zincs • Winch repair/rebuild kits • Winch pawls and springs (at least six)	• White gelcoat and hardener • Gelcoat color additive (if necessary) • Fiberglass cloth, mat, and disposable brushes • Epoxy putty • Underwater epoxy	• Fiberglass rubbing compound • Fiberglass polish and wax • Plastic brushes for use with an electric drill
Rig	• Assorted shackles and blocks • Spare block and tackle that can be used as a vang • Spare Spectra or Vectran line long enough to replace headstay • Spare halyard and set of sheets • Spare turnbuckles • Cable clamps	• Teflon spray • Water-dispersing spray • Whipping twine and vinyl rope dip • Cotter and clevis pins • At least one but preferably three Norseman or Sta-Lok fittings	• Several snatch blocks • Small-diameter messenger line twice the height of the mast
Sails	• Two spare battens of longest length (store in boom) • Spare hanks and slides or two spare batten cars and hardware • Webbing of various sizes • Sailcloth of various weights • Sticky-back sailcloth	• Sail tape, seam tape • Sail twine, plain and waxed • Heavy-duty thread • Many heavy-duty needles	• Sailmaker's palm
Steering and self-steering	• Steering cables • Spare wind vane wind blade (vane) • Spare wind vane crash tube and oar • Spares kit for electric autopilot (belt, shear pins, or sealed motor for wheel-mounted pilot; spare ram for below-deck pilot)	• Hydraulic fluid for below-deck pilot	• Emergency tiller
Plumbing	• Rebuild kits for all pumps and the head • Float switch for electric bilge pump • Bilge pump	• Teflon tape or plumber's tape • Stainless hose clamps of all sizes	• Spare hoses of various sizes • Assortment of hose and pipe fittings
Electrical	• Bulbs of all types • Flashlight bulbs • Batteries of all types	• Assorted crimp-on terminals • Coaxial end fittings and connections • Insulating (electrician's) tape • Heat-shrink tape and tubing • Vaseline and anticorrosive	• Assortment of fuses • Wire ties of various sizes • Multistrand tinned wire of various sizes
Refrigeration/ air-conditioning	• Spare electrical control panel for refrigerator • Spare drive belt	• Gauges, refrigerant and recharge kit • Pencil zincs for condenser	
Watermaker	• O-rings • Rebuild kit for high-pressure pump	• Two or three prefilters • Two or three charcoal filters (if necessary) • Biocide	

[1]The amount that would be necessary if water ever gets into the engine.

TABLE 13-6. ADDITIONAL SUPPLIES FOR MAINTENANCE AND REPAIR	
Fluids	**Supplies**
Light household oil	Box of wooden tongue depressors
Loctite and Never-Seez	Box of surgical gloves
Teak oil, varnish, paint	Monel seizing wire
Lubricating sprays	Wet-and-dry 40- to 500-grit sandpaper; bronze wool pads
Lithium grease	Assortment of 316 stainless bolts, locking nuts, and screws
Solvents including acetone, alcohol, and mineral spirits	Assorted small pieces of plywood, teak, stainless, and aluminum
Variety of bedding compounds	Two or three large medical syringes
Superglue, rubber cement, wood glue	Duct tape, masking tape, aluminum tape
Propylene glycol antifreeze	Shock cord in several sizes
Muriatic acid	

Create a list of all batteries and bulbs used aboard. We stow spare batteries in one large ditty bag and spare bulbs in another. We have a battery inventory on our computer that lists all the batteries used aboard and our current supply. We try to keep a six-month supply of most batteries on hand, although we keep only one spare for the calculator, watch, and camera batteries, because these do not last well.

Over time, you will develop your own list of tools and spares that reflects the complexity of your boat and systems. You will also develop a maintenance mind-set that will allow you to tackle the largest projects with confidence—if not always with enthusiasm.

CHAPTER 14
Galleywise

THE NEED FOR self-sufficiency aboard becomes obvious when it comes to provisioning. When you cross an ocean, provisioning means stocking the boat with everything you will need—from toilet paper to tomato paste, from walnuts to water—for a period of weeks. If you underestimate on the flour, you will have to live without or substitute. If you carry a limited amount of water and do not have a watermaker, you will have to use salt water for everything but drinking.

People the world over eat and drink. When you arrive somewhere you will always be able to find something from which to make a meal and some way to obtain potable water. At the same time, in tropical islands many items will be more expensive and the selection more limited than in the mainland port you set out from. If you haven't laid in a generous supply of the basics, you will have to pay a lot of money to refill the boat. If you haven't gotten enough of your favorites that are hard to come by abroad—like maple syrup or peanut butter (or Vegemite or Nutella)—you may have to do without for a long period of time.

Filling up the boat can seem overwhelming, but information makes the process manageable. You need to know how water management works on a small boat, especially if you don't intend to install a watermaker. You need to know what goods are available in paradise—and what goods aren't. You also need to know the mechanics of filling up: how to select, stow, and preserve everything—from eggs to toilet paper.

FRESHWATER MANAGEMENT

One of the major differences between a 30- and a 50-foot boat is the amount of water each can carry, which to some extent determines the quality of life aboard. Most cruisers miss having unlimited fresh water. But ashore, much of that water ends up down the drain. Voyaging teaches you that a little water goes a long way: to be happy, healthy, and wealthy aboard, you need very little water by shoreside standards.

No matter how much water you carry, water management skills will be important, and every member of your crew will need to master them. Even crews with watermakers cut consumption by more than three-quarters from shoreside levels. And if the watermaker breaks, they will have to conserve what's in their tanks until it is fixed or until they get someplace where they can fill up. Managing water well does not take that much effort. It means knowing how much water you will need, where to find it, how to judge whether to take it on board, and how to stow it and keep it potable.

Assessing Needs

According to the U.S. Geological Survey, the average American uses 80 to 100 gallons of water per day, about what most 35- to 40-foot boats can carry in their tanks. Even if you install a watermaker, you will have to learn to make do with a lot less water than you have been used to. When considering your requirements, then, don't ask how much water you will *want;* ask how much you will *need*. Decide on your standards for hygiene and health and use that to determine what your water usage will be while cruising.

Minimal Requirements

To stay healthy, high-quality drinking water must be freely available. This defines the absolute minimum amount of fresh water that any boat must carry.

Doctors recommend drinking a minimum of 2 quarts of liquid per day normally and 3 to 4 quarts in tropical climates to prevent mild symptoms of dehydration such as headaches or nausea. We each average around 2 quarts a day in cool areas, but our beverage consumption increases to close to a gallon each per day in the tropics. We drink a variety of beverages including tea and coffee, milk, soda, and juices, but water makes up from one-third to one-half of our liquid intake. You should assume an absolute minimum of 2 quarts or ½ gallon (U.S.) of fresh water per person per day for as many days as you may need to go between tank refills. (See Appendix 2 for volume conversions.)

Therefore, a couple on a trade wind circumnavigation will need to carry an absolute minimum of 25 gallons of water for drinking (assuming the longest passage of twenty-five days at ½ gallon per person per day). We have always felt it prudent to double that minimum to 50 gallons to allow for a dismasting, a defunct engine, or some other emergency. That amount should be carried as bottled water or in the boat's tanks to provide an adequate safety margin in the event watermaker water, rainwater, or other beverages are not available.

TABLE 14-1. FRESHWATER USES FOR THREE CREWS (U.S. GALLONS PER DAY)[1]

Water Use	*Simplicity*	*Moderation*	*Highlife*
Drinking	1	4	2
Showering	1/2	4	6
Dishwashing	1/4	2	4
Cooking	1/4	1/2	1
Cleaning boat	—	1/2	2
Laundry	—	1	3
Flushing toilet	—	—	2
Total	**2**	**12**	**20**
Water tankage (gal.)	60	120	200
Without watermaker, can go	30 days	10 days	11 days
Watermaker capacity	None	3.5 gph	28 gph

[1]Total daily consumption for regular crew on each boat: a couple on *Simplicity* and *Highlife;* a family of four on *Moderation*.

Usage on Passage and When Cruising Remote Areas

Beyond that, how much water you use and how you use it will depend upon how much tankage your boat has and whether or not you carry a watermaker. *Simplicity*, *Moderation*, and *Highlife* help illustrate typical water usage on different boats, as shown in Table 14-1.

Simplicity carries only 60 gallons of water and has no watermaker. Susan and Simon have to be very conservative when on passage or cruising remote areas where water is not readily available. They reserve their fresh water for drinking, washing, teeth brushing, and cooking (when salt water cannot be used). They wash their dishes in salt water, though they rinse them with fresh water, and they do the same when washing themselves. They use salt water for most onboard cleaning tasks. They minimize laundry by wearing as few clothes as possible and by waiting to wash them until there is a source of fresh water ashore, be it a stream or a hose. By being careful with their water supply, they can go thirty days between tank refills.

Moderation carries twice as much water as *Simplicity*, but she also carries twice as many people. Molly and Michael have high standards for hygiene and cleanliness, which translates into more water usage per person. To meet their needs, they have a watermaker on board, and they supplement their tank water by making 5 to 7 gallons per day. Though they work to conserve water all the time, they use fresh water for most things. On average, everyone aboard showers every other day and uses 1 gallon of water to do it. They wash dishes in fresh water, and they do laundry once a week and use about 7 gallons of water to clean the accumulated clothing. Using this amount of water, they can go twenty-four days without refilling their tanks. With a bit of conservation, they can go a month.

On *Highlife*, fresh water gets used for everything, including flushing the toilet and washing down the decks. Yet her crew of two uses only about 20 gallons per day, one-quarter to one-fifth of what they would use ashore. Their conservation measures are largely built into the fit and fittings on the boat; appliances, faucets, and toilets are all designed to minimize water usage.

Their watermaker is absolutely critical to maintaining their lifestyle. Without a watermaker on board, their range would be limited to about ten days of cruising. With guests aboard, their range would fall to half that. But as long as the watermaker is running, they never need to fill up from ashore.

Usage in Port or When Coastal Cruising

In port or while coastal cruising when water is readily available, most cruisers more than double their usage

DO YOU NEED A WATERMAKER?

Don't fall into the trap of assuming you have to have a watermaker. They are expensive to buy, install, and fix. They take up a good deal of stowage space and break down more frequently than any other piece of equipment aboard (refer back to Table 8-8). Yet it can be very difficult to resist the advertising hype when you don't know how much water is enough. Our water situation aboard *Silk* and *Hawk* may help frame the discussion for you and your crew.

Silk carried 100 gallons of water in two 50-gallon tanks, a typical arrangement for an offshore boat in the 40-foot size range. On passage, we used between 1 and 2 gallons per day per person. To help us conserve water, we had a manual freshwater system and a saltwater pump in the galley. Though we had pressure water aboard, we used it only in port when water was plentiful. On average, each of us drank 1/2 gallon of water, some in the form of lemonade or ice tea, and used 1/2 gallon for showering (we each used 2 quarts every other day). An additional 1/2 gallon would be used for everything else—from brushing our teeth to rinsing dishes. We washed dishes in salt water and lightly rinsed them in fresh. When it rained, we topped up our tanks first and used extra water for additional showers and laundry. Based on our capacity and usage, we never went through more than one of our 50-gallon main tanks between tank refills.

The only place where a lack of water affected our planning was in the Tuamotu Archipelago in the Pacific, coral atolls where the local population lives off rainwater. We were there in the dry season, so there was no rain and no extra water to be had. We would have cruised the Tuamotus for another couple of weeks if we had had more tankage or a watermaker, but even so we got to spend a month in those lovely islands.

We carry 200 gallons of water aboard *Hawk*. Without making any efforts at conservation, we can go six weeks between tank refills. That translates to a total usage of just under 5 gallons per day or 2 1/2 gallons per person. On our sixty-day Southern Ocean passage, we carried separate drinking water in plastic containers in the icebox. We carefully conserved tank water, and we still had 75 gallons at the end. During that period, we used a bit over 2 gallons per day or 1 gallon per person.

We have never felt deprived without a watermaker, nor do most people we know who have chosen not to carry one. The cost, maintenance, and hassles we have avoided keep us from even considering putting one aboard.

A cruising boat should be able to go thirty days between freshwater refills, which translates into between 75 and 150 gallons of tankage for a couple. If your boat carries 35 gallons or more of water per crewmember, you may want a watermaker, but you probably don't need one. You may actually *need* a watermaker if any of the following apply:

- You plan to have more than two crewmembers aboard for most passages, and your boat carries less than 150 gallons of water.
- You will be spending six months or more cruising areas with very little rainfall where water is hard to come by, such as parts of Mexico, the Bahamas, or the Tuamotus.
- Your boat is too small or light to carry more than 35 gallons of water per crewmember without compromising safety (on a small boat, carrying a 1.5 gph watermaker that can be operated manually will give you an easy-to-stow—but expensive—backup).
- You have a life raft aboard and want to carry a watermaker for emergencies (see the Abandoning Ship section in Chapter 7).

Otherwise, the question becomes whether or not you *want* a watermaker. But remember how much maintenance and complexity it will add. If you think there's any chance you can do without, save yourself a couple thousand dollars and give it a try. You can always add one later.

aboard as well as using a fair amount ashore. Overall, we average between 2 and 3 gallons per day per person from our boat tankage just as we do when cruising more remote areas. But we also use between 5 and 10 gallons ashore per day for showers and laundry. Our water usage is about the same sitting in a marina, cruising coastwise, or doing limited offshore passages in developed countries such as New Zealand, Australia, Scotland, and Ireland.

Getting It Aboard

When you are coastal cruising and your tanks start to get low, you pull out the cruising guide and look for a fuel dock or a nearby marina. After tying up, you set up your own hose or use the marina's, turn on the spigot, and wait for that satisfying boom. You will not have the same convenience when offshore voyaging. In the 8,000 nautical miles between Panama and New Zealand aboard *Silk*, we never pulled up to a dock and took on water. In a handful of places, there were fuel docks where we could have gotten water. But given the condition of the dock, we preferred to use other sources.

When there's no fuel dock, what are your alternatives?

Refilling

In many small islands such as Niue in the Pacific, Christmas Island in the Indian Ocean, and St. Helena in the South Atlantic, the only way to get water out to the boat is to fill plastic jugs and ferry them out to the boat in the dinghy. Voyagers carry lots of plastic jugs for just this purpose.

Consider the strength of each crewmember when selecting water jugs. Large (5- or 6-gallon) containers reduce the number of trips, but they are too heavy for children or anyone with back problems. Three-gallon plastic jugs are easier to carry, handle, and stow, but you will have to make a few more trips. Collapsible jugs are easy to stow, but they are harder to carry and can rip. Whatever jugs you select, when you need to fill the tanks, empty the jerry jugs, rinse them lightly with a mild Clorox solution, and let them air out for a few hours. Pooling plastic containers among several yachts will speed up refilling. However, be sure that any jugs you borrow are clean before using them to fill your tanks.

After taking the containers ashore and filling them, the hardest thing is transferring them from the dinghy up to the deck of the boat. A block and tackle that can lift the outboard motor can also be used for jerry jugs. Alternatively, a block and tackle off the end of the boom or a halyard can be used to hoist the heavy containers on board.

We often top up our tanks this way when coastal cruising rather than going into a fuel dock. If we're regularly going ashore to a dinghy dock with a spigot, we'll bring a jug with us each time we go ashore. This way the tanks stay topped up without having to spend several hours all at once filling them.

Rain Catching

Catching free water from the sky is like getting free power from the sun. Unfortunately, it happens less frequently in the tropics than we had expected—we were surprised by how seldom it rained at sea or near low-lying tropical islands. Outside of the doldrums, we often went weeks without rain. On *Silk*, we filled our tanks this way less often than we filled them using jerry cans and the dinghy or a hose at the dock. In the high latitudes, it rains much more frequently, and rain catching has been our primary means of filling our tanks aboard *Hawk*.

Even if you have a watermaker, you should go through the exercise of figuring out how you could catch rain aboard your boat. The knowledge may come in handy if the watermaker ever packs it in while on passage or in a remote anchorage far from spare parts and FedEx. We enjoy the simplicity, ease, and elegance of rain catching, as well as the feeling that we're getting something for nothing.

You do need to be cautious of contamination when catching rainwater, unless you are far offshore. Many islanders raise sugarcane and burn the cane stalks to clear the fields. Rain can carry ash that will contaminate your tanks. In the Canary Islands and the Red Sea, rain often carries red dust from the nearby desert. Downwind of large urban centers, rainwater may smell or taste questionable and may contain harmful pollutants. We catch all the rain we need on passage, in remote islands, and in most of the places we have sailed in the high latitudes, but we are careful in developed countries and in areas that are sandy or where sugarcane is cultivated.

Whatever system you use for rain catching, it must be efficient, self-tending, workable at sea and in port, and able to stand up to windy conditions. Ideally, it will also keep you from getting wet. You will find the best way to catch rain on your boat through trial and error, but most crews end up trapping rain on the side decks or catching rain in canvas.

The most efficient way to capture the largest volume of water is to use the entire surface area of the boat. Although this seems obvious, making it work may require some minor modifications.

Deck fills mounted flush on the side decks are ideal for efficient rain catching. We had this arrangement on *Silk*, and after getting accustomed to the ease of this solution, we made sure to incorporate it on *Hawk*. At sea or in remote ports, we keep the decks clean with frequent saltwater scrubs. The first 10 minutes of heavy rain rinse off the salt. Then we dam off the decks with towels just aft of the deck fills and open the deck fill. In a heavy downpour, we take on several gallons a minute.

On boats where the deck fills are not flush-mounted on the decks, this method cannot be used. It is also problematic on boats with teak decks because small amounts of wood inevitably end up in the tanks. Both of these problems can be solved if you have scuppers that drain the decks. A Y-valve plumbed into the hoses that drain the deck scuppers can be used to divert the scupper water through charcoal filters into the water tanks. Rather than going out in the rain and opening the deck fills, these

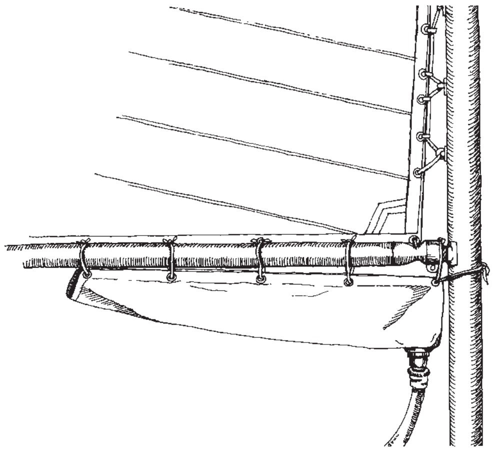


Figure 14-1.
A canvas catcher under the gooseneck and plumbed to the tank fill will be able to capture much of the rain hitting the surface area of the mainsail. (Lyanne Schuster illustration)

crews turn the valve from below and fill their tanks with filtered rainwater.

If the boat is heeled over or if waves are reaching the deck, we risk getting salt water into our tanks when trying to trap rain on the side decks. In these conditions, we rely on canvas. The canvas of the main or mizzen sail provides a sufficiently large surface area for catching rain. A canvas catcher hung under the boom can be used to trap water coming off the sail (Figure 14-1).

Our catcher consists of a 4-by-4-foot square of canvas with grommets at the corners and along two edges. One end is reinforced with a vinyl patch with a nylon through-hull fitting installed through it. To catch rain, we tie the canvas under the boom so that water is directed into the through-hull. Raising the end of the boom with a halyard or the topping lift facilitates water collection. We either fill jerry jugs directly from the through-hull or connect it to our deck fills using a length of hose.

Many cruisers have success using a large harbor awning for rain catching, but we found this method difficult to rig so that more than a small section could catch water. Our 4-by-4-foot square in conjunction with the mainsail did as good a job as the harbor awning on *Silk*. You can never have too many ways to catch water, though, so equip your harbor awning with a removable through-hull and experiment.

Watermaking

If you are considering adding a watermaker, research the available brands, which change rapidly and vary widely in reliability. Make sure to compare warranty information. Find out if they have repair facilities worldwide and if the documentation that comes with the system is complete. Ask how the system is flushed and cleaned and how the membranes are preserved. Try to get some history on the repair record of each of the components. Talk to cruisers who have them aboard and review *Practical Sailor* magazine and the Seven Seas Cruising Association Equipment Survey for unbiased information on different brands.

To minimize the complexity of the system and maximize your enjoyment of the water it produces, you need to size it adequately for your daily demand. Based on the Assessing Needs section above, you should already have some sense of how much water you will need to produce. Most cruisers on boats equipped with high-output watermakers use between 5 and 10 gallons of water per day per person. If you plan on having a dishwasher and clothes washer aboard, you will be at the top of that range. Bear in mind that you will need enough tankage to stow the water you make, especially if you want to maintain your standard of living in a port where you can't run the unit for a week or two.

Given the amount you want to be able to produce in a day, you can't make the logical leap to watermaker capacity without considering some of the realities of how the reverse osmosis process actually works aboard a boat. Manufacturers' rated capacities are generally given in gallons per day, but few watermakers are made to operate around the clock. As a first step, convert the rated capacities to gallons per hour and look for a watermaker that can produce the water you want in an hour or two of operation per day.

No watermaker performs up to its rated capacity in all conditions. Your actual capacity will be determined by the following:

- **Feed water temperature.** Most manufacturers' rated capacities are based on a feed water temperature of 77°F. If the actual temperature is 56°, capacity will be reduced by about 25 percent. Don't boost the temperature of the feed water by passing it through an engine heat exchanger. Even a pinhole in the exchanger will allow enough antifreeze to reach the watermaker membrane to destroy it.
- **Membrane condition.** Membranes become less efficient with age. An older membrane can reduce capacity in the system by 20 to 25 percent, but not be old enough to justify replacement.
- **Salinity.** The watermaker will be less efficient in saltier water.

These factors can combine to cause a 50 percent variance in your watermaker's actual performance compared to its rated capacity. In addition, you will want to be able to meet the extra demand if you have guests aboard. Make sure the watermaker you install is a bit oversized so it will meet your requirements in all situations.

The complex membranes are the heart and soul of any watermaker. They can be destroyed by trace amounts of fuel, chlorine, oil, and even bacteria. Oil droplets can be churned under in harbors, so if the boat is rolling, contaminants on the surface can reach the intake. Therefore, do not use the watermaker in harbors with freighter traffic, large numbers of other boats, or a sewage discharge.

The longevity of watermaking equipment depends in part on how well it was installed. The reverse-osmosis pressure pumps are sensitive to vibration and will wear excessively if not installed properly. The intake needs to be as far below the waterline as possible to avoid contamination by oil or diesel floating on the surface of the water. Even a mechanically adept person will require a minimum of 30 hours to install one of these units. Get some professional advice before beginning the project.

Keeping It Potable

To get good water out of the tanks, you have to put good water into them. If contaminated water ever gets into your tanks, you will have to thoroughly disinfect them. In many areas, that will not be possible for weeks or even months. To be sure that algae and bacteria don't get a foothold, most people treat their tank water. Over time dust, dirt, and other residue will collect on the bottom of the tanks. That residue needs to be cleaned out periodically to keep the water potable.

Deciding Whether or Not to Take It Aboard

The quality of local water is well known within the cruising community. Upon arrival in Vava'u in Tonga, every new crew was warned that, though potable, the water from the fuel dock smelled and tasted like sulfur. In the Cocos Islands in the Indian Ocean, word passed from boat to boat that the cistern that stored rainwater was full of mosquito larvae. Upon entering a new harbor, cruisers aren't referring to swimming when they ask other voyagers, "How's the water?"

The Seven Seas Cruising Association bulletins and local cruising guides offer warnings where water is suspect. But check with people who are there. In the few places where information is scarce, ask where the water comes from. If it is from a desalination plant, a well, or a deepwater spring, you should have little concern over its quality. If it is coming from a cistern or island runoff, avoid it. Water in cisterns tends to be untreated and harbors small critters that will play havoc with your digestion. On most islands, streams and rivers serve as laundromats and bathrooms. They are often contaminated by human and animal waste. Even if the locals have no problem with the water, you probably will.

Smell and taste the water before putting it in your tanks. In some places, potable water carries strong odors that can create a horrible stench difficult to remove from the freshwater system. In other places, the water tastes so good you'll want to fill every available container. If you are the least bit concerned about water quality, put it in your secondary stowage areas and avoid filling your main tanks. Water questionable for drinking is still fine for showers, laundry, and cleaning the boat.

Treating Water

You don't need to treat bottled water or tap water if you are certain of its quality. If you reuse bottles, they should be thoroughly disinfected between uses and discarded when the bottle starts to discolor.

Almost everybody treats their tank water with Clorox bleach, but cruisers disagree over exactly how much bleach to use. Various sources recommend anywhere from 2 to 24 ounces of 4 to 6 percent chlorine solution (Clorox is 5.5 percent) per 100 gallons of water. We find that anything over 8 ounces leaves a strong chlorine taste, which does not dissipate for up to a week. On *Silk*, we used between 4 and 5 ounces per 100 gallons. This did not leave any residual taste or smell after a day or two, and it kept the water free of algae for months. For water stored on deck for showering, we used 1 ounce per 5-gallon container. Otherwise, algae grew within a period of days.

Do not use bleach products with perfumes or deodorizers, and be careful of the different strengths of chlorine products available. Half a teaspoon of swimming pool chlorine is the equivalent of 7 ounces of Clorox in 100 gallons of water.

Like many chemicals, chlorine attacks aluminum. Don't treat your water with chlorine if you have aluminum tanks. We have never treated the water in *Hawk*'s tanks, and we've never had a problem with bacterial growth. However, we have spent most of our time cruising in cold climates. In the tropics, we would use one of the water purifying products sold by marine chandleries for use in aluminum tanks if we were ever uncertain of the water.

Filtering Water

An activated charcoal filter between the tank and the tap will remove any residual chlorine or tank taste. If you have someone on board who is finicky about water, install one of these filters or rely on bottled water for drinking. If you decide to install a filter, you'll need to find stowage space for the spares as they can be difficult to locate in foreign countries. Many crews use the activated charcoal filters that can be purchased at hardware stores, which are much cheaper than the marine equivalent. They last only a few months as opposed to the year or so for the marine version, but the overall cost is still lower. Make sure to stock plenty of extra cartridges, O-rings, and a wrench that fits the filter. Install the filter in an accessible place so you can change the cartridge easily.

More expensive filters such as the Seagull drinking water system remove more contaminants and offer great-tasting water. If you choose to install one, run it through a separate faucet and use it only for drinking water. Not only will that preserve the filter, but it will also keep the slow flow rate from frustrating you when you're doing dishes. The filters can be installed with a manual pump supplied by the manufacturer if you don't have pressure water, but that doubles the cost.

Keeping Tanks Clean

You will store the bulk of your water in your boat's main tanks. Ideally, this stowage will be divided into two or more tanks. Stowing water in multiple tanks ensures that you will not lose all your water if a tank ruptures or becomes contaminated. If your boat has only one main storage tank, add an additional tank somewhere or carry plastic jugs with extra water for use in an emergency.

Track your usage until you get a handle on how much water you use per day when in conservation mode and when using all the water you want. Develop a system for measuring the water left in each tank. Fancy gauges are easy to use, but an old-fashioned dipstick inserted into the inspection hatch works just as well and will never break.

If your boat has multiple tanks, you will want an easy way to switch between tanks, tell which is in use, and equalize the tanks. Before you leave, empty your tanks and then fill them with 5-gallon jugs to determine your usable tank capacity. On many boats, the last few gallons are below the level of the outflow fitting. At the same time, you may want to mark a dipstick at each 5-gallon increment. Once you determine how much water you really have available, you can decide if you need additional capacity. Flexible tanks are easy to install and can be fit to just about any moderately large compartment that is low in the boat.

No matter how clean the water appears, suspended particles will work their way out of the water and down to the bottom of your tank. Over time, this process will create a sludgy residue. To minimize this aboard *Silk*, we shock-treated our tanks once every six months or so when we had plenty of water available. When both of our 50-gallon tanks were down to the last 10 to 15 gallons, we put 6 or 8 ounces of Clorox in each tank to kill everything inside. We let that mixture sit for a few hours and then emptied the tank as completely as possible. Then we half-filled the tank and pumped it out again. After flushing the tank three or four times, the water coming out no longer smelled like a laundry. We then refilled the tanks with clean water without adding any bleach. The residual amount kept the water clean until we filled our tanks again. The bleach smell dissipated within the next day or so. If it didn't, we did one final flush. On *Hawk*, we flush the tanks about once a year without using chlorine because of her aluminum tanks.

Marine chandleries sell several products for treating and cleaning freshwater tanks. Make sure they are compatible with your tank material before using them.

FOOD AND STORES MANAGEMENT

People the world over eat, and exploring exciting and exotic culinary delicacies is one of the joys of traveling. Outside of these forays, most cruisers tend to eat much as they did ashore. If you have a "meat and potatoes" family, you'll return to those staples time and again. If you have always preferred vegetarian dishes with lots of pasta and rice, you'll tend to eat the same way aboard. Provisioning, then, should be done in such a way that you have the basics you are used to and will need, while giving you opportunities to experiment and experience new things.

Food management starts by knowing what you'll be able to get where and then provisioning strategically, using the time-honored tips and tricks passed from cruiser to cruiser on how to preserve food and keep it usable for as long as possible. A variety of specialized skills such as bread baking and sprouting will help minimize spoilage and maximize variety.

Provisioning Basics

What you need to bring depends on what you will find along the way. Different types of ports will stock different things, and you'll soon learn where to buy fresh produce and where to buy canned goods. In addition to knowing where to fill up, it pays to know where to arrive with an empty boat. Prudent provisioning means limiting the amount of food you lose when you reach a country with strict quarantine laws. Finally, when faced with a boat full of empty lockers and trying to figure out how to go about systematically filling them all, it helps to have a procedure for determining what you need and keeping track of everything as you go along.

What's Available Where

Almost every island or remote area has one village where the local people gather to sell their produce. We supplement our ship's stores with fresh fruits and vegetables and freshly baked bread from these market villages. Every few months, we arrive at a regional center, often a major port city, with a wider range of goods; here we can buy basic foods for reasonable prices. But luxuries such as exotic spices, prepared meals, sweets, and snacks are often unavailable or expensive. Most trade wind voyagers spend the tropical storm seasons in mainland towns in New Zealand, South Africa, Australia, Thailand, or the Mediterranean. Here they fill the boat in preparation for another season cruising in more remote areas. Table 14-2 offers some rough guidelines on what you can expect to find in these different types of provisioning ports.

The more developed an area is for boating and tourism, the more variety you will find in the smaller provisioning ports. In the Caribbean, for instance, it is possible to find just about anything you might want in the smallest village on an island like Grenada or Antigua. However, you will pay a significant premium to obtain it over what you would pay in the largest town on the island; and you will pay more in the largest town than you will in the best Caribbean provisioning ports like Philipsburg in St. Martin or San Juan in Puerto Rico.

Market village basics. Only in a few places—such as Suvorov atoll in the Cook Islands, tiny Minerva and Beveridge reefs in the Pacific, and Chagos Archipelago in the Indian Ocean—will you find no population and nothing ashore except coconuts and crabs. Everywhere else, there are villages with people who survive on what can be produced locally and what is brought in by supply ship or by truck.

Places such as Puerto Eden in Chile, the only settlement along the main route up the west coast of Chile, and small villages in the more remote parts of Newfoundland or in the Outer Hebrides in Scotland have limited provisions very similar to those available in small villages on tropical islands. Almost every remote area and almost every island we have visited had a small town with a market where all the locals brought their produce.

Markets in the higher latitudes often carry local apples, cucumbers, green peppers, lettuce, or berries, depending on the season. In tropical climes, we could get coconuts, bananas, tomatoes, carrots, lettuce, and fresh ginger if we arrived early on market day. If the island had an average amount of rainfall we would find cassava, taro, cucumbers, green peppers, pineapples, and watermelons. We often bought succulent lemons that looked like small limes and were orange inside. Occasionally, we found pamplemousses, the delicious softball-sized, green grapefruit of the Pacific islands.

Throughout the Pacific islands, we found less fruit in less variety than we had expected. On arid islands like the Tuamotus, even bananas cannot grow. Much of what is available elsewhere is seasonal.

In addition to the market, look for the village bakery. As you travel from the Azores to the Caribbean, from the Tuamotus to Fiji, from Mauritius to St. Helena, just about every village has a bakery that supplies fresh bread six days a week. Most villages also have a store of some sort. Most of the products are shelf-stable and quite pricey. Canned goods usually form the backbone of the stock (Figure 14-2), though increasingly even small villages have some freezer and refrigerator cases. In almost any small village you will also be able to find potatoes and onions, eggs, rice, pasta (usually spaghetti), ramen noodles, crackers, corn oil, tea, sugar, and shelf-stable dairy products including tinned butter (which is delicious). In the Pacific islands, most of these staples are subsidized, so they are quite inexpensive.

The store will also have yeast and flour. But since everyone buys their bread from the bakery, the flour is often weevily or moldy and the yeast so old it will not prove. When we could, we bought flour and yeast from the bakery. Otherwise, we bought small quantities from the store, inspected them carefully before bringing them aboard, and used them up quickly.

If a supply ship has recently come in, you may find any number of other items such as imitation Rice Krispies or Corn Flakes, cookies, UHT (ultra-high-temperature) milk, and poor-quality paper towels. When available, such things are expensive (two to three times U.S. prices).

Although frozen meat is becoming more common as freezers work their way into these small village stores, don't expect to find fresh meat unless the local chief slaughters one of his pigs for a feast. Fresh fish or shellfish can almost always be acquired by approaching the local fishermen or asking for permission to fish yourself.

Using the provisions available in any market village, you can make basic, nutritious—though often starchy—meals. Rice, pasta, and potatoes cooked with canned tuna or corned beef and flavored by a good dose of spices can provide enough variety for many weeks. With bakery bread, homemade bread, and eggs you can concoct a half-dozen breakfast variations. Fresh fruits and vegetables add some interest and variety. Where fresh is not available, you can almost always purchase canned. The meals you serve made from basic island foods will not put you on the cover of *Gourmet* magazine, but they will provide a healthy diet for you and your crew.

Regional center provisions. Almost every island group has one large port, usually where yachts must clear customs: Suva in Fiji, Nuku'alofa in Tonga, Papeete in Tahiti, Las Palmas in the Canaries, Horta in the Azores. These ports offer an array of goods beyond what is available in the smaller villages (see Table 14-2). Though we could find most things on our provisioning list in these places, imported goods may cost as much as 30 percent more than in the nearest mainland port. To keep food costs under control, we limited our provisioning in the regional centers to reasonably priced local items and to things we couldn't do without.

TABLE 14-2. PROVISIONS NORMALLY AVAILABLE IN DIFFERENT TYPES OF PORTS

Category	Products	Market Village	Regional Center[1]	Mainland Town[1]
Dairy products	• Shelf-stable • Refrigerated	• Tinned butter or margarine • Kraft processed cheese (Velveeta) • Canned parmesan cheese • Limited range of cheese, yogurt	• UHT milk, dried milk • Processed cheese • Cheese • Yogurt • Butter, margarine	• Full variety • Full variety
Meat and eggs	• Canned • Fresh/frozen • Dried	• Corned beef • Ham/Spam • Tuna in oil • Eggs—$$[2] • Frozen hamburger, chicken	• Tuna and other fish (in oil) • Seafood (smoked mussels, oysters, etc.)—$$[2] • Ham—$$[2] • Other meats—mutton, beef • Eggs • Full range of fresh and frozen meat • Pepperoni, sausage, etc.	• Tuna in water • Chicken or turkey in water • Full variety • Beef jerky
Prepared meals	• Canned • Freeze-dried		• Soups, baked beans, spaghetti	• Stews, chili, ravioli, etc. • Pasta or rice packet meals • Full range of camping meals
Cereal/grains	• Cereals • Flours • Pasta	• Rice • White flour • Spaghetti • Ramen noodles	• Breakfast cereals—$$[2] • Oatmeal, Cream of Wheat • Whole wheat flour • Macaroni, fettuccine, linguine, etc.	• Full variety • Rye flour • Cornmeal
Vegetables	• Fresh • Canned • Freeze-dried	• Onions, potatoes • Lettuce, tomatoes, carrots • Beans, corn	• Cassava, taro • Cucumbers, green peppers • Asparagus, water chestnuts—$$[2]	• Full variety • Full variety • Beans, peas, mixed vegetables
Fruits	• Fresh • Canned • Dried	• Bananas, coconuts, pineapples, lemons, ginger • Peaches, pears (in sweet syrup)—$$[2]	• Apples, oranges, breadfruit, mangoes, papayas, pamplemousses, watermelons • Fruit cocktail (in sweet syrup) • Raisins, figs or dates—$$[2]	• Full variety canned in natural juices • Full variety
Baking needs	• Basics • Sweeteners	• Flour, yeast • Corn oil • Basic spices • White sugar	• Olive oil • Baking powder, baking soda • Bisquick • Cocoa • Honey	• Exotic spices—cumin, coriander, nutmeg, etc. • Prepared mixes—cakes, bread, muffins, etc. • Brown sugar • Baking chocolate, chocolate chips
Snacks	• Munchies • Crackers/cookies • Candy	• Digestive biscuits	• Popcorn • Potato or corn chips • Peanuts, other nuts • Fancy crackers • Packaged cookies • Hard candy • Cadbury candy bars	• Full variety • Saltines, graham crackers • Pop-Tarts, granola bars • Full variety
Other foods	• Garnishes/condiments • Sandwich makings	• Mustard, mayonnaise, ketchup	• Pickles, olives • Jelly or jam	• Relish • Applesauce • Peanut butter

(continued)

[1]The items shown are in addition to those listed in the previous columns.
[2]$$ = expensive.

TABLE 14-2. PROVISIONS NORMALLY AVAILABLE IN DIFFERENT TYPES OF PORTS *(CONTINUED)*

Category	Products	Market Village	Regional Center[1]	Mainland Town[1]
Beverages	• Cold drinks • Hot drinks • Alcohol	• Black tea	• Soda, drink mixes, juice • Herbal tea, coffee • Beer, wine—$$[2] unless duty free • Hard liquor—$$[2] unless duty free	• UHT juice • Hot chocolate mix • Full variety
Nonfood items	• Batteries and bulbs • Toiletries • Paper goods		• Alkaline batteries—AAA to D • Calculator, watch, camera batteries—$$[2] • Suntan lotion • Toothpaste, dental floss • Feminine products • Paper towels, toilet paper (poor quality) • Garbage bags, plastic bags	• Flashlight bulbs • Deodorant • Veggie storage bags • Zip-top bags • Heavy-duty aluminum foil

[1]The items shown are in addition to those listed in the previous columns.
[2]$$ = expensive.

All the small island villages bring their best produce to the big market in the major port city. In these ports, therefore, you will find much greater variety and much higher quality than in the villages. Suva, on the big island of Viti Levu in Fiji, and Papeete on Tahiti boast fabulous markets offering mangoes, papayas, breadfruit, lemons, limes, oranges, watermelons, pineapples, coconuts, bananas, pamplemousses, guavas, and a full assortment of vegetables (depending on the season). Similarly, all the small farmers in Chile and Ireland and Scotland bring their best produce to the largest town in the area. When we wintered in Puerto Montt in Chile, vendors hawked fresh carrots and apples out of wheelbarrows on every street corner, and in the produce market behind the U.S.-style supermarket we could find everything from oranges to kiwis.

Figure 14-2.
Canned goods often make up the bulk of the inventory even in well-stocked village stores.

Near the market, you will find a street lined with small bakeries, butcher shops, pastry shops, and other specialty stores. The butchers offer a surprising array of relatively inexpensive, high-quality fresh meat. Western-style supermarkets are increasingly common in many of these ports, but the best prices and highest quality are often to be found in the market and the small specialty stores.

Throughout the world, the French islands offer a fantastic selection of imported French products, but the prices will quickly break most voyagers' budgets. Yet many staples, such as bread, pasta, dried milk, flour, and rice, are subsidized. By stocking up on only these staples and locally grown produce, you can cruise quite frugally throughout French Polynesia and in other French territories in the Indian Ocean and the Caribbean.

Mainland town luxuries. To find the luxuries in Table 14-2 at an affordable price will mean waiting until you reach a port for hurricane season: New Zealand, Australia, Singapore, the Mediterranean, South Africa, and the United States. Even in these mainland ports, however, you will not find some of what you may consider staples. Fat-free, sugar-free, low-sodium, and low-cholesterol products can be difficult to find anywhere. For those who are diabetic or have other dietary restrictions, these items must be provisioned before you set off and replenished when you visit home.

Exchange rates make it difficult to generalize about how prices compare from one country to another. But prices tend to be pretty consistent from place to place in the United States and Canada with the exception of the most remote parts of Labrador and British Columbia. European prices vary a great deal, from country to country and from village to city. European prices are generally somewhat higher than U.S. prices, with southern Europe being less expensive than northern Europe. Scandinavian

TABLE 14-3. ISLAND PROVISIONING PORTS

Area	Port	Selection	Prices	Comments
North Atlantic	Las Palmas, Canary Islands	Excellent	Moderate	Top up boat for Atlantic crossing
Caribbean	Puerto Rico	Excellent	Inexpensive	U.S. goods at U.S. prices
	U.S. Virgin Islands	Excellent	Moderate	
	St. Martin	Excellent	Inexpensive	
	Grenada	Good	Moderate	If not stopping in Venezuela, can use to provision to Panama
Pacific	Pago Pago, American Samoa	Excellent	Moderate	Located halfway across Pacific
	Guam	Excellent	Moderate	U.S. goods at U.S. prices
	Suva, Fiji	Excellent	Moderate	Spot provisioning before heading to New Zealand/Australia
	Papeete, Tahiti	Excellent	Very expensive	French island—stick to subsidized staples for best buys
	Rarotonga, Cook Islands	Good	Expensive	
	Nuku'alofa, Tonga	Good	Expensive	
Indian Ocean	Galle, Sri Lanka	Good	Moderate	
	Port Louis, Mauritius	Excellent	Moderate	Best provisioning port in southern Indian Ocean
	Saint-Denis, Réunion	Excellent	Very expensive	French island—stick to subsidized staples for best buys
South Atlantic	St. Helena	Good	Moderate	

prices are the highest. Spain and Portugal offer the least expensive provisioning, and duty-free Gibraltar remains the best place to fill a boat for the Atlantic crossing.

Strategic Provisioning

Strategic provisioning means buying food where it is least expensive and not arriving in port with food that might be confiscated. Tables 14-3 and 14-4 compare prices and selection in various island and mainland ports. For up-to-date information, check the Seven Seas Cruising Association bulletins and cruising websites. But the overall situation changes slowly. Our list of the best provisioning ports closely matches that of friends who circumnavigated twenty years ago.

Most of the time, the quarantine inspections consist of a cursory check. But in a few places, quarantine is a

TABLE 14-4. MAINLAND PROVISIONING

Area	Country	Selection	Prices	Comments
Mediterranean	Gibraltar	Excellent	Moderate	Best selection and prices in the Med
Caribbean	Florida	Excellent	Inexpensive	Worth a run across the Gulf Stream before spending the season in the Caribbean
	Venezuela	Excellent	Moderate	Getting more expensive, but less costly than Caribbean
	Panama	Excellent	Moderate	Imports somewhat pricey, a good place to provision for the Pacific
Pacific	New Zealand	Excellent	Moderate	Bulk stores offer good prices and no packaging
	Southern Australia (Sydney, Brisbane, Adelaide, Perth)	Excellent	Moderate	
	Northern Australia (Cairns to Darwin)	Good	Expensive	Most produce (including eggs) has been refrigerated and shipped—spoils quickly
Indian Ocean	Singapore	Excellent	Inexpensive	Best provisioning stop before heading to the Red Sea
	Phuket, Thailand	Good	Moderate	
	Salalah, Oman	Excellent	Moderate	Good stop before the Red Sea
	Durban, South Africa	Excellent	Inexpensive	
South Atlantic	Cape Town, South Africa	Excellent	Inexpensive	
	Brazil (Rio de Janeiro, Natal)	Good	Moderate	Used to be least expensive place in the world; prices now comparable to U.S.
	Argentina (Buenos Aires, Ushuaia)	Excellent	Inexpensive	Since collapse of the currency, prices best in region

serious business. If you arrive with problem provisions, you could lose stores intended to get you across an ocean. The SSCA bulletins and cruising websites provide updated information about quarantine issues by country.

Almost all countries confiscate fresh produce and anything that can sprout—beans, seeds, and so on. Australia and New Zealand go far beyond this. They take honey, eggs, fresh milk, and other dairy products. In some cases, frozen meat is confiscated. Meats canned in South America and any home-canned foods are taken. Other canned food, as long as it does not contain meat, is rarely touched. A wide variety of other things may be confiscated, including teas containing citrus, powdered milk, mayonnaise, and other products containing eggs. Check the websites for Australian and New Zealand customs before provisioning for your passage to these countries.

At the Australian territories of Christmas Island and the Cocos Islands in the Indian Ocean, the same restrictions apply. If you leave Australia, visit Indonesia, and return to Christmas Island, be prepared to go through the whole process again.

On most islands, quarantine officers focus on alcohol. In Fiji, anything over one bottle per person was taken and returned at checkout. In other countries, alcohol was sealed in a locker. Cruising websites and the SSCA bulletins provide current information.

Starting from an Empty Boat

So where do you start when the boat is empty and an ocean awaits? Cruisers develop their own methods over time. This section walks you through the provisioning process we went through when we left New Zealand to sail 8,000 nautical miles kitty-corner across the Pacific to British Columbia aboard *Hawk*.

On this voyage, we planned stops in Raevavae in the Austral Islands south of Tahiti and in some of the atolls in the Tuamotu Archipelago—remote islands where we would find little beyond the village market basics. We expected to reach Hawaii two months after leaving New Zealand. Although we knew we would be able to find anything we needed there, we also knew it would be significantly more expensive than in New Zealand. None of these islands have serious quarantine restrictions, so our strategy was to fill the boat in New Zealand and use those provisions for the three months it would take us to reach British Columbia.

OBTAINING PROPANE

Many cruisers worry about obtaining propane and wonder how much they should carry. In most of the world, propane is easy to come by, and filling tanks is straightforward. In New Zealand and Australia, the tanks are filled from a pump using a nozzle like the one used for gasoline in a car. On most islands and in many developing countries, the local people rely on propane for cooking and for heating. In major ports like Papeete in Tahiti and Port-des-Galets in Réunion, we took our tanks to the natural gas facility in the port where gas was offloaded from tankers. They filled them for free or for a small fee.

The only places where we have heard of problems in obtaining propane are in the States and in parts of Europe. In the United States, the issue has to do with safety requirements for propane tanks. If the tank does not meet the latest requirements, no one will fill it. If you plan to cruise for any length of time along the U.S. coasts, you will want to purchase tanks that conform to the safety standards.

In Europe, propane is sold in camping gas bottles, and bottles are exchanged when empty rather than refilling the same bottle over and over. Most marinas in major yachting centers will have some way to fill tanks, but it may take a few days. In a few places, you may have to set up a gravity feed to transfer the gas from camping gas tanks into your boat's tank. Finding out where propane is available and planning ahead will save you from this eventuality.

In some places, butane is substituted for propane. We noticed no difference in cooking. Butane burned a bit dirtier and left black marks on our pots and pans, but they came off with Soft Scrub.

On *Silk*, we had two 10-pound tanks aboard; each lasted for six to eight weeks when cooking two meals a day and baking bread every few days. We never had a problem refilling our tanks, and we never had an issue with fittings. On *Hawk*, we have two 20-pound tanks. We tend to cook three hot meals a day in the higher latitudes, but we still go a minimum of six weeks on each tank.

If your tanks are rusty, repaint them. Some places will refuse to refill rusting tanks for fear that they are structurally unsound.

We had been in New Zealand for almost nine months when we reached Dunedin on the southeast corner of the South Island. We planned to spend about three weeks there before heading off across the Pacific. We started by taking an inventory of everything left on the boat—not just food items but also batteries, lightbulbs, cleaning supplies, toiletries, paper goods, and plastic bags. We went through every locker and examined every can and package. We discarded any cans that were dented or looked rusty. We checked the dates on the pharmaceuticals in our medical kit and decided if they needed to be replaced. We looked at the expiration dates on all batteries and tested any that were suspect. We threw away all spices older than three months.

During our inventory, we made two lists. Our master provisioning list consisted of the items we needed to buy, with rough amounts. Our master menu guide included all the meals we could cook from what we would have aboard. This offered instant ideas when nothing came to mind for dinner and told us what was available without tearing apart our lockers. But most important, this list formed the basis for the next round of provisioning. When we ate the last can of clams, linguine and clam sauce got crossed off the list so we'd know to buy more when we reached a major provisioning port.

With our lists in hand, we spent the next few weeks trying various prepared foods. We sampled canned and freeze-dried foods, paying particular attention to salt as I am on a low-sodium diet. By the time we were ready to begin provisioning, we knew what prepared foods we wanted to have aboard and how much I would need to can using the pressure cooker.

We talked to local butchers about vacuum-packing and freezing meats for the bilge. We looked for a farmer's market where we could buy fresh eggs, fruits, and vegetables that had never been washed or refrigerated. We located batteries for the celestial calculator and lightbulbs for the interior lights, contacted a physician to restock our supply of antibiotics, and filled our propane tanks. I began canning, averaging 4 quarts a day. Each day I made a big pot of something for dinner like chili or beef stew and then canned the rest.

A week or so before we expected to leave, we washed all our dry-goods storage containers, including spice jars, and let them air out for a day. Then we headed to the supermarket with our master provisioning list and bought canned goods, dried foods, beverages, snacks, and nonfood items. We did not purchase any dairy or fresh food. We bought about 20 percent less of the bulk items than we thought we would need, such as flour, sugar, rice, pasta, and dried milk, and we chose small containers, enough to be used up immediately once opened. The cost savings of buying large sizes would be lost in spoiled leftovers. We checked expiration dates on everything and bought the packages that would last longest.

Many of our buying decisions revolved around packaging. Cardboard is never allowed to remain on board: it harbors cockroach eggs, clogs the refrigerator drainage system, and disintegrates in humidity. We bought goods with outer cardboard packaging only if they were also packaged in cellophane or wax paper inside. These would then be transferred to plastic containers aboard, and the cardboard discarded.

Metal is unwelcome aboard, though cans are unavoidable. Baking powder, yeast, hot chocolate mix, crackers, and cookies sometimes come in cheap metal containers. These leave rust marks in lockers and make a gooey mess when they rust through. We looked for the same items in plastic packaging, or we transferred the contents to plastic containers. Soda cans are easily punctured or crushed; we bought soda in large plastic bottles, available throughout the world.

When goods came in either plastic or glass, we generally chose plastic. We have never had a glass container break aboard, but we worry about the dangers inherent in glass. If we bought the product in glass packaging, we stored it in a plastic crate that would contain the mess in the event of breakage. We also avoided light-plastic packaging, which easily ruptures. We looked for plastic containers that felt solid and could not be crushed in the hand as these usually hold up well.

We took a taxi back to our anchorage, unloaded the goods onto the dinghy dock, and then ferried them out to the boat. Now the real work began. We transferred the contents of cardboard, metal, or light-plastic packaging into our plastic containers. We divided dried goods such as pasta, rice, or flour into 1- or 2-pound portions, put them in separate zip-top bags, and stowed the filled bags in plastic containers. We stowed small amounts in the galley and larger amounts in several places around the boat. The plastic bags keep the containers clean; when flour or dried milk gets wet, it dries into a cementlike substance that adheres to containers. We stowed everything we had purchased and saw how much room was left for more. Though we bought 20 percent less than our master list called for, the boat seemed full to overflowing. We disposed of all discarded packaging ashore. We had completed our first round of provisioning.

Based on how much money and space we had left, we reprioritized our master list into essentials and luxuries. A few days later, we took one more look around, rearranged the stowage spaces, and made a final provisioning list of nonperishable items. We went through one more round much the same way as the first.

By now, I had completed the bulk of the pressure-cooker canning. I reviewed the inventory of canned goods

I'd built up and decided what to put in the last few jars. I bought the fresh vegetables and fresh meat and made the last soup before filling my remaining jars, processing them, and stowing them away. By this time, we felt as if we had enough food for a decade, which meant we had it just about right.

When we reached the point where we planned to leave within the next few days, weather permitting, we decided exactly how much more money we were going to spend on provisioning. We set aside $100 or so for perishable foods and went back to the store with whatever was left. This time, we wandered up and down the aisles and looked for things we might have forgotten and for treats, snacks, or specialty items. By the time we got back to the boat, we knew we could not stow another nonperishable item.

We cleaned out our icebox and our vegetable and fruit stowage areas with bleach (about 1 ounce in 1 gallon of water). A small amount of bacteria or fungus in a plastic crate filled with onions or apples can cause them all to go bad within a few weeks. Once our storage areas were clean and dry, we did our first round of perishable provisioning. We bought onions, potatoes, garlic, apples, oranges, and other heavy items that keep for a month or more. We inspected them to make sure they were clean, then stowed them in our storage areas.

Two days later, the weather looked perfect. We decided to leave as soon as we cleared customs. First, off we went to the local market, the farm stand, or wherever the food was the freshest. We bought eggs and the rest of our fruits and vegetables, including the short-lived ones for the first few days at sea. Then we purchased our dairy products and bread. We stopped at the butcher and picked up our vacuum-packed, frozen meat. Back at the boat, we inspected the fruits and vegetables to be sure they were clean. Then we loaded everything aboard, stowed it away, cleared customs, and set sail. We had provisioned for the next three months.

Provisioning Tips and Tricks

Before our first few major passages, I wandered the aisles of supermarkets convinced I had forgotten something essential. If we ran out of anything while we were 1,000 miles from the nearest supply, I knew it would be critical. I eventually realized that you can substitute for almost anything. And what can't be substituted for, you can do without. Appendix 5 provides a list of useful substitutes and equivalents for voyaging, as well as some conversions and translations for international cookery.

Besides understanding what can be substituted for what, Americans need to get used to metric equivalents, and Europeans cruising the United States will need to get used to Imperial measurements. No conversion table can really help you with that. You need to develop your own sense of how much a loaf of bread weighs in Imperial versus metric measurements. But three rules of thumb cover 80 percent of the situations:

1. 500 grams or ½ kilogram is just over 1 pound
2. 25 grams is just under 1 ounce
3. 1 liter is just over 1 quart (2 pints)

To give you some idea of what we stocked, this section details our mainland provisioning list by category. The items and quantities reflect the peculiarities of our diet, the fact that we don't have refrigeration, and the amount of stowage we have. The quantities shown for nonperishables would last for about three months if we did not supplement from ashore. The list you develop over time will be significantly different, but Tables 14-5 through 14-11 can be used to make sure you don't forget any of the basics. Start by stowing much smaller quantities until you get a sense of how much you use of each item over time. This section also offers tips on keeping food for as long as possible, even without refrigeration, and for stowing items.

Shelf-Stable, Canned, and Prepared Products

The items shown in Table 14-5 took up the bulk of our stowage space and were the foundation of most meals once we had been offshore for ten days. If necessary, we could have survived for three months on these provisions alone. We supplemented with locally purchased flour, sugar, rice, vegetable oil, spaghetti, dried milk, and other shelf-stable dairy products. We assumed we could buy or trade for fresh fruits, vegetables, and seafood. We didn't plan on finding meat along the way.

If you have a large freezer aboard, you will be able to stock meat and other frozen items that will greatly reduce your dependence on canned goods. Make sure you lay in a supply of canned goods, however, in case the freezer goes on strike in 90° heat. The provisioning tips that follow assume no refrigeration aboard.

Dairy products. Although none of the shelf-stable dairy products can satisfy a fresh-milk aficionado, many come close, especially if served cold. For cooking, no one can tell the difference.

- **UHT milk** is widely available outside the United States. It does not taste as good as fresh, especially when it's warm. However, it tastes better than dried milk and will last up to two months unopened, even in the tropics. UHT milk has been known to explode in lockers after passing its expiration date, so check the dates when you buy it, stow the boxes in plastic bags or in an easy to clean area, and use them well before they expire. Once opened, UHT milk lasts from 12 to 24 hours unrefrigerated in the tropics.

TABLE 14-5. SHELF-STABLE, CANNED, AND PREPARED PRODUCTS

Category	Products	Specific Items	Approximate Quantities
Dairy products	• Shelf-stable products	• UHT milk • Dried milk • Tinned butter	• 36 1-liter boxes • 2 8 oz. package • 2 or 3 16 oz. tins
Meat	• Canned • Pressure-cooker canned • Dried	• Tuna in water • Canned clams • Smoked mussels, oysters, etc. • Chicken, pork tenderloin, beef cubes, lamb, hamburger • Pepperoni, sausage, etc. • Beef jerky	• 36 6 oz. cans • 6 6 oz. cans • 12 6 oz. cans • 14 1 qt. jars • 5–6 individual meats • Small packages to make ~500 g
Prepared meals	• Canned • Pressure-cooker canned • Other	• Hearty soups • Baked beans, stews, etc. • Chili, beef stew, soups • Taco shells • Enchiladas • Taco sauce	• 8 12 oz. cans • 8 19 oz. cans • 14 1 qt. jars • 4 packages • 4 jars • 5–6 bottles
Fruits	• Canned • Dried	• Fruit cocktail, peaches, etc. • Berries for use in desserts • Raisins • Figs, dates, apples, pears, etc. • Banana chips	• 12 cans • 4 cans • Small packages to make ~1/2 lb. • Small packages to make ~1 lb. • As money allows
Vegetables	• Canned • Dried	• Green beans • Corn • Asparagus • Bamboo shoots • Water chestnuts • Mushrooms • Pureed tomatoes • Whole tomatoes • Chopped tomatoes • Spaghetti sauce • Peas • Mixed vegetables • Chickpeas • Mung and other beans for sprouting • Mushrooms	• 12 cans (or can your own) • 12 cans • 6 cans • 6 small cans • 6 small cans • 12 cans (the smallest available) • 6 12 oz. cans • 6 12 oz. cans • 6 12 oz. cans • 12 12 oz. jars • 12 small packages • 12 small packages • ~1/2 lb. • ~1 lb. • 2 large packages

- **Dried milk** is available in any major island port. Use it for cooking, even if you don't like the taste for drinking. When mixing dried milk, cold water keeps it from lumping. If possible, refrigerate it overnight for a taste and texture closest to fresh. Even if you drink skim milk, buy some whole dried milk for cooking, especially to make substitutes for cream. Anchor's Whole Milk Powder, a New Zealand brand sold throughout the Pacific, comes the closest to fresh. Most kids drink it willingly.
- **Tinned butter** is widely available throughout the tropical islands. It tastes surprisingly good and works well for cooking. Check the expiration dates; some of the cans in Pacific villages have been there forever. Once opened, the butter will keep for a week or two unrefrigerated, so plan your baking accordingly.

Meats. We have never acquired a taste for corned beef or Spam, but canned meats play an important role in our diets. Aboard *Silk*, we ate canned tuna for lunch, canned clams or shrimp in a white sauce over pasta for dinner, and canned chicken with packet pasta meals or in curry dishes. Danish canned ham (the real thing, not the pressed variety) adorned our pizzas and livened up our macaroni and cheese. Mutton stew and corned mutton from New Zealand proved much more appetizing than corned beef.

Cans need to be stowed in a dry place, or they will rust. Even then, they will develop small rust marks around the seams. If your stowage area is large so the cans might roll around, or low in the boat so they might get wet, the labels may come off. Use an indelible ink pen to mark each can with a two-letter code and a date. If you must stow them in the bilge, protect them with plastic or wax. I don't recommend varnish because it may end up in the food

Figure 14-3.
Our pressure-cooker-canned jars (bottles) are each slipped into a sock and then stowed in a plastic crate lined with a heavy-duty garbage bag.

when you open it. To wax cans, melt a small candle and dip the can's bottom, top, and side seams. Some people use a vacuum sealer to protect their cans (see the Other Ways to Preserve Food for the Long Haul section below).

My low-sodium diet has put almost all canned goods off-limits for me. On *Hawk*, therefore, our meals revolve around chicken, pork tenderloin, beef cubes, lamb, and hamburger that I can (bottle) in the pressure cooker (see the Other Ways to Preserve Food for the Long Haul section below). I stow each jar in a sock and then put all of them in a plastic crate lined with a heavy-duty garbage bag (Figure 14-3). We've never had a jar break, but if it did it would be contained.

You can buy high-quality canned beef, pork, chicken, and turkey by the case before you leave (see the Canned and Dried Food section in the resources for this chapter in Appendix 1). Don't buy canned ham from the refrigerated section unless you plan to keep it refrigerated; look for the tins on the shelves.

Salami, pepperoni, and other dried meats of the kind that hang over the deli keep almost indefinitely unrefrigerated. Canned seafood (clams, mussels, oysters)—smoked or in a variety of sauces—are widely available throughout the Pacific and make a nice appetizer.

Prepared meals. A wide variety of very palatable freeze-dried camping meals can now be purchased. These are expensive, but easy to stow. Some vendors are listed in the Canned and Dried Food section in the resources for this chapter in Appendix 1. Keep at least one month of canned goods or freeze-dried meals as emergency rations. Once a year or so, use them up and then renew your stock.

Thick stews or soups that can be heated in one oversized pan provide quick nutrition in heavy weather. These can double as emergency rations. Prepared meals in cans and canned meats are almost impossible to find in parts of South America including Argentina and Chile.

Fruits and vegetables. For those cruisers used to a healthy shoreside diet, the lack of fresh vegetables will be the biggest impediment to re-creating their diet on the boat. When cruising remote coral atolls where water and soil are scarce, you may go for weeks without seeing anything green beyond coconut fronds. If you want vegetables to continue to make up a large portion of your diet, you will need to do two things: learn to preserve vegetables well so they will last several weeks even in the tropics (see the Perishable Foods section below), and be ready to fall back on preserved vegetables when your supply of fresh runs out.

Canned vegetables are readily available even in market villages. For tasty, low-sodium veggies, I pressure-cook-can carrots and beans. Freeze-dried beans, peas, and mixed vegetables are light and easy to stow, though they don't taste quite as good as canned. Drying your own fruits and vegetables using a dehydrator offers a lightweight alternative to carrying cans (see the Other Ways to Preserve Food for the Long Haul section below).

When the last of the salad vegetables disappear, I turn to a mix of whole grains and dried beans and grow my own sprouts. Tabbouleh uses long-lasting vegetables, so it becomes a staple toward the end of a long passage. Whole grains, beans, and seeds for sprouting will be confiscated in places like New Zealand and Australia, so I am careful about how much I carry. After most of the fresh vegetables have run out, we enjoy the taste and texture of exotic vegetables like asparagus, baby corn, water chestnuts, and artichokes. These offer much-needed variety and are worth the premium price.

Fresh fruits are a bit easier to come by than fresh vegetables, though the selection will often be limited to bananas and pineapples. Canned fruit in natural juice (not syrup) is just as healthy as fresh. Commercially packaged dried fruit lasts for months if the bag is well sealed. Even a pinhole rupture will let in enough air to cause the fruit to ferment, so double-bag them in zip-top bags and check the bags often. If a bag puffs up, eat the contents immediately if they taste normal. Figs, raisins, and dates never seem to ferment, but apples, apricots, pears, and prunes do.

Cereals, Grains, and Baking Supplies

Table 14-6 shows the range of items we stock and the approximate quantities of these items.

Cereals/grains. An increasing number of nationalities are coming to share the American penchant for specialty breakfast foods, but many items remain difficult to find. If available, cereal is quite expensive. Pancake mix,

TABLE 14-6. CEREALS, GRAINS, AND BAKING SUPPLIES

Category	Products	Specific Items	Approximate Quantities
Cereals/grains	• Cereals	• Breakfast cereals	• 12 large boxes
		• Muesli	• 4 packages
		• Oatmeal	• 8 1 lb. packages
	• Flours	• White flour	• 10–12 1 lb. packages
		• Whole wheat flour	• 2–3 1 lb. packages
		• Rye flour	• 1–2 1 lb. packages
		• Cornmeal	• 1 1 lb. package
	• Grains	• Basmati rice	• Small packages to make ~5 lb.
		• Bulgur wheat, quinoa, barley	• Small packages to make ~2 lb.
	• Pasta	• Spaghetti, linguine	• 4–5 1 lb. packages
		• Macaroni, bows, etc.	• 4–5 1 lb. packages
Baking needs	• Basics	• Vegetable oil	• 3–4 small, strong bottles
		• Olive oil	• 5–6 small, strong bottles
		• Nonstick spray	• 2 cans
		• Wine vinegar	• 4–5 small bottles
		• Cider vinegar	• 1 large bottle
		• Tabasco sauce	• 2 small bottles
		• Worcestershire sauce	• 2 small bottles
		• Yeast	• 12 small packages
		• Baking powder	• 2 10 oz. packages
		• Baking soda	• 2 1 lb. packages
		• Pepper	• 1 large bottle of peppercorns
		• Salt	• 1 12 oz. package
		• Vanilla	• 2 large bottles
		• Basic spices	• 2 bottles of each
		• Exotic spices	• 1 bottle of each
	• Sweeteners	• Sugar	• 10 1 lb. packages
		• Brown sugar	• 2 1 lb. packages
		• Honey	• 3 1 lb. bottles
		• Cocoa	• 1 12 oz. plastic container

maple syrup, Pop-Tarts, and fresh American-style bacon are difficult to find. Bisquick is widely available, and canned American bacon can be purchased in American Samoa, Australia, and New Zealand. Most of the time, we rely on hot cereal, bread variations, and an occasional egg. For special brunches, we stow maple syrup and make our own pancake batter or French toast.

Cereal needs to be stowed so it won't get crushed. We remove the cereal in its waxed paper liner and discard the box. Then we seal the liner and its contents into a large zip-top bag. We stow these with bags of chips or cookies in a dedicated locker or crate. We also stow cereal on top of fruits and vegetables in our stowage crates.

Select flour carefully. We often buy one bag and inspect it before we stock up. We discard any flour that has colored specks or strings or otherwise looks suspicious. Smell the flour as well—this is the best way to detect mold. We transfer the flour to zip-top bags that we stow in airtight plastic containers. We use one or two bay leaves for each large zip-top bag of flour, and we have never had weevils.

It takes approximately ½ pound of flour to make a loaf of bread. Bread is readily available from bakeries in almost any community of any size around the world. These days, most cruisers make their own bread only on passage or when cruising remote areas with no settlements.

Cereals and grains will be least expensive if bought in bulk, plus you'll eliminate packaging. We are careful about buying flour this way but will do so at high-quality natural food stores almost anywhere or from the bulk bins of supermarkets in more-developed countries.

Baking needs. We don't worry too much about widely available items such as white flour, sugar, and vegetable oil. We buy these as we go and keep a reserve for use if an island hasn't gotten a recent shipment.

Fresh spices turn basic ingredients into palatable fare, but spices are sensitive to light and heat. They keep longest when stowed in a cool, dark place. Even so, spices will need to be replaced once a year. Basic spices include thyme, basil, oregano, parsley, mixed Italian spices, bay leaves, cinnamon, cloves, garlic, black pepper, and paprika. Just about everything else can be considered exotic and will be available only in mainland ports. We carry white pepper, dry mustard, cumin, chili powder, curry powder, cardamom, turmeric, ginger, coriander, nutmeg, allspice, rosemary, tarragon, marjoram, sage, fennel, dill seed, and dill weed.

In many places, yeast is sold in large solid cakes or granulated in jars or cans. We prefer double-acting yeast in small tinfoil packets (one packet makes two loaves of bread) because it seems to keep the longest. Make sure to check expiration dates on yeast and keep it in the refrigerator if you have one. Following are a few other tips for baking supplies:

- **Honey** sometimes crystallizes. If that happens, put the container in hot water for 10 to 15 minutes.
- **Molasses and maple syrup** are almost nonexistent outside of the United States and Canada. In Commonwealth countries, treacle or golden syrup consists mostly of sugar and corn syrup and makes a poor substitute when used over pancakes or in place of molasses. For baking, honey or golden syrup can be substituted in place of maple syrup with only a minor change in flavor. Buy maple syrup in small containers because it will mold after a month or so once opened unless kept refrigerated.
- **Cocoa** is available in major island ports. Unsweetened baking chocolate melts in the tropics.
- **Vegetable shortening** is hard to find and doesn't keep well unrefrigerated. Substitute margarine or butter.

Other Foods

Table 14-7 shows the other foods we carry and the approximate quantities we buy.

Heavy-duty squeeze bottles for mustard and ketchup are ideal when the boat is rolling, and you only have one hand to spare. These can be found in most mainland provisioning ports.

Garnishes and condiments do not need to be refrigerated. Most marine refrigerators do not maintain the temperature as well as a home refrigerator, so keeping mayonnaise in them can be unsafe. But mayonnaise will keep indefinitely without refrigeration if you always use a clean spoon to serve it. We have kept mayonnaise for months in tropical temperatures. If you are uncomfortable with this solution, buy a box of the individually packaged servings meant for use in restaurants.

TABLE 14-7. OTHER FOODS

Category	Products	Specific Items	Approximate Quantities
Other foods	• Garnishes/ condiments	• Mustard	• 4 small jars
		• Mayonnaise	• 4 small jars
		• Ketchup	• 2 plastic bottles
		• Relish	• 5–6 small jars
		• Salad dressing	• 6 bottles
		• Coconut milk—low fat	• 6 12 oz. cans
	• Spreads	• Jelly or jam	• 4 small jars
		• Peanut butter	• 4 small jars

TABLE 14-8. BEVERAGES

Category	Products	Specific Items	Approximate Quantities
Beverages	• Cold drinks	• Orangina, ginger ale, Fresca	• 6–12 1 qt. bottles
		• Sparkling water	• 12 1 qt. bottles
		• UHT juice	• 12 1 qt. boxes
		• Bottled water	• 12 1.5 qt. bottles
	• Hot drinks	• Herbal tea	• 5–6 boxes
		• Regular tea	• 1 large box
		• Coffee	• 9 1 lb. packages
		• Coffee filters	• 2 boxes
		• Hot chocolate mix	• 36–48 packets
		• Drink mixes	• 24 packets or 6 large bottles of Sunquick
	• Alcohol	• Wine	• 4–5 bottles

Jellies and jams may ferment after several weeks in the tropics, so refrigerate them or use them up quickly once opened.

Beverages. Dehydration can be debilitating. Having a variety of beverages on board keeps the crew drinking throughout the day. Table 14-8 shows what we carry aboard *Hawk*.

Our beverage basics include good water and fresh lemonade. We also drink ice tea, made from herbal tea or black tea with spices. We go through about one box of UHT juice per week. Like UHT milk, UHT juice keeps for months. Buy those with the longest expiration dates and use them up before they expire.

Coke, Pepsi, and other soft drinks can be found in any mainland or major island port. These are the easiest beverages to find and stow, and the large plastic bottles hold up well offshore. We carry ginger ale, Orangina, and Fresca. Ginger ale is soothing for a slightly seasick stomach. Orangina and Fresca are more like real juice than most sodas.

We are always trying new drink mixes. Our personal favorite is Sunquick, a concentrated liquid that comes in wonderful flavors like pamplemousse and tangerine. This French product is available throughout the French islands worldwide and in New Zealand and Australia. Many crews carry Tang and use that for breakfast. Regular and sugar-free Kool-Aid and similar products are also available.

Most cruisers' alcohol purchases depend upon the price of alcohol and the import restrictions of neighboring countries. If you want to carry large amounts of alcohol, you can buy it duty-free after clearing customs in many countries including Australia and New Zealand. But check on the regulations of your next port of call—in many places alcohol will be bonded (placed in a sealed locker aboard or held by customs until you clear out), and

TABLE 14-9. SNACKS

Category	Products	Specific Items	Approximate Quantities
Snacks	• Munchies	• Popcorn	• Small packages to make 3 lb.
		• Potato, corn, other chips	• 5-6 packages
		• Peanuts, pistachios	• 12 small packages
		• Mixed nuts—unsalted	• Small packages to make 3 lb.
	• Crackers/ cookies	• RyKrisp or similar	• 3 1 lb. boxes
		• Corn cakes	• 12 packages
		• Packaged cookies	• 12–15 packages
		• Protein bars/granola bars	• 24 bars
	• Other	• Pickles	• 6–8 large jars
		• Black olives	• 12 small containers
		• Green olives	• 5–6 small jars
		• Applesauce	• 8–10 small containers
	• Candy	• Hard candy	• 2 1 lb. bags
		• Candy bars	• 1–2 "fun size" bags
		• M&M's	• 6 8 oz. bags
		• Licorice	• 8–10 packages
		• Sugarless gum	• 12 packages

you will not be able to drink it, or you will have to pay high duties to import it.

Snacks. Our snacks depend upon what is available and what we can afford. Most snacks are expensive, take up a surprising amount of space, and are easily crushed. They do, however, last well. Table 14-9 shows the types and quantities of snacks we carry.

Our base level of snacks includes dried fruit, corn cakes, whole-grain crackers, popcorn, and unsalted peanuts. All are inexpensive and stow well. We consider the rest discretionary and buy them only after the basic provisioning has been completed. Mixed nuts, trail mix, peanuts, raisins and similar items are least expensive when bought in bulk. If the supermarkets do not have bulk departments, look for natural food stores.

After a week or so at sea, we crave textures, not specific foods. Pickles, olives, and crackers combine salt and interesting textures. Canned asparagus and other exotic vegetables provide a refreshing and crunchy treat. M&M's are the only candy that survives unrefrigerated in the tropics, but they do "melt in your hand" when eating them in 90° heat, and the food coloring stains clothes and fingers.

Following are a few hints for stowing snacks:

- **Popcorn.** To keep it fresh, keep it airtight. Tightly sealed plastic containers are the best answer. Good-quality popcorn lasts for several months at sea, though old popcorn takes longer to pop than fresh. If your popcorn is getting tired, sprinkle a few drops of water on it and seal the airtight container. It will be livelier the next time you use it.
- **Cookies and crackers.** We look for cookies and crackers packaged in waxed paper, tinfoil, or cellophane. We discard the cardboard and fit the packages into a large plastic container.
- **Olives.** In many places, small amounts (ten to fifteen) of black and green olives are sold in heavy-duty plastic bags. The small size allows you a quick snack without forcing you to eat a pound of olives before they spoil. This packaging is not completely rupture proof, so store a half-dozen in a heavy-duty zip-top bag.
- **Applesauce.** The single-serving plastic containers store well and prevent spoilage. Applesauce will mold in two to three days if not refrigerated.

Nonfood Items: Paper Goods, Cleaning Supplies, and Toiletries

Many of the items in Table 14-10 won't be found between regional centers. What is available tends to be poor quality and expensive. Although you can always get by with local foods or clever substitutes, you will have to do without if you run out of most of the things on this list. Stock up before you go, even if it means carrying less food.

Buy only the highest-quality alkaline batteries as they last twice as long at sea. Check expiration dates carefully, especially when buying batteries in the islands. Batteries for flashlights, radios, Walkmen, iPods, tape recorders, and handheld GPS units often last less than a month at sea, and good-quality alkaline batteries are unavailable on many islands. We stow at least three sets of spare batteries for these gadgets when leaving a mainland port. Carrying rechargeable batteries and a battery charger is a better solution.

For cleaning dishes, stock up on Teflon scrubbers. Steel wool rusts when used to wash dishes in salt water. A long-handled plastic scrub brush will minimize the drying effects of salt water on your hands.

Although our toiletries list reflects our individual preferences, it also illustrates the reality of life at sea. Following are the reasons behind some of our specific choices:

- **Suntan lotion** is available in any major island port. We carry SPF (sun protection factor) 8, 15, 24, and a complete block. Whenever we return to the tropics from temperate latitudes, we have to reacclimate to the sun, even though we are still tanned. A complete sunblock on nose and ears for the first week protects these sensitive areas from repeatedly burning. We also use lip balm with SPF 15 several times a day.
- **Facial cream** with sun protection is less oily than suntan lotion and can be used several times a day.
- **High-quality facial and body soaps** are hard to come by. If your skin requires a mild soap, take it along.

TABLE 14-10. NONFOOD ITEMS

Category	Products	Specific Items	Approximate Quantities
Nonfood items	• Batteries and bulbs	• Alkaline batteries—AAA to D	• Battery inventory × 2–4
		• Calculator, camera batteries	• Battery inventory × 2
		• Flashlight bulbs	• 1 spare for each
		• Suntan lotion	• 1 spare of each type
	• Toiletries	• SPF 15 lip balm	• 2 tubes
		• SPF 15 face cream	• 2 bottles
		• Face wash, body soap, hand soap	• 2–3 containers
		• Facial soap	• 8–10 bars
		• Antibacterial soap	• 2–3 bars
		• Shampoo/conditioner	• 3 large of each
		• Razor blades	• 1–2 dozen
		• Toothpaste	• 5–6 tubes
		• Dental floss	• 5–6 packages
		• Toothbrushes	• 2–3 spares per person
		• Mouthwash	• 2 large bottles
		• Q-tips	• 2 large packages
		• Lotion	• 2–3 large bottles
		• Baby oil	• 1 bottle
		• Feminine products	• 3–4 packages
		• Deodorant	• 6+ packages
	• Cleaning supplies	• Biodegradable dish soap	• 5–6 bottles
		• Soft Scrub	• 5-6 bottles
		• Biodegradable laundry detergent	• 2–3 large containers
		• Liquid fabric softener	• 1 large bottle
		• Fabric softener sheets	• 1 large box
		• Clorox bleach	• 1 1 gal. bottle
		• Windex	• 1 large bottle
		• Multipurpose cleaner	• 1 large bottle
		• Carpet cleaner	• 1 large bottle
		• Vinyl cleaner	• 1 bottle
		• Shower cleaner	• 2 bottles
		• BBQ/stove cleaner	• 1 bottle
		• Scrub brushes	• 3–4 plastic brushes
		• Sponges/scrubbers	• 6 Teflon
		• Rubber gloves	• 2 pairs
		• Mosquito repellent	• 3–4 small bottles
	• Other	• Bug spray	• 1–2 large cans
		• Cockroach spray	• 1 large can
		• Mosquito coils	• 24 coils
		• Lamp oil	• 2 quarts
		• Oven lighter/striker	• 1 lighter/1 striker
		• Extra-long wooden kitchen matches	• 2 large packages
		• Paper towels	• 6–8 rolls
	• Paper goods	• Toilet paper	• 8–10 rolls
		• Garbage bags	• 2 large packages
		• Sandwich bags	• 1 large package
		• Large storage bags	• 1 large package
		• Zip-top bags—all sizes	• 4–5 large packages
		• Heavy-duty tinfoil	• 1 large package
		• Wax paper	• 1 large package
		• Plastic wrap	• 1 large package

Antibacterial soaps are easy to find. If you are prone to eruptions or sores if your skin is not kept clean, you will want to wash regularly with a good antibacterial soap.

- **Feminine products** are widely available, though often of poor quality. A small stock aboard will allow you to purchase only where the quality is acceptable.
- **Deodorant** can be hard to find, especially if you have a favorite brand. Unfortunately, it does not last well aboard. Cake deodorants break apart after a few months, aerosol deodorant cans rust, and gel deodorants get runny in tropical heat.

Toiletries do best stowed in a cool place, not directly under the deck in a medicine cabinet. Soap and deodorant run if they get too hot; suntan lotion and liquid soaps turn soupy. Install a drawer or plastic dishpan in a cool place for these items.

Laundry detergent has many uses aboard and is very expensive outside of mainland ports. Liquid detergent dissolves better in cold water and cuts grease in the bilge. If powder is the only alternative, stow it in a plastic container to avoid a soggy mess.

Although paper towels and toilet paper are generally available, they are expensive and of poor quality, lacking strength and absorbency. We stow as much as we have room for when provisioning at a mainland port and then rely on rags and tea towels before using precious paper towels. You will find garbage bags and low-quality aluminum foil in major island ports, but you won't see most of the other paper goods until you reach another mainland port. Stow your aluminum foil in plastic; when exposed to salt water and sometimes salt air, it welds itself into a solid round mass.

Zip-top bags are becoming more widely available, but don't count on seeing them outside developed countries. Freezer bags last longer than regular bags. Take a full range of sizes (1 pint to 2 gallons) and reuse them. The 2-gallon freezer bags can be hard to come by, but you will use dozens for everything from stowing sweaters to protecting papers. Make sure to buy several large packages before you set off. We have had mixed results with the long-life vegetable bags and wouldn't recommend buying a large stock of them.

Perishable Foods

We tend to assume many items require refrigeration that really do not. Most fruits and vegetables, eggs, and some dairy products last a reasonable time unrefrigerated, even in the tropics. Fresh dairy and meat products do require refrigeration, but both are scarce in all but the largest island ports. This section offers tips and suggestions for living without refrigeration that will be useful for anyone venturing offshore. If you do refrigerate or if you're cruising areas with water temperatures below 55° and keeping things in the bilge, perishables will last up to twice as long as what is indicated in Table 14-11.

The quantities shown in the table are what we stow for a long passage or for several months in remote areas where we won't be able to provision. After a month without refrigeration, we still expect to have apples, citrus fruit, cabbage, and tomatoes in addition to the longest-lived vegetables such as potatoes and onions (those that show one- to two-month maximum life in the table), assuming the produce had been bought fresh from a farmer or a farmer's market.

Having fruits and veggies for most of a passage is not that much of a challenge. The key is to buy fresh produce that has never been refrigerated and, ideally, never been washed. If you do so, and take a little care in stowing it, it will last for a surprisingly long time even unrefrigerated in the tropics. The real challenge is not overstocking on the shorter-lived fruits and veggies before a passage. Inevitably, everything will start to spoil while half the crew is too seasick to eat any of it. Carefully plan when you will use the green beans and leaf lettuce, and then fill whatever stowage space is left with the longest-lived items. If the only produce available comes from a supermarket, it will last only about half the time shown in Table 14-11 if left unrefrigerated. This includes the long-lived vegetables like onions and potatoes, which have often been in transit or been sitting on the shelf for many weeks before they are purchased.

Fresh meat. Meat cuts are quite different in the United States and Canada than in Europe, Australia, and New Zealand. You can usually muddle through when buying chops or steaks in small quantities but stew meats, roasts, and shoulder and rib cuts are hard to sort out, especially with respect to quality. If meat is central to your diet, ask a local to go through various cuts with you, or purchase a cookbook that shows meat cuts for the country you will be cruising.

Meat will keep longest if you buy it fresh from a gourmet butcher shop and ask them to vacuum-bag (Cryovac) it and then deep-freeze it for you. Bring an insulated bag to the butcher and take it back to the boat frozen.

Even if you don't have a freezer, vacuum-bagged, deep-frozen meat will last for up to a week in the tropics in an insulated bag with a block of ice. Plastic-packaged

TABLE 14-11. PERISHABLE FOODS

Category	Specific Items	Maximum Life	Approximate Quantities
Dairy products	• Yogurt • Hard cheeses • Margarine • Butter	• 2 weeks in cool bilge • 2–3 weeks • 4–5 weeks • 2–3 weeks	• 2–3 1 qt. containers • 6–8 8 oz. packages • 2–3 16 oz. plastic tubs • 1–2 16 oz. packages
Eggs	• Farm-fresh eggs	• 6–8 weeks	• 1 dozen per week
Bread	• Fresh bakery bread • Commercially packaged dark bread	• 7–10 days • 10–14 days	• 2 loaves • 1 loaf
Fruits	• Apples • Oranges/grapefruit • Lemons/limes • Pineapples • Pamplemousses • Bananas (buy green) • Melons • Papaya (green) • Peaches, pears, apricots, grapes, etc.	• 4–5 weeks • 4–5 weeks • 3–4 weeks • 2–3 weeks • 10 days • 10 days • 1 week • 5 days • Less than a week, slightly more if green	• 2–3 dozen • 1–2 dozen • 1–2 dozen • 3–4 small • As many as possible • 1–2 large hands • 3–4 • 3–4 • Small quantities for early use
Vegetables	• Onions (cooking) • Yams (kumara) • Potatoes • Garlic • Winter squash • Cabbage • Tomatoes (firm, green) • Avocado (green) • Cucumbers • Carrots • Zucchini (courgettes) • Iceberg lettuce • Green pepper • Eggplant • Cauliflower • Broccoli • Green beans, celery, mushrooms, spring onions, sprouts, leaf lettuce	• 1–2 months • 1–2 months • 1–2 months • 1-2 months • 1–2 months • 4–6 weeks • 4–6 weeks • 2–3 weeks • 3 weeks in bilge • 2 weeks in bilge • 2 weeks in bilge • 2 weeks in bilge • 2 weeks in bilge • 1 week • 1 week • 1 week • Less than a week	• 20–30 small or medium • 5–10 lb. • 4–5 lb. • 5–6 heads • 2–3 • 3–4 small heads • 2–3 lb. • 3–4 • 2–3 • 1 lb. • 2–3 • 2 heads • 6–8 • 1–2 • 1–2 heads • 1–2 heads • As per menu planning

cold cuts like salami and bologna will last for a week or more in the same bag.

Dairy products. Even for those with refrigeration, fresh milk will last for only a week or so. At that point, your choices will be UHT or dried milk, though the refrigerator will make either more palatable.

Cheese survives surprisingly well unrefrigerated. We buy commercially packaged cheeses sealed in plastic in small quantities and keep them in the bilge for up to a month in the tropics and for several months in the high latitudes. The harder the cheese, the longer it lasts. Semisoft cheeses like mozzarella will get very soft, but they usually won't spoil or mold until opened. Hard cheeses packaged in wax keep indefinitely. You can package your own: Wrap the cheese in vinegar-moistened cheesecloth and dip it in melted paraffin to seal. If the only thing available is unpackaged cheese, coat it lightly in vinegar, wrap it in aluminum foil, and store it in a plastic bag. This retards mold on hard cheese for several weeks.

Margarine and butter also keep unrefrigerated. After a month or so, margarine will mold, but that can be scraped off and the rest can be used. Buy high-quality margarine; otherwise it turns soupy. Fresh butter will go rancid after several weeks in tropical heat. Tinned butter spoils more quickly than regular butter once opened, so be sure to use it up within ten days. For both butter and margarine, plastic tubs make the best packaging (oil leaches through other packaging and makes a mess).

Yogurt lasts a surprising amount of time unrefrigerated, even in warm climates. Large containers will keep for up to two weeks in an insulated bag with ice or in the bilge if the water temperature is below 60°. On many of the tropical islands, you can buy UHT yogurt in single-serving packages that keep for several months. Or you can make your own, as discussed in the Galley Skills section below.

Eggs. Eggs create special packaging problems. Cardboard egg cartons are particularly attractive to cockroaches. We've found that plastic egg carriers from camping stores are too small and regularly shaped for farm-fresh eggs. They also prevent air from circulating and lead to mold, which spoils the eggs. We prefer Styrofoam egg cartons for large eggs, which we obtain in mainland ports. These provide padding while allowing enough air to circulate so that the eggs do not mold. We wash and reuse these in the islands where we get handed eggs wrapped in newspapers. Our egg cartons occasionally get confiscated by quarantine officers, but only where we can replace them.

To keep eggs from spoiling, they need to be bought fresh, and they must never have been refrigerated. To get the freshest eggs, go to a farmer or a farmer's market. Unwashed eggs with feathers and droppings still clinging to them are ideal, for there is a substance on the surface of the egg that protects it from rotting. Don't wash them—just stow them as is.

Eggs start to rot when the air sac inside the egg settles against the shell, eventually causing the shell to become porous. The eggs either need to be sealed so oxygen cannot penetrate the shell or they need to be turned to prevent the air sac from settling. Eggs can be sealed by coating them with Vaseline or by flash-boiling them—dropping them in boiling water for 15 seconds. But we find it much simpler (and less messy) not to coat the eggs at all but just to turn them every two to three days. We stow them in Styrofoam egg containers and turn the whole carton every couple of days. The two alternatives work equally well; I have kept eggs for over two months using either the coating or turning method.

If you have to buy refrigerated eggs, and you don't have refrigeration, buy those with the latest expiration date you can find and turn them every day. They will last for a minimum of ten days. If you can get fresh eggs, stow as many as possible when you leave a major port. Where chickens are scarce, eggs are outrageously expensive—we spent $9 for a dozen eggs on Makemo in the Tuamotus.

When cooking with older eggs, crack them into a measuring cup first to protect your other ingredients from a bad egg. If you are in doubt, put the egg in a pan of water. If it floats, and you know you didn't hard-boil it, toss it overboard. As eggs get old, they get runny; it becomes difficult to separate the yolk from the white, but they still taste fine.

Bread. Bread makes a wonderful midday treat or a great basic breakfast food, but it does not keep well aboard. Bread baked with salt absorbs moisture from the air and starts to mold after a few days.

When leaving on passage, I never assume that I will be up to baking the first few days out. Just before we leave, we buy a loaf or two of fresh bakery bread and a loaf of industrial-strength dark bread—thin-sliced pumpernickel or Jewish rye. The latter lasts up to two weeks, thanks to the preservatives. Make sure the label doesn't recommend refrigeration once it is opened.

When baking bread aboard, leaving the salt out will extend its life to a week or so. Twice-baking it—removing it from the pan when it is almost done and putting it back in the oven for the last 10 minutes—creates an extra-thick crust that will preserve bread longer. You can also lightly coat the bread with vinegar, cover it with foil, and stow it in plastic. Even then, bread won't last more than ten days. On most boats, good fresh bread disappears so quickly that you won't have to worry about preserving it.

Fruits and vegetables. Unrefrigerated fruits and vegetables need air circulating around them to keep for long periods of time. You must also prevent mold growth and bruising. To prevent mold, put them in sanitized stowage areas and keep them dry. Collapsible milk crates, which provide great airflow and can be thoroughly sanitized with bleach, work well. We pad ours with towels and rags to keep the fruit from bruising.

For vegetables and fruits to last for their maximum life, they must be purchased fresh, the fresher the better. Getting your vegetables and fruits from a farmer's market, farm stand, or, better yet, someone with a garden who will let you pick your own will double the life of the produce over what you would get if you purchased it from a supermarket. In our experience, vegetable storage bags don't extend the life of fruits and veggies outside of a refrigerator unless the produce is perfectly dry when it goes in the bag. If there is any dampness at all, or if it is humid and hot, condensation will form that will lead to rot. Fresh, totally dry produce will last longer in these bags in the refrigerator (or a cold bilge). But even then we find they extend life by only about 20 percent, not by as much as the manufacturers claim.

No matter how well they have been stowed, fruits and vegetables will develop mold or start to rot after many weeks at sea. Inspect them daily, and remove and use suspect individuals. The adage "One bad apple can spoil the whole barrel" is true for more than apples. If left unattended, mold from one orange will spread to the rest of the citrus, one rotten onion will start the others fermenting, and one sprouted potato will have the rest full of eyes in a few days.

Our fruit choices depend upon availability. Unrefrigerated, Granny Smith apples and citrus fruits keep the longest (up to five weeks in tropical conditions). New Zealand Granny Smiths are available throughout the Pacific and last twice as long as most red apples. Don't store apples and citrus in the same locker, bin, or milk crate. The citrus will cause the apples to ripen rapidly, bruise, and turn brown.

We buy bananas as green as possible and keep them covered. In theory, ripening can be promoted by dunking them in salt water or exposing them to light. In our experience, bananas tend to ripen all at the same time no matter how we treat them, so we do not stock large quantities. Pineapples, coconuts, and bananas purchased in village markets harbor spiders, ants, and cockroaches. Get rid of them by completely submerging the fruit in the ocean until the critters flee the sinking ship.

Potatoes (baking or sweet), yams, and onions keep indefinitely. We inspect potatoes and yams when we purchase them to be sure there are no eyes and cover them with a towel to keep out the light and slow sprouting. Stowing potatoes with onions will cause the potatoes to sprout; however, stowing them with apples retards sprouting. Onions sprout if covered, so leave them in the light. If garlic gets damp, it will sprout. Buy the driest, whitest garlic you can find. Reject it if you see any green color or signs of mold.

Cabbage lasts four to six weeks unrefrigerated, which is the longest of the green vegetables. Wrap each head in newspaper or paper towels and store them in the refrigerator or in the bilge. Green tomatoes wrapped in paper towels or newspaper last several weeks. Once they start to turn red, putting them in the sun for a few hours will quickly ripen them the rest of the way.

Regular cucumbers become soft and squishy after a week or so unless they are fresh out of the garden (we've had fresh cucumbers last for three weeks unrefrigerated in the tropics). You can purchase English cucumbers in most Commonwealth countries and throughout the Caribbean; they are thinner and longer than the American variety, and come wrapped in cellophane. They keep up to three weeks in a cool bilge, two weeks unrefrigerated. Carrots keep a week to ten days if the green tops are removed. If they become rubbery, peel the skin and soak them in water overnight. They won't taste quite like fresh, but they will be crisp and have good flavor.

We do not treat fruits and vegetables with a fruit dip. Most fruits and vegetables keep best when left unwashed. But if any of the citrus fruits develop mold, we rinse all of them in a mild chlorine solution. We wash all fruits and vegetables thoroughly in fresh water before using them. If we are concerned about bacteria, we remove the skin before eating them.

Galley Skills

Most of what you do in your own kitchen at home will still be relevant when you move aboard. Many cruisers also master several new skills to increase the longevity of food and provide greater variety when far from the nearest supermarket. These include learning how to manage the freezer, bake bread, grow sprouts, make yogurt, and preserve food using pressure-cooker canning, vacuum-bagging, and drying.

Managing the Freezer

In order for a freezer to operate efficiently, air spaces need to be kept to a minimum. If possible, food should be put into the freezer already frozen solid. Not only does this cut down on engine-running time or battery draw, but it also helps keep the freezer at a uniform temperature and prevent partial thawing and refreezing of the contents. Vacuum-packing freezer items also helps prevent freezer burn and prolong life. Most gourmet butcher shops will vacuum-pack and freeze things for you if you ask. Some marine chandleries and kitchen stores sell Scubs, freezer bags divided into small compartments for making ice cubes.

Package prepared meals, meat, and vegetables into small, clearly labeled zip-top bags and stow them roughly in the order in which you intend to use them. If you're not sure of your meal plan, or if you are provisioning for several months, divide the contents into layers containing a bit of each type of food and then work through the layers. As you empty the freezer, fill the empty space with water bottles, bread, or refreezable ice packs to keep the freezer operating efficiently.

Some cruisers use dry ice at the beginning of a passage to cool the freezer and its contents. The ice needs to be wrapped in plastic and surrounded with bags of ice cubes or the reusable ice packs to prevent food from coming into contact with it and getting freezer burn. Big blocks of dry ice will keep about two weeks and will greatly reduce engine-running time or battery draw during a passage.

Bread Baking

Learning to bake bread is no longer the necessity that it once was for voyaging sailors. Good bakeries can be found in just about any community no matter how small or remote. Bread keeps indefinitely in the freezer. Still, nothing beats the smell of fresh-baked bread wafting through the boat on a passage, and nothing beats the taste of warm bread right out of the oven.

Many people are intimidated by the idea of baking bread, and yet bread is very forgiving, especially in a warm environment like the tropics. If you make sure that you have high-quality ingredients, proof the yeast to check it is active, and use water of the right temperature, the rest really does take care of itself. If you've never baked bread, these eight easy steps will get you started:

1. **Gather ingredients and supplies.** For a basic bread recipe that makes two loaves, you'll need:
   - about 6 cups of white flour
   - 1½ cups of warm water
   - 1 package of active dry yeast (about 1 tablespoon)
   - 1 tablespoon of sugar
   - olive oil

   You can add up to 1 teaspoon of salt, but try it without to see if you like it because it will keep better. You'll also need a large bowl or soup pot, a damp towel, a wooden spoon, and two standard-sized loaf pans, greased with butter or oil or sprayed with a nonstick spray.
2. **Proof the yeast.** Put the yeast and sugar into the bowl. Add the water. The water should be lukewarm, just below body temperature. You can test water temperature in the same way you test a baby's bottle—a drop on your wrist should feel pleasantly warm but not hot. If the yeast is good, it will foam to the surface after several minutes, and the bowl will begin to smell like a brewery. If that doesn't happen, the yeasties have died, and you'll need to try again. Water that is too hot or cold will kill the yeast, so check your water temperature carefully.
3. **Add flour.** Stir in half the flour and then add the rest ½ cup at a time. The dough will get stiffer and stiffer as you add more and more flour. Eventually, it will be too difficult to stir it with the spoon. At that point, you can turn it out onto a floured board and use your hands to work in the rest of the flour. The exact amount of flour will depend upon the exact amount of water you used, the humidity, and the dampness of the flour. By the time you get to around 4 cups, the dough should be stiff and beginning to feel smooth. Keep adding flour until the dough is no longer sticky and has the soft, silky feel of a baby's bottom.
4. **Knead the dough.** Kneading the dough consists of nothing more than punching it down, rotating it a quarter turn, folding it in half, and punching it down again. As you go through this process, you'll find areas of dough that are still sticky. Keep adding in small amounts of flour and keep flouring the board. There is no set amount of time to knead the bread. The longer you knead it, the more air you work into it, and the lighter it becomes. You can just set the dough aside to rise without kneading it, but the bread will be quite heavy and dense. For a smooth, light white bread, I knead the dough for a minimum of 5 minutes.
5. **Let rise until doubled in bulk.** Clean the bowl (it's best to pour in some hot water and rub the bowl clean with your hands as the dough tends to stick to any cloth or scrubber and then rot there in the tropical heat). Grease it with a generous dollop of olive oil. Turn the dough into the bowl and spin it around once to coat the entire surface with oil. Cover the bowl with a damp towel and put it in a secure, warm place (between 75° and 85°F). How long it takes to rise will depend upon the exact temperature and humidity. In the tropics, the dough will often double in as little as 30 minutes. In colder climes, it may take an hour.
6. **Punch down and let rise again.** After the dough has doubled in bulk, punch it down and knead it again for several minutes if you want really light, evenly textured bread. I usually don't bother kneading it the second time, especially with whole-grain breads that taste better a little

dense. Divide the dough in half, shape each half into a loaf, and put it in a greased bread pan. Cover the bread pans with the damp towel and allow the dough to rise again until doubled in bulk. The second rising usually takes a bit longer than the first, on average around 40 minutes in the tropics.

7. **Bake and let cool.** If you like a crispy crust, don't preheat the oven. Either way, bake it for about 45 minutes at 350° until done. When it is done, the loaf should be golden brown all over. If you tap it on the top, sides, or bottom, it should sound hollow. Pull it out of the oven and set it on a rack to cool for at least 15 minutes before cutting it.
8. **Cut and eat!**

If you are pressed for time or prefer a denser bread, let the dough rise only once in the bread pans and then bake it. Pizza dough and many whole-grain breads are better with a single rising.

If you have the counter space, stowage space, and electricity, a bread machine takes care of all the details for you. You still have to make sure all ingredients, particularly the yeast, are fresh. If you do not have an oven, you can make bread in a pressure cooker just as many generations of cruisers have done in the past. *The Essential Galley Companion* by Amanda Swan-Neal (see the Cookbooks section in the resources for this chapter in Appendix 1) contains full instructions.

Sprouting

Sprouting seeds and grains is easy to do on board and provides some much-needed greens near the end of a passage. The only equipment required is a jar (stainless steel is ideal because it won't rust) with some kind of mesh lid. But mosquito netting held in place with a rubber band works just as well and is easier to come by. To grow your own greens, follow these five easy steps:

1. **Soak seeds.** The seeds or grains need to be soaked in water for 8 to 12 hours to facilitate sprouting. Table 14-12 summarizes soaking times for different types of seeds and grains. By the end of this period, some of the seeds will be showing signs of sprouting.
2. **Drain and leave to sprout.** Drain and place the jar (lid side down) at about a 45-degree angle to facilitate continued drainage. This can be tricky on a rolling yacht. Dedicated sprouters usually concoct some sort of a rack that holds the jar and fits into the sink. The seeds should sprout in the next 12 hours.
3. **Rinse with cool water.** Rinse the sprouts at least twice a day with fresh, cool water. Position the jar to drain after each rinsing. Table 14-12 gives a rough idea of how long different types of seeds and grains take to mature. Beans and seeds often become bitter if sprouted too long, whereas grains become sweeter on the fourth or fifth day.
4. **Allow to green.** Alfalfa, cabbage, clover, mustard, and radish sprouts need to be placed in indirect light for two days before they are used. This allows them to manufacture chlorophyll, which turns the leaves green.
5. **Store in sealed container in a cool place.** Sprouts will keep up to a week in the fridge.

Many cruisers are avid sprouters, and some even grow their own tomatoes and lettuce using hydroponics. Just remember that when you arrive in countries with strict

TABLE 14-12. SPROUTING GUIDE

Variety	Soaking Time (hours)	Dry Measure for 1-Quart Jar	Days Until Ready
Adzuki	12	1 cup	3–5
Alfalfa	8	3 tablespoons	4–5
Cabbage	8	1/2 cup	4–5
Chickpeas	12	1 cup	2–3
Clover	8	4 tablespoons	4–5
Fenugreek	8	1/2 cup	2–3
Green peas	12	1 cup	2–3
Lentils	12	1/2 cup	2–5
Mung	12	1/2 cup	3–5
Mustard	8	1/4 cup	4–5
Radish	8	1/4 cup	4–5
Rye	12	1 cup	2–3
Sesame	8	1/2 cup	2–3
Sunflower	8	2 cups	2–3
Triticale	8	1 cup	2–3
Wheat	12	1 cup	2–3

Source: From *The Complete Galley Companion*, courtesy Amanda Swan-Neal.

quarantine procedures such as Australia and New Zealand, you will lose anything fresh you're in the process of growing and also the seeds and grains you use for sprouting. Make sure to plan accordingly.

Yogurt Making

Fresh yogurt is easy to make. It requires only fresh or powdered milk, a source of yogurt culture, and a wide-mouthed thermos. Refrigeration will help set it and preserve it for many weeks, but it is not essential. Whole milk powder (available in New Zealand and Australia) makes a thicker, tastier yogurt than nonfat milk powder. You can purchase yogurt-making kits and flavored yogurt packets to use in them in most more-developed countries.

To make your own yogurt aboard without a kit, do the following:

1. **Boil milk.** Bring 1 quart of milk to a boil and let it simmer for about a minute. Let it cool until you can place a finger in it.
2. **Add yogurt culture.** Add 2 tablespoons of yogurt containing live cultures to the milk and whip it, or add freeze-dried yogurt culture.
3. **Place in a wide-necked thermos.** Put in a thermos and leave for a maximum of 12 hours. After that, the yogurt will become acidic.
4. **Cool and set.** Refrigerate the yogurt to stop the fermenting process and set the yogurt. If you don't have refrigeration, make only as much as you can eat in a day or two in the tropics. Put it in the coolest place in the boat to help it set. It will end up soupy but will still taste good. If you don't have freeze-dried culture, make sure to keep at least 2 tablespoons of yogurt to use in the next batch.
5. **Add flavorings (if desired) and eat.**

Other Ways to Preserve Food for the Long Haul

There are several pieces of equipment that can be used to greatly extend the life of food aboard. These include pressure cookers, vacuum sealers, and dehydrators. More information on each can be found in the Canned and Dried Food section in the resources for this chapter in Appendix 1.

Pressure-cooker canning. Using a pressure cooker to can (jar or bottle) fruits, vegetables, meat, and prepared meals makes high-quality, nutritious meals that will keep virtually forever. For those who don't have a freezer aboard, it is the best way to preserve food for long periods of time. To get started pressure-cooker canning, you'll need a heavy-duty pressure cooker, high-quality canning jars and lids, and a guide to processing times.

Any heavy-duty, high-quality stainless steel or aluminum pressure cooker capable of generating 10 to 15 pounds per square inch (psi) of pressure can be used for canning; however, size does make a difference in canning efficiency. Canning quart-sized jars requires a large, 8- to 10-quart pressure cooker. The pressure cookers that use a weight to regulate the pressure are more convenient for canning than those that have a gauge. Ideally, the pressure cooker will be fitted with a rack, a heat-proof trivet, or a perforated piece of aluminum to keep the jars separated and lifted slightly off the bottom. Alternatively, a dish towel folded in half and placed in the bottom of the pressure cooker offers adequate protection to the jars during processing.

Mason-type, highly tempered, threaded, home-canning jars with two-part, self-sealing lids—the classic Ball jars are one example—provide the safest and most hygienic seals and the least breakage and most uses per jar. The wide-mouth versions make filling much easier and can be obtained in both quart and pint sizes. Jars can be purchased in many hardware stores and supermarkets. Make sure to obtain several sets of extra lids for reusing the jars. Lids should not be reused. The screw bands can be reused but will rust eventually. They can be replaced wherever jars are available.

The U.S. Department of Agriculture's *Complete Guide to Home Canning and Preserving*, available in most major bookstores and through Amazon.com (or see the Canned and Dried Food section in the resources for this chapter in Appendix 1 for how to download a copy), describes the canning process and provides information on processing times for various types of foods. Several home-canning websites also provide information on home canning as well as recipes and accessories to make canning easier.

Vacuum sealers. These can be used for preserving dozens of food items and for keeping everything dry, from electronic spares to sweaters. Vacuum-packing frozen items helps prevent freezer burn; vacuum-packing flour and dry goods slows the reproductive cycle of weevils and other pests by removing most of the available oxygen. If sealed with a proper vacuum, foods retain their freshness and flavor three to five times longer than when in contact with air. Prices range from $50 to over $150. Make sure you get a high-quality unit with a real electric pump (those that use a fan do not remove enough air to create a vacuum) and a wide sealing bar. Temperature control is essential: too hot and the bags melt, too cool and they won't seal. You can find vacuum sealers in specialty kitchen catalogs and stores.

Dehydrators. Almost any food can be dehydrated and stowed. Corn, carrots, apples, pears, and fish, to name just a few, can be dried to a quarter or less of their original weight and reconstituted with some water. The big downside of a dehydrator on a boat is the electrical draw. Most of our friends who use them do their dehydrating when they have access to shore power. Both American Harvest and Mr. Coffee make dehydrators for less than $50. They can be purchased in kitchen and department stores. Look for one that has a timer that will turn off the power when finished drying, an enclosed heating element, an enclosed thermostat that reaches 160°F, a fan or a blower, and at least four durable plastic trays.

CHAPTER 15

Staying Safe: Lessons Learned Over 90,000 Nautical Miles

This chapter first appeared as a series of columns in Yachting Monthly *written by Evans Starzinger.*

EVERY CRUISER WE know who returns ashore after several years of cruising gets asked the same questions: Did you get into any storms? Were you ever attacked by pirates? Were you ever afraid of losing your boat? These questions always bemuse us, because in more than a decade of full-time voyaging we've experienced only eleven frightening situations, none of which ended in disaster.

When sailors talk about safety, most automatically add the words "at sea." Yet only four of our eleven incidents occurred on passage, and only two—a storm at sea and a near crew-overboard incident—were problems *because* we were on passage. That means that nine of our eleven "worst-case scenarios" were unrelated in any way to offshore passagemaking. One involved a tropical illness, which is discussed in the Infections and Serious Illnesses section in Chapter 16. Eight were, in general, a function of being too close to rocks or docks. These could have happened along any coast, at any time, to any sailor. The skills necessary to avoid these situations, therefore, would be necessary even for a liveaboard cruiser who never made a passage.

EIGHT DANGEROUS SITUATIONS AND WHAT WE LEARNED FROM THEM

All sailors would like to exercise perfect seamanship all the time, but most of the threatening situations we found ourselves in resulted from mistakes we made. In most of them, after first getting ourselves into trouble, we did the right thing to get ourselves out again unscathed. A few situations we got out of in spite of ourselves, however. In talking with dozens of accomplished offshore sailors, we have found a surprising degree of commonality in the root causes of dangerous situations faced by liveaboard cruisers. We therefore recount this painful litany of mistakes in hopes of helping others avoid them.

On the Rocks in Iceland

SLAM, CRUNCH, SMASH . . . a ½-meter swell lifts *Hawk* and then slams her keel and rudder down on the hard, rocky bottom. We are in an isolated anchorage on the east coast of Iceland and have put our baby on the rocks.

The day had started well—clear, sunny, and relatively warm. We were tied up in Seydisfjördur and getting ready to leave when an Icelandic friend told us we should visit the very beautiful Borgarfjördur, just up the coast. We did not have a chart for this harbor, so our friend offered to get us one. Beth and I got *Hawk* ready for a day sail while our friend went to the harbormaster. The photocopied chart she got for us did not show latitude or longitude but made the harbor look safe and easy to enter.

After a lovely sail in perfect conditions, we reached Borgarfjördur, but what we found did not quite match the photocopied chart. As we got in close, I could see a strong surge on the old stone fishing mole we were supposed to tie alongside. It was at this point that we made our first mistake, which was not skipping this harbor and going on to the next safe one. But the next harbor was an overnight sail away, and we both wanted to explore the lovely valley behind Borgarfjördur, so we decided to tie to the mole and see how bad the surge really was.

Then we made mistake number two. The harbor was quite small, lacking room to turn around, so I decided to back in with our port side to the mole. Our bow would be pointed out for an easy exit if the surge proved too violent, and being port side to would allow me to use *prop walk*—our right-handed propeller's side thrust—to pull *Hawk*'s stern gently into the mole in reverse, against the breeze. Once we were tied against the wall, however, the surge started throwing us hard against our shore lines, and it was obvious we couldn't stay. We had just agreed to motor off the mole and see if there was enough swinging room to anchor in the mouth of the harbor when the wind switched from onshore to offshore, putting us hard against the mole. Now we would have been better off bow in/starboard side to, as prop walk would have helped us get off the mole in this new breeze.

Then we made our final mistake of the day. I should have simply motored forward off the end of the mole, but with the wind pinning us we were concerned about scraping our topsides on the rusty iron fittings protruding from the concrete. We discussed inflating the dinghy and setting a kedge anchor to pull us off. But the chart showed we had plenty of deep water behind us, so I decided to spring the stern out (by powering forward against an after bow spring line to kick the stern of the boat to starboard), motor off in reverse, and then give the engine a quick shot of forward throttle with the wheel hard over to end up where we wanted to try to anchor. If the chart had been accurate, this would probably have worked. We sprung the stern out, I switched to reverse, and we pulled nicely off the mole. Then the rudder bounced over a set of rocks not shown on the chart. Before I realized what was happening and got the boat stopped, the surge had lifted us over another rock ledge.

SLAM, CRASH . . . I try to motor forward, but she won't go back over the rocks. We get a bow line to the mole and use the windlass to pull the boat forward, but she still won't go. All the while the surge is dropping the boat on the rocks with a force that jars our teeth and shakes the rig. At about this point the radio announces that a Force 10 gale is expected in 24 hours. Beth gets the kedge anchor out while I inflate the dinghy. I set the anchor abeam on 100 meters of rode and grind us off using a sheet winch. While painfully slow, this works surprisingly well, and slowly we pull *Hawk* over the rocks and out into deeper water.

A quick inspection reveals we are not taking on water, but our rudder is jammed up against the hull, and various parts of the steering linkage and autopilot have been twisted. A small hydraulic car jack pushes the rudder roughly back into place, and the primary winches in conjunction with an iron ring on the mole come close to straightening the steering linkages. A quick look at the pilot book shows the nearest repair facilities to be at a major shipyard in Akureyri, an overnight sail away.

We arrive there with the Force 10 gale and spend the next 24 hours in a blizzard. The next day, a commercial diver uses an underwater video camera to film the keel and rudder. The video shows we have a dent or two but nothing serious. The local machine shop makes replacements for all the twisted parts. We discover that the harbor chart we had been given was for a proposed harbor expansion and dredging that had not yet taken place.

Thoughts on Avoiding the Situation

If we had obtained a real chart of Borgarfjördur we could have avoided this situation. But cruising entails a number of fine balancing acts, one of which trades off being careful with money versus buying lots of safety equipment. The vast majority of the expensive safety equipment we have bought has (thankfully) remained unused for ten years. Charts are one piece of safety equipment that get used regularly, and we carry lots of them.

When doing an extended cruise, however, few people can afford to buy detailed charts for harbors they don't plan to visit. In most places, we could have bought a chart relatively easily when we changed our plans, but there had been nowhere in Seydisfjördur to buy a real chart. Our mistake lay in trusting a photocopied chart received secondhand from a nonsailor who had gotten it from someone who did not speak English. We should have gone with our friend to the harbormaster's office and had her translate for us to be sure we understood what the photocopied chart actually was.

Another balancing act is between adventure and prudence. If we had listened to our doubts about the chart and the surge, we would have avoided the situation, but we go cruising to have a little adventure and see new places, which entails some risk. When your gut gives you a warning, however, you have to listen. As our miles of experience accumulated, we had gotten a little overconfident in our skills and drifted too far toward taking risks. This experience was an unmistakable message telling us to swing the pendulum back the other way.

Bad decision making when tired and when dusk is approaching contributes again and again to most of our cock-ups. We have to remind ourselves to be especially careful and cautious when tired or trying to beat nightfall, even if this extra caution results in more effort, as would have been the case if we had left Borgarfjördur and sailed on to the next good harbor.

Thoughts on Dealing with the Situation Better

All in all, once we got ourselves into the situation, I think we dealt with it reasonably well. There are only two things I would do differently. First, I would use the motor more conservatively. If we had been going slower initially, we might have bumped over only one rock ledge rather than two, and if I hadn't tried to motor out hard against the rocks, we would have done less damage to the rudder. Motoring hard can often get a boat off sand or mud but is not effective against rocks.

Second, I yelled and swore too much. This undermines Beth's confidence that I know what I am doing or think it will work. The captain's job is to lead, and the crew will work to full potential only if they know exactly what they should do and believe it will work.

Night Reef Entrance

At 0200 a warm, gentle breeze washes the first scent of New Caledonia's soil and tropical flowers over the boat. On a moonless night after an unpleasant eight days hard on the wind from New Zealand, we are very close to landfall. We are tired, the boat needs to be aired out, and we want nothing more than to be in harbor with all the motion and noise behind us.

We disagree with those who say flatly you should never enter any harbor at night. A good seaman can make a night entry into a well-marked and charted seaport without endangering the boat, and we feel safer doing so than lying outside a busy commercial harbor in the path of big ships in the dark. When making our first approach to a well-maintained commercial harbor with working navigation aids, we will enter at night provided we have accurate charts and can use radar, the depth sounder, and GPS to confirm our position.

Before we left New Zealand, everyone had assured us that there were excellent leading lights through the New Caledonia barrier reef and right into the main anchorage at Nouméa, and the chart made it look pretty straightforward. We had therefore planned on making a night entry if necessary. When we first saw the loom of the Amédée Lighthouse just after midnight, we both felt relief; this uncomfortable passage was almost over, and we would be anchored and sleeping soundly well before daybreak.

But now I am frustrated. The pass entrance should be right in front of us. We can see the lighthouse and leading lights, and the flash patterns all match the charts. Although I have no immediate way of knowing how accurate the charts are, a note on them says they are within 1⁄10 mile to WGS 84 (standard GPS datum), and my radar distance to land seems to confirm that. When we line up on the leading lights, however, our course is about 10 degrees out from what the chart says it should be. I double-check the variation shown on the chart to correct the true course to a magnetic course . . . no error there. The reef is steep-to and mostly submerged, so neither the depth sounder nor the radar will be much help in feeling our way in. We try to line up the leading lights once more, with the same odd result.

Do we go ahead or not? If we go ahead, do we follow the leading lights or the course indicated on the chart? It's like a Yachtmaster exam question, and I suspect there is a clever way to safely work through the pass, but after eight days of pounding to windward neither of us can come up with it. After much indecision, Beth and I agree to heave-to offshore until dawn and run the pass in daylight. We head out on a reciprocal course from the bearing for the pass entrance until the GPS indicates we are about 8 miles offshore. In the few hours until daylight we can drift no more than 3 or 4 miles, so we shouldn't get anywhere near the reef before then. But just in case any of Nouméa's commercial shipping traffic happens by, we stand watches until daylight.

In the morning we find the pass easily, run in on the course shown on the chart, and the leading marks seem to be exactly where they should be. We can't figure out what was wrong the night before. Only the recent-looking wreck of a sailboat on the reef's edge keeps us from feeling foolish. We're happy that it's not us.

A month later another cruising sailboat tries to enter the same pass at night and runs up on the same reef and one of her crew drowns. Something was clearly wrong with the entrance at that time, but we never discovered what it was.

Thoughts on Avoiding the Situation

We seem to find ourselves in this situation rather frequently. For some reason, more than three-quarters of our passages have ended at night, and half of those were in overcast or moonless conditions. Some people are quite good at controlling their sailing speed the last two days of a passage so they arrive at their landfall during the day. I hate to slow down when I have a favorable wind, as I worry it might switch around and come on the nose, and I dislike pounding to windward more than heaving-to off a harbor entrance for a few hours to wait for daylight. In this case, we had been assured we could enter at night, so we had made no effort to slow down the boat.

Thoughts on Dealing with the Situation Better

After some debate, we did the right thing in this case. We did not allow ourselves to get drawn into making a night entrance when it did not feel right. We also kept a careful watch while we were hove-to. We all have to fight the tendency to go below and leave the boat to herself when hove-to, especially at the end of a long, tiring passage. The boat is at least as vulnerable to ships when hove-to as when sailing, because it takes a certain amount of time to get the boat underway again, and only a wide-awake watch person will be able to respond quickly enough in a collision situation. Several cruising boats have gotten run down while hove-to in areas of heavy shipping.

In poor visibility, virtual reality (e.g., the chartplotter or electronic charts on a computer) sometimes gets confused with reality. We have several quite experienced friends who have sailed their boats right into rocks, racon buoys, and reefs in daylight and good visibility because their electronic charts showed their little boat icon moving through clear water.

That night, the chartplotter's "reality" could have drawn us right into that entrance, but quite a few things can go wrong with a plotter-only approach:

1. The reefs and sandbars might have grown or shifted since the chart was made.
2. The GPS datum might be as much as several miles off.
3. There might be temporary obstacles not shown on the chart, such as log booms, recently disabled ships, parked oil drilling rigs, newly built bridges, etc.
4. The lag between the boat's actual position and the boat icon moving on the plotter/computer can be several seconds, which is enough to put you on a reef in tight quarters.

Only if the chart, the radar, the depth sounder, and the compass are all giving us a consistent message do we feel comfortable entering a harbor at night. In this case the chart, radar, and depth sounder looked right, but the compass disagreed.

Close Encounters with Ships

I'm sound asleep when I hear Beth yelling for me to wake up. I climb out of my bunk asking her what's wrong. It's 0200, and we're sailing dead downwind in 25 knots with 2- to 3-meter seas, about 150 miles off the Brazilian coast. The jib is poled out to port, and the main is prevented to starboard.

She tells me she's been watching a ship approach right on our bow. When she first spotted it, she could clearly see a green light and thought it would pass to starboard. But in the last few minutes she's been seeing a white light with occasional flashes of green and red. She has tried raising them on the VHF but has gotten no response so she turned on the radar and the motor and called me to help her sort out what is going on.

The radar takes 2½ minutes to warm up, so it's no help for the moment. I grab our megawatt spotlight and shine it on our mainsail to make us easier to see while I try to figure out which way they're heading. I am not really awake, and my brain is working very slowly. My immediate reactions to the situation are: (1) we don't have right-of-way now that we have turned on the engine, (2) the collision regulations say we should avoid turning to port in a head-on situation, and (3) turning to starboard looks like a turn into the ship's path. My brain basically locks up as it tries to untangle this dilemma.

The radar finally comes on. We fix a bearing line on the ship but still have to wait another minute or so before we can determine their track. We are going to be very close by then.

With the ship closing rapidly I am still not sure which way to change course. I shine the spotlight right at their bridge—something I have been told not to do, as it might kill their night vision—but in this case it appears that I have woken someone up. The ship makes a sudden turn to port and we pass starboard to starboard, less than a quarter mile apart.

A few years earlier, we were approaching the entrance to the Chesapeake Bay, also at 0200. To enter the bay, we had to cross a traffic separation scheme, in which the navigation rules say "a vessel of less than 20 meters in length or a sailing vessel shall not impede the safe passage of a power-driven vessel following the traffic lane." This meant that I not only had to avoid ships but also was not to "impede" them—not cause them to change course or speed.

We waited until we couldn't see any ships' lights in either direction and then started across the shipping lane at a right angle at our fastest motorsailing speed. About a third of the way across, someone called on the VHF, "Fishing boat near the Bay Bridge this is the bulk carrier XYZ." We were not a fishing boat and not that close to the bridge, so we ignored the call.

After hearing them call twice more and not hearing a response, I answered, "This is the sailing vessel at position ABC. Are you calling me, XYZ?" We got a colorful answer spiked with expletives saying they were going to run me down unless I got out of the traffic lane. We could now see their running lights occasionally, though the shore lights obscured them and made it impossible to tell what their track was. I politely explained my current course and speed and told them I would take any alternative course they might suggest. The X-rated reply concluded by saying they would try to maneuver to miss us. After a few tense moments they zoomed by a half-mile behind our stern.

Thoughts on Avoiding the Situations

We theoretically had right-of-way off Brazil until we got nervous and turned on the engine. I believe the ship's watch was not paying attention in that situation. In the Chesapeake, we were in a traffic separation channel where sailboats never have right-of-way over ships, but I believe the ship was going too fast for the conditions. No matter who's right or who's wrong, in a close encounter we're the ones who could be killed. Ultimately, then, it's the sailor's responsibility to keep clear.

We do not keep our radar on at night on passage, as it uses way too much power. Our radar takes 2½ minutes to warm up, and we then need at least a minute to determine if we are on a collision course. In a head-on situation, we can close 1½ miles or more in that time. Off Brazil, Beth should have turned on the radar when she first saw the ship's lights on the horizon, and not waited until she started to get nervous about its course.

When coastal sailing, we regularly use the radar's "standby" feature, which allows it to come on in a few seconds at the cost of a small electrical drain. The "watch" feature allows it to come on every few minutes, do a scan, and sound an alarm if it sees a target, but we have not found that to be very useful. Waves or rainsqualls frequently set off the watch alarm, and it does occasionally miss a ship.

In the Chesapeake we started crossing the channel when the coast was clear, but once in the channel we were simply not fast enough to maneuver out of the ship's way. If I had answered the first VHF call to "the fishing boat," we might have had time enough to turn around and retreat to the edge of the channel. The ship had obviously expected us to be a motorboat capable of moving at 12 knots rather than 7 or 8 knots. The miscommunication here demonstrates the importance of being absolutely clear when speaking on the radio. If the ship had initially hailed "the small vessel at position XY on a course of ABC at Z knots," I would have known they were calling me and answered immediately.

Thoughts on Dealing with the Situations Better

Despite our best intentions in the Chesapeake, we ran out of options, and it came down to the ship maneuvering to avoid us.

Probably the best thing we could have done off Brazil would have been to jibe the jib and turn sharply to starboard as soon as we determined we were in a head-on situation. But at that point it did not seem necessary. Beth assumed the ship's watch would see us or hear her radio call, and they would both agree to make a small correction, but that's not what happened. As the ship got closer we froze like a deer in the headlights, not knowing which way to turn. Probably a sharp turn in either direction at full speed would have done the job and been better than just continuing. This is exactly the situation a white flare is designed for—to attract attention—but the megawatt spotlight pointed at the bridge also seemed quite effective.

Close Encounters with Hard Objects

After spending three blissful weeks in the Tuamotu Archipelago, a collection of dozens of atolls between the Marquesas and Society islands in the Pacific, we are on our way to Tahiti and civilization. "Tuamotu" means "low" or "dangerous island" in the Polynesian language, and the area has a reputation for strong but unpredictable currents, treacherous reef entrances, and changing coral reefs. The tropical swell grinds down the windward sides of the atolls into strings of barely submerged coral islets, invisible on radar and difficult to see in strong trade winds until you're right upon them. The area was rarely visited when sailors relied on sextants for navigation, and we are among the first wave of GPS-equipped sailors to explore them.

We sailed out the narrow pass through the reef encircling Tahanea atoll, skirted its northern edge, and have now turned to go through the channel between it and neighboring Faaite atoll. It is blisteringly hot. Beth is on watch and trying to keep out of the heat—pretty much impossible given that *Silk* has no dodger to provide shade in the cockpit. The wind vane steers while Beth goes below to plot our position from the GPS onto the chart to track our progress. She comes on deck about every 10 minutes to visually check our position as we work our way through the channel.

From where I'm trying to get some sleep in the cool of my quarter berth, I see Beth stick her head out of the companionway for the third time. She shouts something I can't hear, but the tone of her voice launches me up into the cockpit. Not 200 yards straight ahead, I see breaking water and the emerald green of Faaite's inner lagoon just as Beth reaches the wheel. She unhooks the wind vane, grabs the helm, and bears off. Almost before either of us realizes we're in danger, all is fine again; yet at 6 knots we were only 60 seconds from piling up on that reef.

Though it all happened in a flash, this was probably the closest we ever came to losing *Silk*. A combination of things set us off course. Some current in the pass had swept us to the west. A slight wind shift had caused the wind vane to steer us a few degrees closer to the reef. Some chart error, and likely some changes in the reef itself, had taken our course closer to the reef than we intended. All these factors combined to push the boat just far enough so that our actual course was tracking right across the reef, even though the GPS had us passing a quarter mile east of it.

Another close encounter six years later was not boat-threatening but did add an important footnote to the lesson learned. In Annapolis we were putting in the interior in our new sloop *Hawk*. Each weekend we sailed 3 miles to an almost completely enclosed anchorage surrounded by hardwood trees and filled with birdsong, where we could pretend we were done with building the boat and were out cruising. There was a large unmarked mud bar at the entrance to this cove, and we had to make a big sweeping S-turn to enter or exit. We carefully made this turn twice a weekend for nine months. After we finished fitting out the boat, we spent one last night in this favorite anchorage. The next morning we raised our mainsail and sailed off the anchor, eyes set on the open ocean and the distant shores of Newfoundland—and we ran right smack into the mudbank at about 7 knots. After sheeting in the sails to heel the boat and wiggling the wheel a bit, we sailed off with only a few scrapes on the keel.

Thoughts on Avoiding the Situations

In the Tuamotus, if one of us had been on deck all the time we would have picked up on the approaching reef much earlier. The main reason we weren't on deck was because of the heat and the lack of shade in the cockpit. Any boat being fitted out for the tropics should have a large dodger under which the crew can take shelter from the sun. This can be considered an even more essential piece of safety equipment than a life raft for tropical sailing. *Hawk*'s hard dodger allows us to stay comfortably on deck in extreme cold, heat, rain, and wind.

In the Annapolis experience, on the other hand, we were on deck all the time. The deeper lesson is that merely being in the cockpit "keeping watch" is not sufficient. In cold, hot, wet, or windy weather, the watchkeeper will want to snuggle up in a protected corner of the cockpit and look around once every so often, and in nice weather the watchkeeper will be tempted to read a book, listen to music, or engage in some other distraction. This is not much better "watchkeeping" than we were doing in the Tuamotus. In any sort of near-shore situation, the watchkeeper needs to be paying careful attention, scanning the sails, the horizon, the chart, and the depth sounder.

Beyond the basic seamanship of keeping a proper watch, GPS needs to be used to minimize the possibility of navigational errors. Our cockpit instruments now display cross-track error, which shows us if we have deviated from our track and might be wandering into danger.

Over the years we have refined our procedures for positioning waypoints. In the Tuamotus, we put one waypoint in the middle of the channel near the hazard we wanted to avoid. We now put a waypoint at the middle of the entry and the middle of the exit from the channel, in clear water well away from dangers. This prevents us from clipping a corner if wind or current pushes us off our planned track and, if the charts are accurate, allows us to check that we are safe with a single glance at the cross-track error.

There are several theoretical ways to get a feel for chart and datum accuracy when entering new waters. One is to sail up close to an offshore buoy and compare your position to the charted position. When making a night entrance into Fremantle, Australia, this told us right away that the charts were accurate to within 10 feet. In flat water, taking cross bearings on two navigational marks or radar bearings on shore features can also be used to confirm the accuracy of the charts. Neither of these options was available in the Tuamotus, which had no offshore buoys and a nearly featureless horizon.

Thoughts on Dealing with the Situations Better

In the Tuamotus, it was all over in an instant. Only the night after, when we were relaxing at anchor, did it really strike home how close we had come to losing our boat.

The Tuamotus happened to be an exotic tropical location, but Annapolis was home waters. The basic elements of both situations had little to do with offshore sailing or exotic waters. As with many of our screwups, these situations were induced by a lapse in basic seamanship—becoming complacent and not paying attention—and were resolved by obvious and immediate corrective action, not by any fancy safety gear.

Close Encounter with a Hurricane

Lenny has been upgraded to a Category 4 hurricane (winds of 114 to 135 knots) that will hit somewhere between Antigua, St. Martin, and Tortola within the next 48 hours. For three days, we have been tied into the mangroves in English Harbour, Antigua, with torrential rains and 30 to 35 knots of wind right on the beam, waiting to see if we are going to get hammered. The tension is unbearable.

We got about 24 hours' notice before the gale-force winds at Lenny's periphery began. The initial forecast called for "only" a Category 1 hurricane (winds of 64 to 82 knots), so we set up the boat with that in mind. We cleared the decks completely and took our furling genoa down to reduce windage and avoid the possibility of it unfurling in strong winds. We tightly wrapped the mainsail with two lines to reduce its windage as much as possible and prevent the sail cover from flogging.

In English Harbour, boats are tied either bow-to or stern-to the mangroves. *Hawk* is secured stern-to with four anchors over her bow and three lines ashore from each stern quarter. We decided to go stern-to so we could use the windlass to handle the heavy ground tackle and to keep our bow into the wind and rain. But now that Lenny has been upgraded to Category 4 and is heading due east toward Antigua, I can't help but visualize 135 knots of sustained wind, our anchors dragging, and the mashed rudder pounding up and down on the bottom just before the hull splits open.

We started out with three anchors set (port, center, and starboard) and one in reserve. As the wind began building through 30 knots I realized it was not going to be possible to dinghy out the reserve anchor if I waited until we got into trouble, so I took it out and set it as a second center anchor. When sailing I sometimes wish we didn't have to lug so much weight around, but right now I am glad to have oversized anchors (a 110-pound Bruce, a 55-pound Delta, a 32-pound FX-55 Fortress, and a 40-pound Danforth type). We did put a "backup" snubber line on our main anchor chain, and we will always do so in future storms, since a few hours ago the primary snubber started tearing itself apart, and the backup gave us time to replace it.

We carry five 100-meter warps on *Hawk*. These allowed us to set our three spare anchors with enormous scope and to reach in ashore as far as we needed to find solid attachment points. We had to reposition one shore line when we started pulling a mangrove tree out of the ground, roots and all. With three lines to different anchor points on each quarter, we had plenty of time to retie the line to a bigger tree.

I took round turns on all the trees before tying a bowline, and our lines are not chafing at all. Lines from other boats tied in a loop around the trees are experiencing quite a bit of chafe. Long pieces of fire hose threaded over each anchor line where they pass through the fairlend have protected our lines during the last three days of gale- and storm-force winds while the plastic or rubber hoses some people are using are splitting. It has turned out to be very important to have gotten all the chafe protection on right at the start, since the strain on the lines now makes the chafe guards very difficult to adjust.

We just heard on the radio that Lenny has decided to hammer St. Martin rather than Antigua. I feel a bit guilty about my initial burst of joy when I heard we were "only" going to get tropical-storm-force winds. My heartfelt prayers go out to those on St. Martin.

Thoughts on Avoiding the Situation

Several years ago I wrote a letter to the editor of a sailing magazine saying the best hurricane tactic was simply to avoid being inside the hurricane belt during hurricane season. That's still pretty good advice, but our experience with Lenny suggests how difficult it is becoming to follow. In 1999, when Lenny caught us in Antigua, we waited until mid-November before sailing down to the Caribbean. Usually hurricanes are well over by then, and waiting any longer increases the risk of encountering a winter gale. But even after doing everything by the book, we ran afoul of "wrong-way" Lenny, which traveled east instead of west through the Caribbean. Given the changes in tropical storm seasons in recent years, sailors must be prepared to encounter a hurricane or a cyclone.

When we got the initial forecast for Lenny, there was a lot of discussion on the radio among the superyacht skippers about trying to make a run south, away from the storm. The general consensus, agreed to by the local meteorological office, was that the storm path was so unpredictable that there was just no way to be certain which way to run and, in any case, English Harbour was the safest hurricane hole within 300 miles. As it turned out, Lenny's course was so erratic and unusual that if we'd run based on the initial forecast we would almost certainly have ended up right in the thick of it.

In the final analysis luck plays a big part in surviving a Category 4 or stronger hurricane. When deciding where to spend Christmas that season, we had tossed a coin between Antigua and St. Martin. The coin came up Antigua. We had no way of knowing that we were actually tossing the coin between facing 50 knots of wind or close to 150. Neither of us likes having luck decide our fate. We still believe it is best, if at all possible, to avoid the tropics during storm season entirely. But we now have to admit that that may not always be possible.

Thoughts on Dealing with the Situation Better

Our coin toss not only kept us out of the strongest winds, but it also put us in English Harbour, a narrow, well-protected harbor with mangroves. This virtually eliminated one of the biggest uncontrollable risks in a hurricane—the possibility of an upwind boat dragging its anchor, slamming into your boat, and taking both of you onto the beach. If stuck in a harbor like Simpson Bay Lagoon, St. Martin, where everyone lies to anchors, I would try to anchor in a corner upwind from the fleet during the strongest initial winds, but it is not always clear what wind direction to plan on. With Lenny's center west-northwest of us, we should have had southwest winds through much of the storm, but instead we had southeast winds driven by a feeder band of strong squalls. In addition, it's rarely clear when you set your anchors whether the storm center will pass north or south of an island, which makes it impossible to be certain where the initial winds will come from.

Although we sat out the winds we had with no problem, when Lenny got upgraded to Category 4 and headed toward Antigua for several hours, we realized there were quite a few shortcomings in the way we'd set up the boat. What had seemed bulletproof for 70 or 80 knots of wind didn't look so good when we were thinking we might get 130 or more. If we were in the same situation again, we would prepare for the worst, even if it meant a day or two of extra work.

We would remove *Hawk*'s mainsail completely to further reduce our windage. We would go bow-in to the mangroves to protect our rudder in the event of being driven aground. Instead of putting four anchors out on separate rodes, we would put two of the anchors in tandem (see the Tandem Anchoring section in Chapter 6) on a single rode off the stern as this would provide greater holding power. We would use doubled or tripled lines off the bow, but we would look harder for thigh-sized or bigger trees rather than the arm-sized one we pulled up.

Finally, we would pay much more attention to shelter from nearby windbreaks. When we tied up, we positioned the boat so that a hill 100 yards to the southwest would act as a windbreak for the strongest forecast wind direction. However, we noticed that all the locals, who have much greater experience with hurricanes, snuggled into two particular spots where the mangroves provided shelter from three directions. These created real lees that kept wind off the boats. As we were to learn later in Chile, some hill and ravine shapes actually funnel and accelerate the wind rather than break it. Buildings on the shoreline can provide windbreaks, but island buildings are prone to shredding in 100 knots of wind and sending a steady stream of deadly projectiles downwind. Nearby windbreaks can also protect the boat from such projectiles. If we ever have to sit out another hurricane, we will look for a spot where the boat is right up against mangroves or steep hills on at least two and preferably three sides.

Fire On Board

Silk sashays along merrily beneath white fluffy trade wind clouds with about 15 knots of wind over the stern quarter. We're mid-Atlantic, on passage from the Canaries to the Caribbean, with a little over 500 miles to go to Antigua. About 30 minutes ago we started the engine to charge the batteries. I'm out in the cockpit enjoying the sunshine and a good book when Beth comes up on deck.

"Do you smell something?" she asks. I sniff and shake my head. "I smell something . . . chemical. Nasty."

Bad smells—mold, head odors, chemical smells—are never a good sign, and our immediate reaction is to find the source. Beth ducks below and starts searching around, opening up the engine compartment, crawling around the galley area, and checking around the navigation station. When I open the cockpit locker, acrid white smoke comes pouring out. Beth kills the engine immediately while I grab the dry-chemical fire extinguisher from the galley, but the smoke quickly dissipates, and I see that there are no flames.

A quick inspection of the cockpit locker reveals a black line burned into the fiberglass, all that's left of a wire that's been completely vaporized. I trace this to the solar panel. The boatyard that installed it led the wires directly to the battery bus bar without the protection of a fuse. After some testing we discover that the solar panel developed an internal short, which caused the full battery amperage to flow from the battery to the panel across the now nonexistent wire. The boatyard workers had convinced me that the "single wire to solar panel" setup was pretty foolproof and unlikely to need a fuse. Even so, I had considered adding a fuse a year or so ago, but after seeing the slight voltage drop it caused, I had opted to maximize the voltage generated by the panel. Obviously this was a mistake.

Neither of us thinks much about the danger of the situation at the time. The drama is over before it has really begun, and we are worse off by one solar panel, one wire, and one slightly melted hose. It is only later that night, sitting on watch under a bright starry sky, that it hits me how lucky we have been. The hose that melted carried diesel to our cabin heater. The wire that vaporized ran near some oily rags and a couple of cans of paint and solvents. Had we carried an outboard motor, we would have stowed a gas can in that locker. If we had been just a little less fortunate, any of these things could have caught fire or exploded and burned the boat to the waterline.

Later that season, we learned how incredibly quickly fires on fiberglass boats can get beyond anyone's ability to control. In a marina in the Virgin Islands, the battery charger on a boat right across the dock from us shorted out and ignited a can of paint thinner. By the time her crew, who were eating on a deck overlooking the marina, saw the smoke and got to the boat, she was beyond salvage. Despite the professional firefighting equipment on the dock, the raging flames reduced the boat to a burned-out hulk in less than an hour. It took a concerted effort to keep the fire from spreading to nearby boats, including ours.

Some years later we had a more dramatic close call with fire aboard *Hawk*. I was having trouble getting our diesel cabin heater started in a Force 10 blizzard in Iceland (on June 2!). Usually we put a teaspoon or so of methylated spirits or kerosene in the bottom of the diesel heater to get the diesel to ignite. But in the subzero, 45-knot beam wind, gusts coming down the chimney were snuffing the flame before the diesel ignited. I was not about to spend the night without heat, so I poured in a large quantity of methylated spirits and dropped in a match. It ignited rather too well, and suddenly we had flames licking out the sides and top of the heater, threatening to reach a small diesel tank mounted on the bulkhead right above and behind it.

I grabbed the dry-chemical fire extinguisher mounted near the heater and gave the bottom of the flames a little squirt. The fire went out, but as the chemical dissipated and oxygen reached the hot diesel at the base of the heater, the whole thing ignited again. I reacted by aiming the extinguisher at the base of the fire and spraying for 5 or 6 seconds. The flames went out immediately, but the cabin filled with the thick white powder. We couldn't see a thing, and worse, we couldn't breathe. We were forced out into the cockpit, into a raging snowstorm, in our pajamas. I had to make a dash through the powder-choked air inside the boat to reach the sail locker and open the large hatch there. It took more than 10 minutes for the air to clear enough so that we could return below. We spent most of the night clearing away the masses of powder produced by the extinguisher discharge. Beth was still finding pockets of white powder in the backs of lockers and distant parts of the bilge six months later.

Thoughts on Avoiding the Situations

Electrical shorts do happen, occasionally even with well-maintained equipment. Two precautions are essential. First, every wire on the boat, no matter its function or location, should have a fuse. Second, all flammable materials, especially those with flammable vapors such as acetone, gasoline, and propane, should be stowed either on deck or in an overboard draining locker with no electrical wires or source of heat. Our current boat has a specially designed, self-draining locker for all flammables and explosives.

We later found a solution to the chimney heater "downdraft" problem that led to the fire in Iceland. Because of the chimney orientation relative to the mainsail cover, the flame can be snuffed in a gale-force wind only on the port beam at temperatures close to freezing. If we find ourselves in this situation and unable to change our orientation to the wind, I slide a 12-volt bilge blower fan into the top of the exhaust stack oriented to suck air up and out of the chimney. This creates a positive draft, allowing the diesel to catch fire and the heater and stack to get warm. Once the stack is heated, the rising warm air creates its own updraft, and the heater will continue to function no matter how strong the wind. We remove the fan before the air in the chimney gets too hot and melts the plastic fan blades. I am sure that somewhere there is a heatproof fan I could install permanently, but the bilge blower is cheap and easy, and we need it only once or twice a season.

In neither of these cases would a smoke detector have been of much use. But every boat should, at a minimum, have fire extinguishers appropriate for Class B (flammable liquid) and Class C (live electrical) fires installed near the engine, near the cabin heater, and near the galley.

Thoughts on Dealing with the Situations Better

In the Iceland situation, our dry-chemical fire extinguisher did the job quite effectively but made an enormous mess. We were totally unprepared for how quickly and completely the oxygen got sucked out of the air. If you have to set off an extinguisher in an enclosed area like an engine room, be prepared to get out into the open quickly even if you can't see. A fire blanket would likely have put out the fire just as well, not made such a mess, and not nearly asphyxiated us.

Pinned on a Fuel Dock

We have just finished topping up our diesel tanks at the fuel dock in Nouméa, New Caledonia. The early morning winds were light when we tied to the dock but have since built to a steady 20 knots on the beam, pinning us to the dock. We are port side to, and our centerboard ketch is not very nimble at springing off in such situations. I walk down the dock to see what kind of room we have to motor straight off the end. Less than a boat length to leeward lies a really nasty rock breakwall that forms the seaward side of the marina, and it curves out from the dock for about 30 feet across the axis of the wind. We won't have much room to maneuver once the dock ends.

I ask the dockmaster if we can stay until the wind dies in the evening. She says, rather emphatically, "No." We have to leave.

We try springing out the stern and then the bow. Either way, powering against the spring, we can get one end of the boat about 20 degrees off the dock, but the minute we release the spring line we're blown back in. If we had come in starboard side to I could have powered against a forward spring and then used prop walk to pull us away from the dock in reverse, but port side to our prop pulls us into the dock.

Our best option seems to be to spring the bow out as far as it will go, then power forward with a couple of people helping to fend the stern off the dock. We think we can build enough speed by the time we get to the end of the dock to turn farther up into the wind and not get blown down into the breakwall. We set up a doubled spring from the stern cleat to a bollard forward on the dock. We position a large ball fender near the stern quarter to act as a fulcrum and allow us to get the bow a bit farther into the wind. I power back in reverse against the spring and the bow points off the dock about 20 degrees. I quickly shift into forward gear, Beth pulls the spring line off the bollard, and a couple of people lean on the stern quarter to hold it off the dock.

As we power forward the bow stays up toward the wind, but the fender on the stern continues to bump along the dock. I cannot steer away from the dock very sharply because that pulls the stern hard against the wharf. We suddenly run out of dock and find ourselves being blown much faster that I had expected down onto the breakwall.

The dockmaster yells at us (in French) to go in reverse, which I ignore since our prop walk in reverse will just pull us more quickly into the breakwall. We are less than a boat length from disaster and closing rapidly. I slam the throttle forward, redline the engine, and, with no dock to interfere with our stern, swing the wheel hard to starboard. There is a long moment of hesitation as the prop spins up seething whitewater. Our speed finally starts to build, but we are still pointed right at the curved breakwall. With about 8 feet to go to the wall, our boat speed and the prop wash on the rudder finally lever the bow through the wind. Our stern quarter misses the boulders at the foot of the breakwall by less than 2 feet as we shoot by the end of the breakwall and out into open water.

Thoughts on Avoiding the Situation

We have since encountered many fuel docks oriented beam-to the prevailing wind. We have learned to wait and go against these docks late in the afternoon, as the trade winds often drop in the early evening. Also, a dockmaster is often more willing to allow us to stay until the wind dies—even if that means dawn the next morning—if we're the last boat to be fueled for the day.

In light to moderate winds, we usually go in starboard side to and spring off stern first. Both our boats have had reasonably strong prop walks in reverse, and this will get us off with a beam wind of up to 25 knots. If the wind might be stronger and we can't wait on the dock for it to drop, as was the case in Gove, Australia, two months after this incident, we drop an anchor upwind from the dock and let the rode run as we tie up. We'll go stern-in and Med moor if the fuel hose can reach our fuel fills; otherwise we go side-to and then use the anchor to winch us off the dock or to pull the bow through the wind when we want to leave. In Iceland, we would have set a kedge anchor and avoided going aground if we'd known how shallow the harbor was behind us.

Thoughts on Dealing with the Situation Better

When maneuvering around marinas and other tight situations, it is almost always better to use less engine power and go slower. That way, things happen more slowly, you have more time to react, and if you do hit something it will be with a bump rather than a crash. But trying to turn sharply into the wind is one of the few counterexamples. In this situation, more throttle and more prop wash against the rudder would have been better. I might have gotten the boat moving into the wind before the dock ran out if I had used the engine more aggressively, but we would later get into trouble in Iceland using too much power when springing off a pier. This is a tricky balance that can only be learned through experience.

After this incident, we have been careful to avoid going on fuel docks where we could be pinned by the wind, but still, on a couple of occasions, we have had the wind come up unexpectedly when we were wrong side to a dock. Rather than trying to power off, we take lines to an upwind piling or drop a kedge anchor off the beam and winch ourselves off using our primary winches or our anchor windlass. In the situation in New Caledonia, there were several piers across the aisle from the fuel dock. We could have rowed warps over to them and winched the boat to the upwind side of the channel.

In this situation, a dinghy with a large outboard can serve as a tugboat, pushing the bow through the wind. The outboard needs to be at least 15 hp to be of any use in 20 knots of wind, and we have never carried a powerful enough outboard for this approach.

Trying to simply motor away when pinned on a dock is the quick, easy, and seductive option. In this case, we just barely got away with it. A kedge anchor or some long warps would have taken more time but would have been a much safer way to get off.

GPS Waypoint Mistake

After a week cruising around the southern tip of New Caledonia, we are sailing back to Nouméa to provision, clear customs, and head for Australia. We planned on a relaxed coastal sail, including a lunch and photo stop at the Amédée Lighthouse that marks the entrance through the coral reef. Unfortunately our relaxing day sail has turned into a 4-hour close reach into 30 knots as the leading edge of a strong high-pressure system drives up the barometer rapidly. The short, steep seas building quickly inside the lagoon make for a wet and uncomfortable ride.

We reach the lighthouse, take a few quick pictures, and abandon the idea of lunch in the choppy anchorage. Instead, we turn toward Nouméa, sailing along the track we followed when we made landfall upon our arrival from New Zealand three weeks ago. I ask Beth to put a route in the GPS and give me a course to steer, and I give her the name of the stored waypoint I used to reach the entrance to Nouméa Harbor when we made landfall. She drops below, finds the waypoint, and creates a route that starts from our current position. She glances at the chart, notes the waypoint I plotted three weeks ago, and eyeballs the route from our position to the waypoint. Satisfied that the course is clear of dangers, she reads out the bearing and distance to me.

I turn onto that bearing. A few minutes later the depth alarm goes off, and our depth drops, from 15 feet, to 12, to 8 . . .

As has been the case all week, the water is cloudy with sediment from strip mining, the island's biggest industry, making it difficult to read water depth visually. The choppy seas and whitecaps make it impossible to pick out water breaking on shoals. By the slight change in water color we can see that it is shallow all around us, but we cannot see any deeper water that would lead us back to the main channel. There is an islet about a half-mile to starboard and a stake to port, the kind commonly used in the Pacific islands to indicate shoal water not shown on the charts. Beth races below to check our GPS position on the French chart only to find that it shows us still in deep water. The depth is continuing to drop so I turn on the motor, stop the boat, hold it in position against the wind, and call for Beth to tell me which way to turn.

There are too many reefs and small islets on the chart to identify where we are by fast eyeball navigation. The GPS position is also too far off to help. After some discussion we decide we should be okay if we motor very slowly and stay well away from the stakes. Our best guess is that we are south of the channel so we head north. After about ¼ mile of shallow water, giving a wide berth to a couple of stakes, we finally work our way back into the deeper channel.

Thoughts on Avoiding the Situation

It took some time to reconstruct exactly what happened. To start with, we should have been following the basic rules of coastal navigation. Even if we didn't feel the need to take bearings on landmarks and plot our position on the chart, we should have been mentally checking off the various little reefs and islets we were passing and keeping track of our position. But we were lulled into a false sense of security by the GPS, something we have seen happen to dozens of other crews sailing in islands charted far less accurately than U.S. or European waters.

When we did sit down and sort out what had happened, it turned out that when we had come this way three weeks before I had noticed that the chart and GPS did not match and had corrected the position of the channel waypoints in the GPS. But I did not change the position of the waypoints I had marked and labeled on the chart. So when Beth took our current position and checked for hazards along that course to the waypoint I had given her on the chart, she was not checking the same course the GPS had given her. The course and waypoint were just different enough to take us across an area of shoal water extending off one of the small islets along our course. We were off the GPS course by less than ⅒ mile, but in those coral-infested waters, that was enough.

If I had erased the old waypoint mark on the chart or used a new name for the corrected waypoint, Beth would not have been confused. Alternatively, she could have determined the chart and GPS waypoints didn't match if she had plotted it on the chart using calipers, but that would have taken several times longer, and she did not think it necessary.

A chartplotter or PC charting system would have kept track of the waypoint change and immediately given Beth a correct course to check for hazards. At the time, we did not have either aboard. We now have both, and in this situation it probably would have kept us out of trouble. But in practice, we have found four problems with these systems:

1. Electronic charts are hideously expensive, especially when, like most cruisers, we are usually just sailing through an area and use each chart only once. We often choose not to buy electronic charts for areas where we already have paper charts.
2. I don't like having our laptop computer on when we're sailing, especially in vigorous 30-knot close reaches, as I am afraid the boat will take a lurch and something will get thrown at the screen or water will drip into the keyboard. As a result, we still often plot our position on paper charts.
3. The charts in some areas outside more-developed countries are not accurate and have not been corrected to standard GPS datums (as was the case for this chart in New Caledonia).
4. As already mentioned, we have recently seen more "electronic chart–assisted groundings" than any other type of accident. The electronic charts look so real you can start thinking they *are* reality, and neglect to check them against other navigational aids.

In the end, the GPS is *an additional* aid to navigation, not *the* aid. The old warning about never relying on one aid to navigation is as true for GPS as for any other position-fixing device. We have to constantly remind ourselves to corroborate its readings with the radar, depth sounder, and bearings on landmarks, or by just eyeballing and identifying each passing island so we know where we are. These good habits can die quickly when GPS comes aboard, but preserving and encouraging them may well save your boat someday.

Thoughts on Dealing with the Situation Better

We both panicked a bit, as the shallow water took us totally by surprise, and we had become so reliant on GPS that we couldn't at first think of any other way to check our position. We should have stayed calm and composed, as we always had the option of sailing out on a reciprocal course or dropping an anchor so we could sort out our position. If panic sets in for one person, it can make the whole crew lose their heads, and that's when the worst things happen. Staying calm and clearheaded when we unexpectedly find ourselves in danger is often more difficult than in a storm or entering a strange harbor, when we're anticipating the worst.

SUMMARY OF LESSONS LEARNED

We have identified four underlying factors, one or more of which contributed to each of the dangerous incidents described in this chapter:

1. **Inattention and complacency.** After many offshore miles and landfalls, it's very easy to get complacent and become inattentive. Humans cannot remain focused and at full attention all the time, but we can make sure we relax at anchor or in open water, where there are few dangers. In near-shore waters, we can't let a good conversation or daydreams distract us from sailing the boat. Rather, we need to focus on the here and now and pay close attention to the immediate environment—the sails, the horizon, and the chart. Our current boat has a sizable hard dodger that provides shelter even in extreme cold, heat, rain, and wind. It enables us to keep a good watch and stay alert in unpleasant conditions ranging from the debilitating heat of the tropics to the numbing cold of the Roaring Forties.
2. **Exhaustion.** Fatigue begets errors of judgment and has contributed to many of our worst situations. Most mishaps occur due to a string of fatigue-induced poor judgments and/or a lack of energy to take necessary actions. We have learned to be extra cautious and less adventurous when we are tired. Keeping fatigue levels manageable requires bulletproof steering systems and competent crew when sailing coastwise in dangerous waters. Hand steering will quickly exhaust a shorthanded crew and should be avoided if at all possible. Unless the crew includes one experienced person the captain trusts with the watch, the captain will always be fighting fatigue.
3. **Charting and waypoint errors.** We have learned to position our waypoints so that even if we get pushed off course or the chart has errors, we will still have a clear run to each waypoint. Our chartplotter on *Hawk* allows us to see exactly where the boat is and the course to the next waypoint, but we have to avoid falling into the trap of believing the virtual reality on the plotter *is* reality. Electronic charts can have GPS datum errors; there may be temporary obstacles not shown on the chart from oil drilling rigs to fishing floats; sandbars and reefs may have shifted or grown.
4. **Maneuvering around docks.** A quarter of the time when we've gotten into trouble, we have been trying to leave a dock against a beam wind. Investing some time in learning how to handle a boat in this situation will save a lot of grief. Our docking decisions used to be made based on the easiest approach. Now we decide based on what will make it easiest to get off again, which usually means going starboard side to the dock (since our prop walks us to port in reverse). We also consider whether we should drop an anchor before approaching a dock to help us get off later.

When we ask other long-term cruisers about their worst experiences, they often mention horrendous anchoring situations. We have been fortunate with our anchoring, perhaps because we carry a "storm-sized" primary anchor, pick anchorages conservatively, and head out to sea before an anchorage becomes untenable.

Although proper equipment, experience, and preparation are important contributors, the will to survive is the most essential factor in survival, as discussed in the Surviving an Emergency section in Chapter 23. To manage our worst situations, we needed to jump into immediate corrective action, not freeze up, and our fancy and expensive safety equipment has been of relatively little use. The gear that has actually made us safer includes ground tackle, accurate charts, satellite communications (Iridium and Inmarsat-C), our drogue (see the Running Off Free or with a Speed-Limiting Drogue section in Chapter 22), and medical supplies (see the Know Thy Medical Kit section in Chapter 16). We are skeptical of the reliability and value of much of the other safety equipment available. To repeat the above point: Mental attitude is more important than even the most basic equipment.

Frequently, our first action did not solve the problem, and our eventual success depended upon trying another approach and continuing to try things until something did the trick. We continually think about and plan for contingencies: Where are we going to go if the wind shifts and makes this anchorage untenable? Which approach to this dock will give us the best options for getting off again? If we lose our engine through this reef pass, what sails should we have up so we can get safely away?

Various comparative studies have found that sailing is just about as safe as golf and has a much lower injury rate than mountain climbing or rugby. That's consistent with our experience. Eleven incidents in more than a decade of full-time cruising means that we find ourselves in a frightening situation less than once a year. Our worst moments have almost all been caused by our own stupid mistakes, and we have so far managed to get out of them without permanent damage. Over time, we have even come to appreciate the emotional highs and lows and embrace these challenges as part of the cruising life. They are the price we pay for the hundreds of trouble-free days and thousands of indelible memories that cruising has given us.

CHAPTER 16

Staying Healthy: Being Your Own Doctor

EVERY OFFSHORE CRUISER must be prepared to handle medical emergencies without outside assistance. Our medical log reveals that with one exception, we have suffered only minor ailments. But even minor infections and allergic reactions can become medical emergencies if they are not treated quickly and effectively. Though voyaging tends to be a healthy way of life overall, voyagers must deal with some long-term health issues specific to cruising.

Successful medical care aboard comes down to three things: preparation, prevention, and protection. Before you leave, you need to equip your boat and prepare yourself for medical issues that may arise. Once you are voyaging, you need to take steps to prevent day-to-day health problems. Finally, you need to protect yourself from the effects of sun exposure, limited exercise, and occasional poor nutrition.

PREPARATION: BEFORE YOU LEAVE

Evans and I believe that you can learn most offshore voyaging skills as you go. If you don't know anything about diesel mechanics, provisioning, rain catching, or even sailing your boat, you will learn if you want to continue voyaging. The one exception is medical skills and preparation. If you are skilled but poorly equipped or if you take a sophisticated medical kit but lack basic first-aid skills, you won't figure it out once you're out there—and your health or the health of your crew may be seriously jeopardized.

How do you go about learning medicine in months instead of years? Obviously you can't learn everything. You have to use the medical history of the crew to focus your efforts. With the help of a doctor, you need to put together a complete medical kit that reflects those health requirements. You must master some basic skills and be certain that every crewmember is prepared to deal with a medical emergency.

Know Thyself

When we left on our first voyage, we had tremendous faith in the medical profession and little knowledge of our own bodies. We now know that medicine is a developing science, and for some ailments, there are no easy answers. We learned that our bodies were like the boat: No one knew them as well as we did. We became less reliant on getting ourselves "fixed" and more aware of how to avoid getting "broken" in the first place. Our faith in medicine declined, but our faith in our abilities to stay healthy and to help our bodies heal when necessary increased.

Evaluate Your Health

Before you become serious about leaving civilization behind, consider your medical history and its implications for life aboard. If you are young and healthy, this takes about 5 minutes. But if you are older, or if you have even minor health problems, consult your doctor early in the planning process. Talk to others who have been voyaging that share your health profile. Doctors who sail offshore can also provide a useful perspective.

We have met voyagers with major health issues who have found ways around the difficulties in order to live their dreams. It is possible to cruise with diabetes even if you are insulin-dependent, though you will need a bulletproof refrigeration system and someone else on board who can measure your blood sugar and inject insulin. We even met one brave woman with a brain tumor who had been a nurse; she was doing her own chemotherapy treatments on the boat with the help of her husband. She told us that she would rather spend what was left of her life seeing the world than sitting in waiting rooms in hospitals. If you want to go badly enough, almost any manner of disability can be accommodated, but it takes commitment and courage on the part of everyone aboard.

Though most cruisers find voyaging a healthy way of life, don't assume you will be healthier voyaging. Most ailments improve, but a few are aggravated, including the following:

- **Sun sensitivity.** If you have any history of abnormal sensitivity to the sun, whether mild rashes or major lesions, you will need to protect yourself at all times.
- **Allergies.** Allergies to mold and mildew can be a major problem. On tropical islands with plenty of rainfall, the wealth of vegetation can make hay fever sufferers miserable. Insects abound; if a crewmember is allergic to bites or stings, the medical kit will need to include the necessary antidotes, and every crewmember must know how to administer them. Take into account any drug allergies when putting together the medical kit.
- **Arthritis or joint pain.** If you suffer from arthritis or joint pain, the inactivity of passagemaking followed by vigorous exercise in port may aggravate the situation.
- **Ear infections.** If you have a history of chronic ear infections, even as a youth, assume that you could have a recurrence when you start swimming and snorkeling in waters near coral reefs, which harbor a lot of bacteria. If you have children aboard, prepare for ear infections.
- **Hemorrhoids.** Sitting at sea for days on end will aggravate any tendency toward hemorrhoids.
- **Yeast and bladder infections.** The moist, humid environment and sometimes less-than-hygienic conditions make vaginal yeast infections and bladder infections common among women.

A nutritious diet, outdoor living, and exercise make most voyagers feel healthier. Most believe that they have reduced their long-term health risks for heart disease, high blood pressure, and even cancer. Against these benefits, the list above represents small risks. By paying attention to these minor ailments, you can ensure that your new lifestyle will be as disease-free and healthy as possible.

Get a Major Physical and Inoculations

In those last hectic months before you head off to sea, get a full physical and dental examination. Talk to your doctor and dentist about your plans. Ask them to assume that you will not have access to high-quality care for a minimum of six months. Based on your history and your current physical condition, have them put together a list of specific medications you should bring along. If you have any complications in your medical history, get them to be as specific as possible about early symptoms and possible treatments. Have your dentist fill even the smallest cavities. Take care of any major dental work you've been putting off.

Some physicians are uncomfortable with equipping you to doctor yourself. If necessary, spend money outside of your health-care plan. Find someone who understands your situation and is committed enough to invest time and energy in your dream. Many doctors sail and will be sympathetic to your needs. If you are a member of a yacht club, you probably know several sailing doctors. Otherwise, taking an offshore medical training course will introduce you to a sympathetic physician who can help you find someone in your area. For information on the courses, organizations, books, and products discussed in the following pages, see the resources for this chapter in Appendix 1.

Plan on spending two or three sessions lasting an hour or more with your doctor. If you have children or a complex medical problem, the time required will double. To be sure that you are properly prepared, start early. Unless you are under 35 and completely healthy, your first visit to your family doctor should be at least six months before your planned departure date.

Right before you go, get a complete copy of the medical records for every person aboard along with a written summary of their medical history. Enter them into the ship's medical log. Include baseline data from blood work, an EKG, a mammogram (for older female crewmembers), dental X-rays, and records of medical conditions and medications. The baseline data provides valuable information for diagnosing ailments, and the other records will allow a doctor to offer immediate assistance.

You need to get inoculations against any major diseases you might encounter. Every two years, the Centers for Disease Control (CDC) publishes the Yellow Book, *Health Information for International Travel*, which specifies health risks throughout the world. The International Association for Medical Assistance to Travellers (IAMAT) produces a World Immunization Chart that recommends inoculations by country. These will help you decide what immunizations to get and understand how long they will protect you.

Of the dozens of immunizations available, very few are appropriate for everyone. IAMAT recommends the tetanus-diphtheria booster for all travelers over age 7 and the poliomyelitis booster for all travelers regardless of age. Hepatitis A and B vaccines are now good for life, and these diseases are serious and common enough that most travelers should be inoculated. Measles, mumps, rubella, influenza, and pneumococcal vaccinations are recommended for different groups depending on age, sex, and immunization history. Yellow fever is endemic in parts of Africa and much of South America. Most doctors agree the vaccine is necessary for travel to those areas. The vaccine for yellow fever cannot be administered to children under 1 year old, so don't plan on visiting an infected area with an infant. The litany of other possible vaccinations includes typhoid, cholera, meningococcal meningitis, plague, and encephalitis. Each of these vaccines has risks and benefits, and a few are effective only for periods of six months to a year.

After reviewing the CDC and IAMAT material, you should discuss the vaccinations you are considering with your doctor. Ask about special health issues you should consider, how long the vaccinations last, and the pros and cons of inoculations for older or younger crewmembers. In the United States, your county health department will administer the vaccines and provide you with the World Health Organization's International Certificate of Vaccination. This yellow booklet documents the vaccinations you have received and proves you meet the entry requirements for a specific country. It also serves as a record for keeping your vaccinations up to date.

Get organized, and get the first vaccinations well before you plan to depart as vaccinations must be spread out over several weeks to minimize the chances of a severe reaction. In addition, some vaccinations require a booster within six months to ensure full protection. After an immunization you will probably feel lethargic for 12 to 24 hours, and you may experience a low-grade fever.

Know the Basics

Understanding your specific needs is not enough. You also need basic knowledge of medical treatments and emergency procedures. Unfortunately, first-aid courses and references appropriate ashore are not designed to meet the needs of a ship's crew at sea. Most first-aid courses and books aim to stabilize, not treat, the patient.

CHILDREN AND OLDER VOYAGERS: SPECIAL CONSIDERATIONS

Children and older voyagers have special medical needs that you should take into account as you prepare your medical kit.

The children we meet cruising seem healthier than their shoreside counterparts. They spend most of their time outdoors and get plenty of exercise. The total isolation of passagemaking and relative isolation of living aboard limit exposure to germs. Kids are in frequent contact with local children ashore, so they do contract some ailments. You will want to bring a quantity of antibiotics and cold remedies in children's dosages. If your children are not yet swallowing pills, make sure you have an emergency water supply in your medical kit to mix up antibiotic dosages from powders. If your children suffer from ear infections ashore, prepare to deal with them in the tropics. Whenever they come out of the water, flush out their ears with an over-the-counter product designed to prevent swimmer's ear or a solution of 50 percent vinegar and 50 percent rubbing alcohol. At the first sign of ear pain, administer ear drops containing hydrocortisone and acetic acid, such as Acetasol or VoSol, to stop a developing infection. If an outer ear infection develops, use antibiotic ear drops, such as Cortisporin or Otocort.

Beyond individual ailments, arthritis and muscle pain seemed to be the major medical complaints for older voyagers. Their boats need to be set up to minimize strains. Before leaving, equip the boat with oversized winches, electric windlasses, outboard motors, sail handling systems, and an easy and effective block and tackle arrangement for getting things on and off the boat. Once out there, always use these systems.

Strategically placed handholds and a swim ladder or a well-designed dinghy step can reduce the strain on hips and knees as you travel up and down the companionway and on and off the boat. The medical kit should include a variety of over-the-counter pain relievers including aspirin and ibuprofen. Several dozen chemical ice packs will relieve joint swelling after a strain or injury. Hot-water bottles for cold night watches will keep a problematic joint limber.

For those on medications, you need to understand drug interactions. Ask your doctor about possible interactions with each drug you plan to carry. Find out what symptoms will result from each interaction. If certain crewmembers can't use certain drugs, mark the jar itself. Keep a separate list of all drugs each person takes in an accessible place in case you have to pass the information over the radio in an emergency.

Instructions for handling injuries or illnesses usually end with "Call 911 or contact your physician." Many books and courses designed for use at sea focus on emergency situations. These are long on treatment procedures and short on diagnosis. Given a series of nebulous symptoms, you won't know where to begin. To be prepared for the variety of roles the ship's doctor must play, take a variety of courses and carry a number of information resources.

Every crewmember should take a basic first-aid course and a cardiopulmonary resuscitation (CPR) course during the year before heading offshore. Although the basic first-aid course ends where the real treatment begins, everyone on board needs to know how to stop bleeding, prevent shock, and stabilize a patient. CPR teaches you how to resuscitate someone in the event of a near-drowning, a skill anyone who lives on the water should possess.

At least one member of the crew should take an advanced medical training course designed specifically for sailors. There are several excellent courses available. You can find others in the classified ads in national sailing magazines. Make sure the course is designed for offshore sailing where you could be out of SSB or ham radio contact. Ask if the course covers suturing, splinting, dehydration, shock, severe infections, and allergic reactions. Find out what offshore experience the instructor has and make sure that he or she is a qualified doctor.

If you have a friend who is a doctor and a serious sailor, you may be able to arrange a private course tailored to your needs. A cardiologist friend of ours ran a clinic for a half-dozen offshore sailors that included suturing a chicken leg and injecting an orange. If your first offshore experience is going to be a cruiser's rally, check with the organizers to see if they have scheduled a seminar with a doctor to cover these topics.

These courses deal primarily with major trauma and life-threatening illnesses. You also need to know how to handle more mundane situations. If you have a rash or need antibiotics at home, you make a quick phone call or schedule a short office visit with your family physician. At sea and in many remote ports, you have to manage these situations yourself. No course covers all this ground. To prepare for this role, you need to sit down with your sympathetic doctor and talk through the range of symptoms and possible treatments for common ailments.

We did this with a good friend and sailor, Dr. LaFrate, before leaving on *Silk*. He spent several hours with us going over notes he had made when he was considering running a medical course for offshore sailors. Then Evans and I put together a reference notebook from our discussion. We went over this notebook with Dr. LaFrate, and he corrected and amplified where necessary. We ended up with twenty pages of notes on ailments, symptoms, treatments, and the uses and dosages of the drugs in our medical kit. Unlike any reference we could have purchased, our notes reflected our medical history and were organized in a way that we understood.

Take along a variety of other medical references. An unexplained ailment can be terrifying, and a lack of information to resolve the problem can be traumatic. We purchased the usual medical references recommended for the ship's library, including *The Ship's Medicine Chest and Medical Aid at Sea*, the standard text used by the U.S. Merchant Marine. Although these books offered excellent advice on treating illnesses and injuries, they did not help in diagnosing some of the more exotic symptoms associated with infections or allergic reactions.

Wilderness survival guides are often recommended for voyagers. While useful, they can be too basic. Many assume you do not have access to antibiotics or prescription drugs. Therefore, in addition to the standard shipboard medical texts, carry one of each of the following:

- **An excellent first-aid reference with diagrams.** Some of the shipboard first-aid books are too specialized and describe only typical shipboard injuries. For cruisers traveling in remote areas far from medical help, a wilderness first-aid reference with step-by-step instructions and diagrams is useful. These books aim to stabilize the patient and await the paramedics, but your offshore medical course should take over where these books end.
- **A general reference book on symptoms.** These affordable consumer books are meant to educate patients on their treatments and diagnose ailments from general symptoms. They provide flowcharts and diagrams organized by symptom to aid in diagnosis. The flowchart will identify the most likely ailment, but it generally ends with "See your family physician." Given some idea of the ailment, you can turn to other references for treatments.
- **Traveler's information.** The CDC website highlights health risks of various regions, necessary vaccinations and precautions, and recommended treatments for malaria where it is endemic. Other publications for travelers are listed in the General Information section in the resources for this chapter in Appendix 1.

If you have children aboard or you have a medical condition that could prove life threatening, a high-frequency radio or satellite phone will help you contact medical aid while at sea. Assuming that you have a well-equipped medical kit and some basic knowledge, a doctor can talk you through even extreme emergencies. But this does not reduce your responsibility to be self-sufficient. In a serious emergency, the ship's batteries may be down, the antenna gone, or the radio not working.

Know Thy Medical Kit

An offshore medical kit must include prescriptions for a variety of drugs from antibiotics to analgesics. Without a sympathetic doctor, you will find this the most difficult part of preparation. Beyond knowing what to include, you need to know how to make use of it and be able to find the right supplies at a moment's notice.

Appendix 6 details the contents and quantities of our current medical kit. It reflects the needs of two healthy 45-year-olds with fairly high medical competence cruising for up to three months at a time in remote areas with no medical facilities. While it can serve as a starting point, you'll need to modify your kit with your physician's advice to reflect your situation and training as well as your itinerary.

Don't take along too much of the more common medical supplies such as cotton swabs and gauze, which can be restocked almost anywhere. Take a wide variety of antibiotics and antihistamines, as these will be your most frequently used prescription drugs. Unfortunately, the shelf life of most prescription drugs is relatively short (a year or so) and, with any luck, you won't use what you have aboard. Try not to overstock, and plan on updating the medical kit each year when you reach a developed country or return home for a visit.

A few months before you leave, start buying medical supplies and organizing your medical kit. It took several tries to find a solution for stowing things so we could get to them quickly. We keep day-to-day supplies such as Band-Aids, nonprescription pain relievers, cold medicines, skin creams, antibiotic ointments, and antibacterial soaps in the head. Supplies for more serious conditions are organized by ailment—lacerations, gastrointestinal problems, severe burns, eye problems, and orthopedic problems—and stowed in our medical kit. This consists of a lockable aluminum suitcase stowed on a special bracket behind our hanging clothes that can be reached in a couple of minutes. We store prescription drugs in a zippered bag in a separate locked briefcase away from the medical kit to prevent an intruder from finding them.

The Medical Sea Paks from Fieldtex Products can be purchased from marine suppliers and offer a well-organized, simple alternative for creating a medical kit, but they are expensive. These come in a large canvas bag with smaller bags inside that are color-coded, labeled, and organized by ailment. They include a booklet that is color-coded to match the labels and coloration for each ailment. Other suppliers produce similar products. These prepackaged kits cost significantly more than if you bought the same medical supplies yourself. But if you can't organize your own medical kit, the money saved is meaningless. These kits do not include any prescription medications, so you will still need to arrange those through your own doctor.

Make sure that everyone aboard is familiar with the location of all medicines and supplies. Keep a master list of all supplies and their locations in the medical log.

As you put your kit together, pay particular attention to medications and prescriptions. Many drugs have a short shelf life, so check expiration dates and buy the freshest available. Tell your pharmacist that the drugs are not for immediate use but for long-term storage, and allow some extra time in filling the prescriptions to obtain fresher drugs. Drug names change from country to country. Ask your doctor or pharmacist to give you the scientific name and the common brand names for all drugs you are taking aboard. If you will be carrying a wide variety of drugs, buy a copy of the *Physician's Desk Reference*, which identifies every drug made worldwide, provides information on dosages and side effects, and lists all the names for each drug.

Keep a copy of each prescription with your doctor's signature in your medical log. We were almost always asked if we had drugs aboard when clearing in. The answer "Only in our medical kit" was usually sufficient. On a few occasions we had to describe what drugs we had, and once we had to show the prescriptions. The customs officials sometimes want to know if the drugs are stored in a locked area. They hope to prevent the drugs from being stolen and sold on the streets.

On each prescription, write the expiration date of the drug and highlight it. This helps you manage your drug inventory and replace prescriptions as needed. Track the use of prescription drugs in the medical log. Note the crewmember's name, dosage, number of days that the drug was used, and any side effects or reactions. The record will assist a doctor in determining how to treat a more complex problem and may protect you from liability when treating nonfamily members.

By now you should feel well prepared to manage just about any emergency aboard. You cannot eliminate the risk, but you can manage it. In all likelihood, you'll never use even a fraction of what you have learned—and you'll be glad for that.

PREVENTION: MANAGING DAY-TO-DAY HEALTH

While we always worried about a major medical mishap, most of what we dealt with was more mundane and, in retrospect, fairly predictable (Table 16-1). We both suffered from seasickness to varying degrees. Exposure to strange insects and foods caused allergic reactions, and the humid, bacteria-rich environment fostered frequent infections. We've had to deal with a few minor traumas, with galley-related injuries being the most common.

TABLE 16-1. COMMON MEDICAL SITUATIONS ABOARD CRUISING BOATS				
Situation	**Type**	**Usual Cause**	**Prevention**	**Treatment**
Seasickness	• Minor • Serious—repeated vomiting/dehydration	• Boat's motion • Boat's motion	• Limit work down below, hand steer, nap; keep some food in stomach • Treat minor seasickness	• TENS (see page 370) or acupressure bands, ginger, medications • Suppositories, enemas to restore electrolytes
Infections	• Skin • Ear • Sinus, chest, systemic • Bladder • Vaginal	• Coral cuts, insect bites, lack of hygiene • Snorkeling/diving • Various • Lack of hygiene, hydration • Lack of hygiene, antibiotics	• Disinfect all cuts, bites; proper hygiene • Flush with drops to prevent swimmer's ear after diving; use ear drops at first sign of infection • Proper hydration, feminine hygiene • Feminine hygiene	• Antibiotic ointments, oral antibiotics if severe • Oral antibiotics, preventive or antibiotic ear drops • Oral antibiotics of appropriate type • Oral antibiotics • Vaginal creams or suppositories
Allergic reactions	• Localized hives • Generalized hives • Systemic	• Insect bites, other allergens • Food allergies, insect bites, other allergens • Bee stings, food allergies	• Insect repellent, avoid allergens • Avoid allergens • Avoid allergens	• Corticosteroid creams, ointments • Antihistamines • Injectable adrenaline (EpiPen or insect sting kit), follow up with antihistamines
Traumatic injuries	• Sprains, fractures • Burns	• Being thrown around boat in a seaway • Galley accidents	• Galley straps, lee cloths, handholds, etc. • Good pot holders on stove, rubber apron	• Painkillers, first-aid kit with full range of splints, braces • Silver sulfadiazine cream, bandages
Other	• Kidney stones • Dehydration, heatstroke	• Lack of hydration • Lack of hydration	• Proper hydration, especially for men • Proper hydration, salt tablets	• Painkillers, antibiotics if infection develops • Ice packs to cool victim

Seasickness

The sailor's most common malady is mal de mer. Seasickness is caused by conflict between visual perception and inner ear balance perception, and it results in a range of symptoms from lethargy and queasiness to headache and vomiting. Like most of our friends, we experience listlessness, drowsiness, mild queasiness, yawning, and increased salivation the first few days of every passage. During that period we are susceptible to more extreme seasickness. Once acclimated, we feel fine for the rest of the passage unless we encounter severe weather.

When seasickness progresses to vomiting, dry heaves, dizziness, and eventually total apathy, it ceases to be a minor annoyance and becomes a serious health risk. The classic quip "No one ever dies of seasickness, they only wish they would" is not true at the extreme. In our first gale at sea, we were both so seasick we could not even keep water down for over 60 hours. At the end of the gale, we were so weak from dehydration and hunger that I could not coil a line without stopping to rest. If the gale had continued for another 24 hours, we could have been too weak and apathetic to respond to an emergency.

Prevention

To prevent seasickness, avoid crossing the line from mild discomfort to full-blown symptoms. Once vomiting has started, very few drugs will have any effect. We take several precautions to reduce our chances of getting sick the first few days at sea.

The day prior to leaving, we avoid drinking alcohol or eating fatty foods. The first few days at sea, we do everything possible to limit time spent below. Before leaving port, we make up all sea berths, put extra clothes at the foot of each bunk, and premake meals and leave them in a handy spot in the galley. Once at sea, we stay on deck as much as possible. We avoid extremes in temperature, strong odors, and poor ventilation. If we can make it through the first night when the sun goes down and we can no longer see the horizon, we are usually fine for the rest of the trip. Leaving on a full moon almost always means a faster adjustment to sea conditions.

Close eye work increases the likelihood of getting ill. No matter how good we feel, we don't read for the first two or three days of a passage. For those first few nights when we can't read, listening to music or books on tape often takes our mind off our stomachs and keeps us from getting sick. We limit time spent navigating, reading weather faxes, or writing to 10 or 15 minutes until we're fully acclimated.

It is important to keep the stomach busy, for hunger seems to lead to queasiness. Everyone has their favorite foods for staving off seasickness. We like bread, saltines, pickles, hard candy, and dried fruit. Ginger has been medically proven to help prevent mild seasickness, and we both find it effective. I will often make gingersnaps right before we leave, and we keep ginger ale and ginger teas aboard for those first few sensitive days.

If we start to feel early symptoms, staring at the horizon or lying down with our eyes closed will often end the conflict between the ear and the eye and alleviate symptoms. An hour spent steering the boat or an hour's nap in a bunk down below will often get us over the first symptoms of seasickness.

Treatment

There is a wide variety of seasickness medications, but it is impossible to generalize about their efficacy. Seasickness symptoms and their severity differ from person to person, along with the usefulness and side effects of medications. Anyone who suffers from severe seasickness will have to experiment to find a cure that works. Try medications on land first to check for side effects.

Evans and I illustrate how different symptoms and reactions to medications can be. For Evans, seasickness is closely associated with stress. He has never been sick when crewing on someone else's boat, but he is almost always sick the first few days of a passage on our boat. He also succumbs in heavy weather with the wind on the beam or forward when the boat is fully loaded and he is worried about something breaking. He will feel fine for several hours, suddenly feel sick, vomit within a few minutes, and then be fine again for several hours. Medications make him feel drugged, so he won't take any. I get sick the first few days of a passage or when the wind is over the stern and light and we have a long, slow ocean swell on the quarter. I feel queasy and headachy, and get more lethargic and miserable with each hour. I rarely vomit, although I often wish I would. Dramamine and other mild medications don't help, but stronger medications eliminate all symptoms for as long as I take them.

Before turning to drugs to treat seasickness, experiment with some of the less traditional cures. Some of our friends find relief through TENS (transcutaneous electrical nerve stimulation) bands, marketed in the United States as ReliefBands, worn on the inside of the wrist. These use electrical stimulation that cannot be felt and are often recommended to prevent nausea in chemotherapy patients. Others find acupressure wrist bands to be effective. If these cures work for you, you'll be able to avoid the side effects of medications.

For mild seasickness, most people used Bonine (meclizine) or Dramamine (dimenhydrinate). After being taken off the market due to reports of hallucinations and irrational behavior, an updated scopolamine patch is available with a doctor's prescription. The drug of choice for most experienced cruisers is Stugeron (cinnarizine), but it has never been available in the United States. Many cruisers stock up when they are in Europe, Mexico, or Bermuda. Stugeron totally eliminates my symptoms during the first few days of a passage until I become acclimated. Like most people we know who use it, I feel slightly drowsy taking it but have no other side effects. Evans, on the other hand, feels lethargic and drugged and won't take it. Note that Stugeron's effectiveness declines rapidly after it passes its expiration date.

All these medications must be taken before the onset of symptoms. Only one drug we know of will stop vomiting once it has started. A combination of one 50 mg tablet of ephedrine and one 25 mg Phenergan (promethazine) tablet relieves symptoms for me even after the onset of vomiting. As long as I can keep it down for an hour, all symptoms disappear. This combination is called the "Navy cocktail," because the Navy (and astronauts) uses these drugs to prevent or control seasickness. The pills work for about 12 hours, and I do feel slightly drugged, though not to the point of slowing my reaction time or putting me to sleep.

Once seasickness moves into the phase of repeated vomiting, it can become life-threatening. When electrolytes get too far out of balance, seizures or heart attack can result. If a victim has not been able to keep water down for 12 hours, medication will need to be administered by suppository. Phenergan or Dramamine both come in suppository form. Administer enemas of electrolyte solutions (or even chicken bouillon) to provide needed nutrients and water.

Infections and Serious Illnesses

Microbes flourish in the warm, moist climate of the tropics. Coral waters harbor a wealth of bacteria, some quite toxic. Infections in the tropics are much more virulent than in colder climates. Severe infections can develop from minor scrapes, posing a serious health risk to a crewmember. Higher dosages of antibiotics are required to treat infections effectively.

Marine wounds are much more serious than the same injury incurred on land for three reasons: the bacteria-rich waters foster infection; the complex nature of many marine wounds (including punctures) facilitates bacterial growth; and bites or stings often involve poisons that frustrate the body's natural healing mechanisms. To avoid problems, treat every cut as if it were already infected and assume coral waters are hostile. The following precautions and practices have become routine for us:

- **Treat cuts and scrapes quickly.** Clean open cuts or scrapes thoroughly when they occur and after swimming with a good antibacterial disinfectant such as Betadine. Apply antibiotic ointment or powder several times a day to open cuts. Try to avoid covering scrapes to encourage them to dry out. If going ashore where there are flies, cover open cuts with fabric Band-Aids (plastic bandages fall off when exposed to salt water).
- **Fight waterborne bacteria.** Avoid swimming in major ports, even if the water seems clean. To prevent ear infections after snorkeling or diving, dose your ears with an over-the-counter product designed to prevent swimmer's ear or a solution of half vinegar and half rubbing alcohol. Cuts from coral, fishhooks, or other fishing equipment and stings from venomous marine life are highly susceptible to infection. If the cut is deep or redness and swelling develop, a course of antibiotics should be administered immediately.
- **Disinfect skin irritations.** Acne, pustules, shaving nicks, and other skin irritations can foster staph infections. Scrub them with antibacterial soap whenever showering.
- **Use effective dosages and types of antibiotics.** Although not all infections are bacterial, most of the ones we encountered in the tropics were. No one antibiotic works for every person or against every bacterium. Carry antibiotics of several varieties. If in port, see a local doctor conversant with tropical infections. Using too low a dosage will only serve to make the infection more resistant. In the tropics, a dosage two to four times the normal amount may be required. We carry a potent injectable antibiotic as a last resort in case of a severe infection where the patient would be too ill for oral administration.

If not properly treated, infections in the elderly, diabetics, those with liver disease, and others who are immunocompromised can enter the bloodstream and compromise the cardiovascular system. This is called *sepsis*, and it can be life threatening. If someone has had an infection and shows signs of fever, weakness, low blood pressure, confusion, nausea, and vomiting, you need to get medical assistance as soon as possible. Several cruisers have been airlifted out of remote atolls in the Pacific when a coral cut turned septic.

Aside from bacterial infections, fungal infections occur frequently. Among women, yeast infections result from antibiotic usage and less-than-perfect hygiene on passage. If you have a history of yeast infections, ask your doctor to prescribe the potent one-time oral remedies and take one a week for a month after taking antibiotics in the tropics to prevent a yeast infection from developing.

Diarrhea and fever can be every bit as serious as infections and need to be treated properly. A good traveler's health reference will provide the necessary information for sorting out what treatment to use for a given set of symptoms. In our most serious medical situation aboard, Evans got very ill after diving in Durban harbor to check the keel when we were hauling *Silk*. He had a high fever and diarrhea for several days. We were both worried he had been infected with some horrible disease from the raw sewage in the water. We used our traveler's references to be sure he hadn't contracted a giardia infestation or amoebic dysentery. We then followed the recommendations, keeping him hydrated with an electrolyte solution, using aspirin to bring the fever down, and using the recommended antibiotic.

Allergic Reactions

Besides the normal travel hazards of unusual foods and different water, cruisers also face venomous marine life and stinging insects. Though rarely life threatening and generally treatable with over-the-counter antihistamines, some symptoms are so unusual that they can be quite alarming. To manage allergic reactions, you need to recognize them and then treat them with antihistamines (systemic reactions) and corticosteroid skin ointments (localized itchy rashes).

It can sometimes be difficult to distinguish between an allergic reaction and a localized infection. Infections are characterized by heat and painful swellings under the skin, but the same symptoms can appear with severe but localized allergic reactions. If in doubt, rub the area with cortisone cream. If symptoms diminish, you are having an allergic reaction and should dose yourself with antihistamine. Assume that any type of inexplicable redness on the skin is caused by an allergic reaction.

You cannot have too many antihistamines aboard, ranging from Benadryl and other over-the-counter drugs to adrenaline or an EpiPen in the event of a life-threatening reaction. If anyone aboard suffers from particular allergies, discuss the range of possible symptoms with your physician. If anyone is allergic to bee stings, carry an emergency kit with you at all times.

Overexposure to the sun can lead to a red rash that resembles hives on the backs of hands and feet. This can be puzzling when first encountered. Corticosteroid creams will get rid of the rash, but the victim will need to stay out of the sun as much as possible and use a total sunblock (SPF 30 or higher) when outdoors until the skin acclimates.

Emergencies and Traumatic Injuries

We carry a full range of emergency and first-aid equipment that, fortunately, we have never had to use. This includes air splints and fiberglass cast materials, suturing supplies, and an airway resuscitation kit (see Appendix 6).

Pain relief plays a central role in effective trauma management. Carry a variety of pain relievers, including injectables. When out of reach of hospitals, some treatments can be simplified with the proper equipment. Steri-Strips function as well as stitches in most cases. If using Steri-Strips, make sure to put some sort of balm on the skin first to facilitate removal. Friar's Balm or Bag Balm works well. Air casts or fiberglass casts can be used to set a broken bone until port is reached. Adjustable finger and wrist splints and knee and ankle braces offer a quick response to a trauma. Discuss all this equipment with your doctor and practice using it where appropriate.

Burns are the most common galley injury. Make sure you have a medical reference aboard that describes their treatment. Carry Silvadene cream (silver sulfadiazine), the most effective medication for treating burns.

PROTECTION: ENSURING LONG-TERM HEALTH

Although the overall voyaging lifestyle is a healthy one, it does increase certain types of health risks. You will need to learn how to protect yourself from the sun and still stay comfortable in tropical climates. You will also need to learn to manage nutrition aboard. At times, the diet can be long on starches and short on fruits and vegetables. Finally, exercise is a major issue for most long-term liveaboards. It can be very difficult to get adequate aerobic exercise, a downside consistently cited by new cruisers (see The First Year section in Chapter 27). Finding ways to work exercise into your onboard routine will extend your cruising years.

Sun Protection

The greatest risk the offshore voyager faces may well be the long-term effects of overexposure to the sun. Sun protection starts with a good source of shade for the cockpit. Find a canvas or hard dodger solution that offers two people adequate protection in most sun angles. If you are particularly sensitive to the sun, use a bimini and side curtains to protect you from reflected sun glare. Any such arrangement must be removable for heavy weather, but leave them on as much as possible in other conditions.

Dress for success. Lightweight, light-colored, long-sleeved cotton shirts and long pants block the sun and keep you cool. Surgical scrubs are ideal. A good hat that you will wear in the heat of the tropics comes next. Buy a good pair of wraparound polarized sunglasses with full UV protection. The wraparound glasses reduce the risk of cataracts from exposure to reflected glare. Good sunblock is the last ingredient for the perfect tropical wardrobe.

Suntan lotions are rated by their sun protection factor (SPF). The SPF rating is inversely proportional to the amount of UVB radiation the lotion allows through. If you're going to be in the sun all day, SPF ratings of 30 and higher should be used. Facial skin reacts to many sun products, and waterproof lotions do not last well if you are sweating. Putting on a layer of facial moisturizer such as Oil of Olay with an SPF in it first protects the skin of the face. Apply a total sunblock over the moisturizer to sensitive areas such as the nose and ears.

We apply normal suntan lotion to the rest of our bodies and use lip balm with sunscreen several times a day. Sunburned lips can be accompanied by an allergic reaction that causes them to swell to several times their normal size. Protect your lips as carefully as you protect the rest of your face.

The ozone layer is thickest over the tropical latitudes. We therefore had the most protection when we were wearing the least clothing, on our trade wind passages. New Zealand, Australia, and Chile, on the other hand, have been experiencing intensified UV radiation due to the hole in the ozone layer. While in those countries, we used a minimum of SPF 15 sunblock on exposed skin at all times, and we often upgraded to an SPF 30 product or a complete sunblock—especially on sensitive areas such as ears and lips.

Sometimes you will burn. The very best treatment for minor sunburn is pure aloe vera gel. This takes the heat and sting out within a few minutes and will often turn a burn into a tan overnight. If you don't have any aloe on board, wet tea bags, dab them on the burn, and allow the liquid to evaporate. A paste of baking soda and water will also relieve the pain.

The sun poses dangers beyond the long-term damage from UV radiation. Dehydration can be debilitating. Recognize and react to early symptoms: headache, general listlessness, or slight queasiness in conditions where you should not be seasick. Immediately get out of the sun and force yourself to drink water. Monitor your intake and drink at least a quart of water within the first hour. But your body will not be able to absorb that water unless it has the proper amount of salt. Take a salt tablet or eat something salty. If you experience these symptoms frequently and water helps, increase the amount of fluids you drink to at least 2 quarts daily and add a couple of salt tablets to your diet. Those on low-sodium diets will need to take a diuretic and drink at least 1 gallon of fluids a day in the tropics to prevent dehydration.

Left untreated, dehydration can lead to kidney stones, which are extremely painful and can be life-threatening. We know several cruisers who have had to be evacuated from their boats when they had not passed urine in more than 24 hours. For this reason, John Neal and Amanda Swan-Neal, who run sail training classes on their Hallberg-Rassy 46, *Mahina Tiare III*, give each of their students a 1-quart water bottle when they arrive and require them to empty it at least once a day.

If you have pets aboard, bear in mind that they too are subject to the debilitating effects of dehydration. Try to make sure they get plenty of water. Sailing veterinarians recommend equipping your boat with an IV and learning how to use it so you can rehydrate your pet if necessary.

In cases of sunstroke or heatstroke, the victim loses the ability to sweat or dilate blood vessels under the skin and cannot dissipate heat. When the symptoms for dehydration are accompanied by an elevated body temperature and warm, dry skin, the victim is suffering from heatstroke. The patient must be cooled to avoid death. Apply ice packs to the groin, armpits, neck, and chest.

Nutrition

Reliable refrigeration and freezers have improved the diet available on offshore boats. But many crews still tend to move toward a diet high in starches—pasta, potatoes, and bread—and reduce their consumption of fresh fruits and vegetables. That's partially due to the fact that on many remote tropical islands vegetables and fruits are seasonal, and in the winter months when cruisers tend to be visiting them there are fewer available than might be expected.

As a result, many women gain weight in their first few years on the boat. Men vary more, with some putting on weight and some losing it, depending on whether their exercise level has increased or decreased versus when they were ashore. Although it takes a bit of effort, you can maintain a low-starch diet that is high in fruits and vegetables. It's relatively easy to do if you can rely on a refrigerator. If you can't, carry freeze-dried and canned veggies, or can your own. Try sprouting. Experiment with whole grains and substitute these for starches. Grains such as bulgur and quinoa mixed with navy beans or lentils make great salads with much better nutrition than a potato salad. For more suggestions on maintaining a healthy diet, see Chapter 14.

Our voyaging diet is normally well balanced, but we occasionally lack certain nutrients. Women may need to take an iron supplement if they are not eating much red meat and a calcium supplement if they are not consuming enough dairy products. A lack of vitamin C can cause gum problems, and scurvy still occurs. Take a daily vitamin supplement if you were not able to stock up on many fresh fruits and vegetables before a passage. If a good portion of your water is coming from a watermaker, the minerals will be filtered out of your water along with the salt. Stock up on a general mineral supplement and take it regularly.

Nutritional supplements can be hard to find in less-developed countries, and they can be expensive even in developed countries. Buy in bulk before you leave. Make sure to check the expiration dates and get bottles that will last for several years.

Exercise

In port we get a good deal of exercise. We walk miles to the grocery store and back, carry heavy bags of groceries, handle water and fuel jugs, and, in tropical waters, swim and snorkel. On passage, we continue to get a good workout for our upper bodies, but we both lose muscle tone and condition in our legs. After several weeks at sea with almost no leg exercise at all, we arrive in port and walk 4 or 5 miles the first day to clear customs, go shopping, get water, and so on. I have arthritis in my knees and hips, and this sudden workout after minimal exercise for some time causes joint pain and inflammation.

Pulls and strains are also common problems. When you need to do something on a boat at sea, it often comes after many hours of inactivity and is accompanied by a burst of adrenaline and sudden loads. Muscles that are not warmed up or kept flexible can rip and tear; joints can be sprained or strained.

Anyone with orthopedic problems should wear high-quality, supportive boat shoes at all times. Going barefoot causes your feet to spread and aggravates orthopedic problems. Anyone with back problems, joint pain, or arthritis should have a plan for maintaining their muscle conditioning and joint flexibility at sea.

But finding exercise you can do on a pitching, rolling boat takes ingenuity and preparation. You need to be able to do your onboard exercise routine even if the boat is rolling through 30 or 40 degrees. Aerobic exercise videos can be used when anchored but not underway. Exercises that can be done sitting, lying, or standing braced against something work best. The following alternatives work reasonably well on a boat:

- **Stretching or yoga.** Twenty minutes or so a day of stretching will help your muscles adjust to sudden demands. Hamstring stretches (runner's stretch), quadricep stretches, and straddle stretches work major muscle groups and help you stay limber. Unlike stretching, yoga maintains muscle strength as well as tone. But don't try it on your own or from a book. Many of the positions are extremely difficult. If not done correctly, they can damage muscles and joints. Take a class for a few months before you leave and then keep up the workout once you get out there.

- **Isometric exercises.** Isometric exercises, where you contract a muscle group and hold it, maintain muscle strength and endurance and keep you limber. For example, put your back against a bulkhead or the mast and slide down until your thighs are parallel to the deck or sole. Hold this position for 30 seconds and repeat the exercise three times. Work up to holding the position for several minutes and performing the move five times. You can buy exercise books that describe isometric exercises, or you can develop a customized plan with an aerobics instructor or personal trainer. Most isometric exercises can be done sitting or lying down.
- **Stretch bands and Bullworkers.** For a more intense workout, add resistance to the exercises in order to push specific muscle groups. Many health clubs use stretch bands with handles on either end or small circular bands that look like oversized rubber bands. These take almost no room to stow and work major muscle groups such as triceps, biceps, quadriceps, calves, and hip flexors with exercises that can be done seated or lying down. Bullworkers are spring-loaded devices advertised in weightlifting magazines. These offer more resistance than the bands and can be used to work major muscle groups in much the same way. When you buy either type of equipment from a sporting goods store, they come with a booklet that describes exercises for specific muscle groups.

When considering an exercise routine for use at sea, focus on maintaining muscle tone and strength; don't worry too much about aerobic conditioning. If you have problems with your joints, work on a program with your doctor, a physical therapist, a personal trainer, or a yoga or aerobics instructor. Ask your adviser to recommend several different exercises that work the same muscle group so you can always find one that will work in the conditions.

Although we generally get a good deal of exercise in port, it's difficult to get strenuous aerobic exercise if you are outside the tropics and cannot swim. One option that offers a good workout in a small space and that can be stowed on a boat is called an X-iser (Figure 16-1). This uses the resistance from gas cylinders to provide similar exercise to a stair machine at a gym. Rehabilitation therapists use it when working with professional athletes who have been injured. The X-iser unit is made from aluminum, folds flat, and can be stowed against a bulkhead. It can be purchased on the Internet or at boat shows.

Figure 16-1.
Lorraine Colman demonstrates the X-iser in the cockpit of her 34-foot boat. It offers a compact solution to the aerobic exercise problem. (Peter Colman photo)

MANAGING MAJOR HEALTH CONCERNS

A range of additional health risks peculiar to voyaging can be serious, although their actual incidence is low among offshore sailors.

- **Appendicitis.** We know voyagers who had their appendix removed before leaving to eliminate the risk of appendicitis at sea. But a person with appendicitis can be stabilized for many days using injectable, high-potency antibiotics. Many hospitals now treat appendicitis this way rather than performing surgery.
- **AIDS.** In some parts of the world, including much of Africa, up to half of the population can be HIV positive. Where medical supplies are scarce, needles often get reused even in hospitals or clinics despite the risk. Besides the normal precautions against AIDS, carry your own hypodermic needles aboard and ask a doctor to use them if you need an injection.
- **Malaria.** Malaria is not present in the majority of trade wind destinations. However, the Solomon Islands, Vanuatu, and parts of Indonesia have serious malaria problems with strains that are resistant to quinine. The best way to prevent malaria is to make sure you are not bitten by the anopheles mosquito. That means not being ashore at dusk when they feed, anchoring away from villages, and using screens and repellent from mid-afternoon until well after dark. The use of prophylactics has changed radically since we began cruising and is now recommended for some areas and not for others.
- **Ciguatera.** This nerve disorder can occur after eating reef fish. It is caused by a toxin that accumulates in fish that live and feed off infected reefs. Different fish species exhibit varying toxicity in different areas. Symptoms include upset stomach, numb lips, and tingling limbs, but the effects are cumulative and can be fatal. The best way to avoid ciguatera is not to eat reef fish at all; pelagic fish caught in the open ocean are free of the toxin. If you catch a reef fish that you want to eat, show it to the local fishermen and ask their opinion. Don't eat any reef fish that are "ugly" (an exotic-looking fish covered with spines, for instance) or over a foot in length.
- **Dengue fever.** Also known as breakbone fever because of the intense joint pain that characterizes it, dengue fever is caused by a virus carried by mosquitoes. These mosquitoes feed during the day, so wear repellent, pants, and long-sleeved shirts where dengue has been reported. Symptoms include several days of a very high fever, rash, muscle and joint ache, and headache. It can take several weeks to get over, though the reduced energy level may last for several months. Bed rest is the only cure. We know people who picked up the disease in relatively "civilized" places like St. Martin and Tahiti. Those suffering from dengue fever should not take aspirin, since it can cause internal bleeding. Seek medical help at the first sign of internal bleeding (black or bloody stools).
- **Cholera and typhoid.** Both these ailments are transmitted through human waste. If you are in an area where you are at risk, do not take on water, do not swim in the harbors, and peel all fruits and vegetables before eating them. Be particularly careful ashore about ice in drinks, salads, and food made with water (e.g., ice cream). Although there is a vaccination against cholera, it is short-lived and offers only moderate protection. The new typhoid vaccination prevents the disease for three years and is well worth considering if you plan to cruise in areas where it is endemic.

On a final note, voyagers need to be careful about birth control. Birth control pills have to stay in your body to work. We know five couples who had an unplanned pregnancy thanks to a few pills that ended up "feeding the fish" during a bout with seasickness. In most cases, they didn't realize what had happened for many weeks. Morning sickness was mistaken for seasickness, and a skipped period was attributed to changes in food, water, and surroundings. If there is a woman aboard who is of childbearing age, carry a pregnancy test in the medical kit. That will answer any questions early in the cycle.

CHAPTER 17
Staying Challenged: Following Your Heart

SHIP-SUITABLE ACTIVITIES
Water Time Learning Time Social Time Quiet Time
SHIP-ADAPTABLE ACTIVITIES
Photography Other Arts

NO MATTER YOUR age when you set off, going voyaging is like retiring. The day-to-day activities that once defined your life are gone. You have to create a new routine based on who you are and what you really want to do. Many people find the adjustment to retirement difficult. They lose their sense of self-worth and their orientation within society. This can happen to new voyagers, too. To avoid it, prepare yourself mentally for free time and consider how you want to use it.

During our years in business, we had come to treat time as a precious commodity, something to be "managed" and never "wasted." Yet as voyagers, we have come to understand that time is the only space in which the soul can expand, the only place where you come face to face with yourself. And we have realized that what we choose to do when we have all the time in the world says far more about us than what we must do to earn a living.

So what do you want to do? In the midst of becoming diesel mechanics, doctors, and radio operators, it can be difficult to really consider the answer to this question. But there have almost certainly been things that you've told yourself you *would* do someday—when you had time. Well, now you do. Make sure you have whatever you need aboard so you can explore that part of yourself. The resources for this chapter in Appendix 1 include a list of references for getting started in some of these activities.

SHIP-SUITABLE ACTIVITIES

A wide variety of activities are a natural outgrowth of living aboard. For most of these you need very little in the way of extra equipment or special planning. Raising children aboard can be considered an activity unto itself, well suited to voyaging. The time you spend together and the experiences you share will make your family life rich and intense. If you have children aboard, consider the following ideas a grab bag from which to select the day's entertainment.

Early on, you will probably find yourself spending much of your free time doing something from this list of activities. But as the months pass and living aboard becomes your life, you will feel more like you do in your own home on a Sunday afternoon. Your extracurricular activities will be less a way to find amusement and more a way to seek stimulation and enrichment. At that point, you may find yourself becoming less interested in snorkeling and shell collecting and more interested in developing a new skill or pursuing a long-held passion.

The ship-suitable activities will also be your primary means of entertaining your friends and relatives who come to spend time aboard. Remember that what has become your life represents a vacation to your visitors, and they will want to be entertained. Join them snorkeling and sailboarding, or turn them loose to enjoy themselves.

Water Time

If you are going voyaging, you presumably like the water. When you are anchored in a remote lagoon, water-related activities are an obvious form of entertainment. Although people often worry about sharks and venomous marine animals, a bit of common sense and a healthy respect for local knowledge will ensure that you can safely enjoy the water that is all around you. The best way to learn about sharks is to dive with locals and watch how they behave toward different species. Generally speaking, the only sharks that will be aggressive in tropical island lagoons are the largest, gray reef sharks, and they tend to congregate around reef passes.

To make sure that you don't end up with salt-impregnated cushions throughout the boat, after water activities everyone should rinse off in the cockpit with fresh water. This will keep your home dry and your cushions free of salt.

Fishing

There are two kinds of fishing that voyagers engage in, and the goals, methods, and satisfactions from each are quite different. There are the game fishers—those for whom fishing is a sport, with a fair struggle under specific rules being far more important than catching a fish. Then there are the meat fishers—those for whom fishing has one and only one purpose: catching some of the most delicious food on the entire planet. No words can describe the flavor of a thick steak cut off a fresh-caught tuna. No restaurant in the world can match this delicacy, for any price.

If you are an aficionado of game fishing, you will want to buy the heaviest, highest-quality ocean fishing rod you can find. When trolling on passage, you will need the full advantage of your rules of engagement, or you will lose the fish that strikes before you even get to the fair-fight part. Dispense with the rod altogether if you are after meat and nothing else.

We are not into fishing—the one time we put a line over we caught a tuna, and I didn't want to kill it, and Evans didn't want to get blood on *Silk*'s teak. Therefore most of the following comes from accomplished angler Amanda Swan-Neal, who, with her partner John Neal, runs sail-training courses on their Hallberg-Rassy 46, *Mahina Tiare III*, and who regularly manages to feed a crew of eight on her catches.

There is no fair fight here. You want to hook the monster and get it aboard as painlessly as possible. Most offshore voyagers use a sturdy stainless steel swivel and closed hook catch for attaching lure leaders to a 150-foot length of 200-pound-test monofilament line. This is generally led directly to a winch or to a reel mounted on the pulpit. For a leader, use an 8-foot length of 200-pound-test stainless steel wire. Put an eye at one end for attaching to the line. At the other end, the leader passes through a lure just before it is crimped to a hook.

The following suggestions will increase the likelihood a fish will actually end up on your line:

- **When to fish.** Pelagic fish generally feed at dusk and dawn, so that is the best time to try to catch them. At those times, they are cruising near the surface and looking for small, shiny things to eat. At other times, they are in deep water sleeping or otherwise entertaining themselves.
- **Where to fish.** Most species of pelagic fish feed near land. The best fishing is generally to be had when you are approaching or leaving land. Fish favor currents where they find other critters to feed on, so you have a better chance of catching something wherever a current flows. This includes reef passes and river entrances, as well as the great ocean currents such as the Gulf Stream and the Agulhas Current.
- **Be careful of seabirds.** Pelagic birds gravitate to a boat at sea, often hoping for a little ride. If you are towing a lure and it is flashing on the surface of the water, a bird will mistake it for a small fish and try for it. There is nothing fun or funny about a very frightened, angry wild bird with a hook in its gullet. If you can see your lure in your wake or you notice a bird repeatedly flying over the area where your hook is, haul your line back in and put more weight on it.
- **Faster is better.** Boat speed is not too critical, but faster speeds (for sailboats) seem to yield a better catch. Most of our serious fishing friends suggest a boat speed over 6 knots, though many of our friends on small boats that rarely hit those speeds seem to get their share of fish.
- **Put in a shock absorber.** To ensure that you don't jerk the line right out of the fish's mouth, you need to put in some shock absorption. The simplest method is to clip a loop of the line to the lifeline with a clothespin. Another option is to put a rubber link in the line.

Many crews rig a bell on the line to sound the alarm when they get a strike. Once the fish is hooked, there are two schools of thought on what to do next. One school advocates towing the fish along behind until it drowns, then bringing it in to fillet for dinner. But the catch could be lost to sharks before it gets on board the boat. The other school recommends pulling your catch alongside the boat and pouring a generous dose of alcohol (cheap gin, rum, or whiskey) into its gills. This sedates the fish and allows you to bring it aboard with very little fuss, bother, and bloodshed. Once aboard, place it in a garbage bag and fillet it inside the bag to minimize the mess.

Snorkeling and Swimming

Swimming slowly over a reef teeming with technicolor fish opens up a whole new dimension and changes your perspective on the ocean. Snorkeling can be enjoyed by young and old, fit and not-so-fit, sailors and nonsailors. A face mask, flippers, and a snorkel are your passport to a new world.

Every crewmember should have high-quality gear that fits properly, and you'll want to carry several extra pairs of fins and snorkels for guests. The fins should be broad with good ribs to provide maximum power from your kick. Get fins that fit your foot without binding around the ankle (blisters are very uncomfortable in salt water and can become infected). Everyone's face is shaped differently, and your enjoyment will be directly related to how much water is seeping in around your mask. It took Evans and me three tries each to find masks that suited our faces, but the rejects became spare snorkel gear for visitors.

Snorkel gear is prone to mold and mildew. Keep a toothbrush with your snorkel gear and scrub the snorkel tubes and mouthpieces with baking soda before and after use. Every once in a while, soak the mouthpieces in a mild vinegar solution and rinse them thoroughly. That will keep them mold-free for several weeks.

Before you don your gear and head into the water, ask the local fishermen about any hazards—sharks, moray eels, stonefish, and so on. In our travels, sharks posed a serious threat in only two places—the Great Barrier Reef from Australia up into Papua New Guinea and along the eastern and southern coast of South Africa from Richard's Bay to Mosselbaai. In the Pacific, we frequently saw small (2 to 4 feet) nurse sharks, which had no interest in us. If locals or other cruisers mention any problems with sharks, keep a person posted on deck as a lookout.

Three other hazards should keep you out of the water, and all are found along the Australian coastline. Box jellyfish are an extremely poisonous type of jellyfish whose sting is often fatal. Though summer temperatures soar well above 100°F along the northern coast of Australia, no one swims during the annual box jellyfish migration. Saltwater crocodiles also prowl the Australian coast. These ferocious beasts can reach lengths of 12 feet or more, and they are quite common in the brackish water where rivers meet the sea along the Great Barrier Reef. Though large, they can be tremendously fast, even on land. They do not usually reach the small islets on the outer reaches of the Great Barrier Reef, but ask to be certain before you go into the water. Sea snakes along the Barrier Reef are very large and very poisonous. They are usually seen offshore, but you may run across one while snorkeling. Get out of the water immediately. We were told that touching one could prove fatal. This may have been an Aussie exaggeration, but after seeing a sea snake half the length of the boat, we had no desire to find out.

Most other marine hazards can be managed by a simple rule: Look, don't touch. Many denizens of a coral reef are poisonous, but they are not aggressive. Even the coral itself, if you are scratched by it, can cause serious infections. Cruise quietly over the top of the world you are viewing, but keep your hands to yourself, and everyone will be happy.

Don't assume that because you are in the water, you are protected from the sun. In clear water, the sun's rays can be magnified, and many people have been quite seriously burned while swimming or snorkeling for an hour or so in the heat of the day. A T-shirt over your swimsuit offers some protection, especially for guests who do not have a deep tan. Wear waterproof sunblock. Be particularly careful to cover the backs of your knees and the backs of your upper arms when you apply it.

Drift-diving through a reef pass is exciting and magical. Coral atolls, such as the ones that make up the Tuamotu Archipelago in the South Pacific, consist of a barrier reef of coral with small, sandy islets linked by reefs on the leeward sides of the atolls. The inner lagoon enclosed by the reef and islets may be 20 or 30 miles long and half as wide. On the windward side of the atoll, the barrier reef breaks down under the constant assault of the sea, so it is often awash. Most atolls have a constant flow of water coming in over the windward side and flowing out of one or more passes on the leeward side. In the Society Islands of French Polynesia, barrier reefs surround high volcanic islands. The same pattern of an inflow over the windward reef and an outflow through one or several passes exists. This current through the pass is rich in nutrients from the surrounding coral, and it attracts all manner of sea creatures. When you drift-dive, you allow the current to carry you through the reef pass, and you watch the wildlife that has gathered there to feed.

Be sure that the current is not so strong that you cannot return when you reach the other side. In some areas, outflows can be up to 7 knots at certain tidal states, so figure out the tidal flow before you go. A "chaser" in a dinghy with an outboard can recover anyone who seems to be having trouble with the current.

Spearfishing is a wonderful way to get dinner, but ask permission before you do it. In many places, like Fiji and parts of Tonga, the fish in the lagoon are considered the property of the local people, as are the coconuts on the trees and the shells on the beach. Some of these reef areas are becoming so overfished that local people are forced to buy high-priced canned tuna and corned beef to supplement their protein intake. Taking fish without permission is a serious breach of local custom and common courtesy. In the Cocos Islands, Christmas Island, and many other places, your speargun (or at least the rubbers) will be confiscated when you clear customs. This protects their underwater wildlife, especially in areas designated as marine parks.

Scuba

Everything that was said about snorkeling applies equally to scuba diving. In addition, scuba requires special gear and certification. Certification is mandatory, not only legally but for your own safety. Most places will ask you to show proof of certification before they will fill your tanks.

The gear, particularly the tanks, must be stowed so that it cannot break loose. A special rack in a large locker is a good idea. You can have tanks refilled at dive shops and resorts the world over. Even on remote atolls, many of the locals dive for pearls or fish, so there is a compressor somewhere. Tank fills cost between $5 and $10 in most places.

Scuba provides more than just recreation; it can help you free a fouled anchor or work on the bottom of the boat. If your primary goal is to use scuba for boat maintenance, you probably need only one tank (a tank lasts about an hour). If you are planning scuba as recreation, you will want two tanks per person. If you have a large crew and scuba is likely to be one of your key activities, you may want to consider putting a compressor on board to reduce the cost of tank fills. Compressors are available that can be belted off the engine and will fit aboard a 35-foot boat if diving is a passion.

Dinghy Sailing, Kayaking, and Sailboarding

If you have children aboard, some sort of small watercraft is guaranteed to keep them occupied for many hours. A small sailing dinghy or sailboard can be a link between your children and the children of a Polynesian village. Two-time circumnavigator Kitty Kuhner, aboard *Tamure*, a Valiant 40, said that her sons, Alex and Spencer, made more friends by teaching local children how to sail than any other way.

Kayaks offer exercise and transportation, but they also provide a way to explore your world so quietly you will not disturb seabirds or marine mammals. Inflatable kayaks are now available that stow easily and row reasonably well. Some high-latitude cruisers have a passion for exploring where the sailboat cannot go and camping out for short periods of time. Kayaks allow these adventurers to immerse themselves in their environment in a way that wouldn't otherwise be possible.

Learning Time

Traveling means always learning. Whether you are researching the history of your next landfall or searching the night sky to find the Southern Cross for the first time, every day offers numerous opportunities to expand your horizons and your mind. Learning time comes in many different guises aboard, and none of them require much preparation. If you are blessed with an open mind and abundant curiosity, you are as prepared as you need to be to use the time aboard effectively.

Decide if there is a specific skill you want to develop. Have you always wished for enough time to learn a language, play a musical instrument, read the classics, or learn to sketch? Whatever your desire, plan on making it a focus for your learning aboard. For many activities, this will take no more than a little forethought and a few supplies. If there is a subject you have always wanted to study formally, set up your own self-study course or take a correspondence course. If you have a general thirst for knowledge, you will be quite happy learning about the things you come across during your voyage.

We spent much of our time trying to learn about the places we were visiting before we arrived and while we were there. One of the joys of traveling is to make an intimate connection with a place, to discover where it stands in relation to history, culture, anthropology, geopolitics, and local politics. This understanding made personal interactions deeper and more meaningful and our appreciation of the culture more complete. This learning covered many different aspects—from reading history and literature to trying to master a bit of the language. It was extremely fulfilling, and it made each place more real and more special.

Cultural Literacy

I am a firm believer that cultural literacy must start with linguistic literacy. Anyone who has mastered a second language to a basic conversational level knows that language captures the personality of a culture—that the culture's idiosyncrasies, fears, logic, and history are embedded in its language. Although you can never completely understand a culture you weren't born into, you will not even come to a superficial understanding without insights gained from the language.

Of course, you cannot learn a dozen languages as you cross the face of the globe. But you can learn a key language to a level where you can converse—not flawlessly and not in written form, but to the point where you can exchange ideas with someone who is patient. You can also master a few key words whenever you approach a new culture. For a Pacific circle or a trade wind voyage, French in addition to English will allow you to communicate almost everywhere. Acquiring a basic knowledge of Polynesian is not difficult, and a similar vocabulary is used from the Marquesas to Fiji, New Zealand, and Hawaii. For travel in South America, Spanish should be your first choice.

If you do not have any basis in the language, your instruction should start before you head off to sea. But good intentions seldom lead to actions on this front, so arm yourself with a comprehensive self-teaching course on cassette or CD, or, better yet, a DVD course for your computer that has the ability to correct your pronunciation. The best way to learn any language is immersion, and the best way to improve your language skills is to have to survive using them. If you can learn basic phrases, sentence structure, and a vocabulary of several hundred words, you will improve rapidly once you are in a place and using the language.

Look for a course that emphasizes living in the culture rather than being a tourist or a business traveler. Knowing how to ask a cab driver to take you to the airport is not going to be very useful. Try to develop a broad vocabulary and rely on intuition and sign language to make up for gaps in grammar and sentence structure. Courses that emphasize immersion and that focus on speaking and pronunciation will be of more use than ones that are based on the written language.

Beyond understanding some of the language, we want to know about the country's history, culture, and traditions. Travel guides provide much of this information. The Lonely Planet series and other backpacking guides meet our needs better than tourist-oriented guidebooks. These give good, up-to-date information on the culture, history, current political situation, medical and other hazards, and the local traditions that you will be expected to respect.

The information in guidebooks can be a bit superficial. For most places we visited, we also looked for a history of the country and any related literature we could find. We read books on Darwin as we approached the Galápagos, Melville's *Typee* when we were on passage to the Marquesas, Robert Louis Stevenson's short stories *(South Seas Tales)* while traveling through the South Pacific, and *Cry, the Beloved Country* by Alan Paton as we approached South Africa. A quick search at a library or online will turn up relevant titles. These books make wonderful gift suggestions for loved ones trying to figure out what to give non-materialistic, nomadic adventurers for birthdays and Christmas.

In addition to books like these, written by Europeans or those of European descent, try to get some modern literature by aboriginal authors. The insights you will gain into the current political, social, and economic situation will go a long way toward helping you to understand what you are seeing while you are there.

Arts and Crafts

You can pursue an endless range of hobbies at sea. With some colored paper, scissors, and felt-tip pens, you and your kids can stay busy for hours. As we crossed the Indian Ocean, we became friends with a couple on a 37-foot steel boat named *Skerryvore*. They were both artists, Spider in oil paints and Kim in a variety of media. They each kept a sketchbook of their trip just as I kept a journal, and the images they recorded of sunsets and stormy seas are most certainly worth many thousands of words. If you have ever had an interest in sketching, bring along a basic how-to book and give it a try. Store your paper in heavy-duty, zip-top plastic bags. Pencils, felt-tip pens, and colored pencils are most easily managed aboard. Pastels and oils can be very messy.

For those with little experience, acrylic paints are most forgiving. They mix well, clean up with water, and dry quickly. One cruising friend painted courtesy flags and sold them to other boats. She also painted on shells, sand dollars, and T-shirts. Her most popular items were specialized voyaging T-shirts with a boat's name and insignia on the front and the sailing route shown on a globe on the back. For someone with some artistic talent, the possibilities are endless.

Learning a musical instrument is another favorite pastime. Once you have mastered some basic tunes on the guitar, fiddle, harmonica, or flute, you will be a welcome addition to any party. Not many other instruments do particularly well on a boat, and even those mentioned must be protected from humidity. Our musical friends recommended leaving your best instrument at home and buying an inexpensive model that you would worry about less and enjoy more at sea.

Needlepoint, knitting, or quilting projects pass the time when you are tired of reading on a long passage, and they don't take up much space. Both sewing and knitting needles tend to rust over time. Keep your needles separate from your work and make sure they are not rusty before you resume.

If you enjoy woodworking, basket making, weaving, and other traditional arts, you have at your fingertips a way to open doors in the many places you visit. Deep and lasting bonds can result after time spent with local craftspeople sharing your skills while learning theirs. We have friends who have traveled the globe in search of the most colorful weavings, the most intricate baskets, and the most elaborate carvings. They end up with beautiful mementos of their voyaging, support the local communities along the way, and make dozens of lasting friends.

Making bead jewelry can be fun, but you may not want to try managing the small beads on passage. In many parts of the world, beadwork is a treasured art. If you have an interest, you will find immediate entree into the local culture and a variety of skill-building opportunities.

Shells collected from the beach offer almost unlimited possibilities for creativity. We saw wind chimes, bookends, plant holders, bowls, and potpourri containers made from shells. Small shells can decorate cards to family and friends. Larger shells can be strung on a chain to make a necklace or a bracelet. But please, don't collect live shells. Not only are many of the creatures that live inside quite capable of defending themselves, but the coral reef habitat is also a fragile one. The collection of live shells and the killing of their inhabitants have damaged reefs in many places.

Finally, traditional sail crafts offer modern sailors entertainment and satisfaction. If you ever wanted to learn how to carve, get a few how-to books from woodworker specialty shops and bring along a few carving knives and a small set of chisels. Traditional knotwork keeps the hands busy while the mind wanders where it will. *The Marlinspike Sailor* by Hervey Garrett Smith is the bible of knotwork. Macramé is also popular, and wrist and ankle bracelets are traditional tokens of friendship between children on cruising boats.

Nature Watching

If you love nature and your tastes run toward identifying and cataloging species, you will find much to keep you busy. Many of the pelagic birds' life cycles and behaviors are poorly understood because they are so seldom observed in their natural habitat. The same can be said for many species of dolphins and whales. Identifying tropical fish, different corals, and various types of mollusks can heighten the wonder of snorkeling. Ashore, learning to recognize frangipani and bougainvillea as well as lemon and breadfruit trees offers practical as well as aesthetic rewards. Some sailors we knew prided themselves on being able to identify stars and name constellations. Even those who think they have no interest in such things suddenly want to know more when a whale is looking them in the eye.

Take along a good field guide for whatever your particular passion might be—shells, whales and dolphins, seabirds, land birds, flora, tropical fish, corals, and so on (see the resources for this chapter in Appendix 1). Field guides will help you identify particular species, but they typically do not go into too much detail on life cycles and animal behavior. If these areas interest you, find some good naturalist's books to accompany the guides.

Many researchers use voyagers' sightings to gather information on dolphin and whale populations. If you are interested in participating, search on the Internet under "report whale sightings" and the area you will be cruising.

If you would like to learn the stars and constellations, buy a star finder, a cylindrical tube that illustrates the night sky at different latitudes and times and labels the stars and constellations. I have seen these only for the Northern Hemisphere, but they can be lots of fun as you are sailing along at night. If you have a serious interest in astronomy, you may want to consider taking along a spyglass. A boat is not stable enough for very high magnification, but the clarity of the sky and the utter darkness of a moonless night will permit you to see many things not visible from land.

No matter what interests you, enjoy the beauty, record it, and then leave it for those who follow to enjoy.

Celestial Navigation

If you haven't already learned celestial navigation, you'll never have a better opportunity. It makes a wonderful diversion when on passage and offers an easy way to learn the southern stars when you cross into the Southern Hemisphere, and the night sky changes in ways you've never seen before. On night watch, you naturally orient yourself by the stars. Knowing how the Southern Cross will move while you are on watch lets you keep track of your course without having to get up and look at the compass.

If someone on board knows how to do celestial navigation, that person should become the instructor to the rest of the crew. Otherwise, take along a good celestial navigation book. Practice makes perfect. You will take many sights before you experience the thrill of that perfect cocked hat around your current position.

Social Time

Voyaging offers the opportunity to meet new people, to rebuild old relationships, and to develop new friendships that will last a lifetime. For many cruisers, the social side of the cruising coin is the most rewarding and what keeps them out there year after year. After a decade of cruising, we have friends in more than thirty countries. Our e-mail inbox frequently contains messages from a half dozen different nations. And despite prolonged absences, we have never been closer to our families. The dispatches we send to them and the intense time we spend when we return to visit have allowed them to share in our lives in a way that was close to impossible when we were working full-time.

Social time occurs along three dimensions. Each is important, and each will become part of your normal cycle of activities as you move into the cruising life.

1. **Making new friends ashore.** Arriving on a boat allows us to really interact with local communities because we have to shop in the local market, get water from the local well, and get diesel from the fuel dock used by fishing boats. Whether we've made landfall in Fiji or France, we have the opportunity to get to know people whose lives are very different from our own and to share something of our lives with them. But the doors do not always open easily. In fact, it is astonishing how often the voyaging community becomes insular. It takes a special effort to meet and really get to know local people, but when we make that effort we are rewarded with

new friends and a new way of viewing the world. Chapter 26 discusses various ways to connect to local communities and find your way in to new cultures.

2. **Making new friends afloat.** Part of the reason why the cruising community sometimes gets insular is because cruisers share so much. They have been through the same storms, anchored in the same anchorages, and come to think the same way about many things. As a result, cruising relationships develop quickly and tend to be very intense. Wherever a group of cruisers congregates, socializing becomes a major part of life, with drinks or dinner or potlucks several times a week. With the advent of e-mail, we no longer have to say good-bye knowing we may never see or hear from someone again. These days we plan months in advance to meet friends in faraway places.
3. **Staying in touch with those you left behind.** Just because you're a long way away physically doesn't mean people have to feel out of touch. E-mail updates, photos, websites, blogs, and journals can all be used to help bring your experiences alive for family and friends. We lost touch with many land-based friends during our first circumnavigation because they literally could not relate to what we were doing and had no way of understanding it because we could not share it with them. This time around, not only do our friends and family understand and appreciate our life, but many anticipate our updates and share them with their friends. If you have children aboard, sharing their experiences with their classmates creates a unique educational opportunity and makes it easier for them to fit back in once they return to school.

Like most cruisers, we could spend all day every day on social time, but we usually manage to squeeze in a few other things here and there.

Quiet Time

Before you head off, you may picture yourself flitting from anchorage to anchorage, eagerly embracing every culture and new experience, and always being challenged and active. But most cruisers find they learn to treasure the quiet that the sea offers in abundance—to pause and reflect, to breathe and to be. This is time we did not allow ourselves during our hectic shore-based lives.

When not contemplating the endless expanse of the ocean, most voyagers fill their quiet times with a few simple activities. Sailors have been avid readers since the average seaman knew how to read. They have also been avid scribblers—writing letters, keeping notes and journals, chronicling their own sea changes and experiences with different cultures. These things still entertain us at sea.

SHIP-ADAPTABLE ACTIVITIES

Both Evans and I came to voyaging as overachievers who had been "doing things" all our lives. Over the course of our first year aboard, we had to learn to slow down and live life—not just skate over it. Over the course of our second year aboard, both of us came to understand the value of not doing anything and embraced it for perhaps the first time in our lives. But by the third year, we realized that if we were to continue indefinitely, we would need some sort of intellectual stimulation. We found ourselves hungering for a mental challenge to accompany the physical and emotional challenges of voyaging.

Some people are content for the long term with the activities described above, and we envied them their inner peace. But we, and others who came from similar backgrounds, started looking for a way to find mental stimulation, focus our energy, and grow in a different plane after a few years of living aboard. Many long-term voyagers come to a balance that works for them. Some cruise for a few years and then work for a while. Others take up the part-time life, where they cruise for a few months each year and spend the rest of the year working in their home country. We have chosen to take our work with us. While this has at times limited our mobility and reduced the amount of time we could spend sightseeing and traveling, it has proved very satisfying as we have found ways to interact with and contribute to the broader cruising community.

If you have an interest you wish to pursue, you can probably find a way to do so with a bit of ingenuity and a few compromises. We have seen the following ideas in practice on different boats. Some of them may even earn you some money, but don't count on it.

Photography

Photography has become much more sea-suitable than it was when we started cruising more than a decade ago. If you want to capture a few digital images to accompany your updates to friends and family, buy an inexpensive digital camera and enjoy yourself. But if you really want to capture some of those indelible "Kodachrome moments," you will need to invest in expensive equipment and protect it from the corrosive environment. Magazines are always looking for excellent photos of the cruising life, because one photo can capture the essence of voyaging. Yet the realities of taking pictures from a small boat make them hard to come by.

To give yourself the best chance of getting those breathtaking photos, outfit yourself with good camera equipment and keep it protected and in good working order. While you can do a great deal with a high-quality "point-and-shoot" digital camera, your average photo quality will increase markedly if you purchase a high-resolution SLR (single-lens reflex) camera and a high-quality telephoto lens. A 300 mm, image-stabilized lens will allow you to take photos across a much wider range of light conditions and to capture beach and water scenes from the deck of your boat.

To minimize damage from salt water and humid air, keep your camera in a waterproof safety case with desiccant whenever it is not in use. Use a dry bag or inflatable zip-top sport bag for transporting the camera ashore in the dinghy. Make sure the bag has sufficient air trapped inside to float if it goes overboard. If the dinghy is swamped, your gear will remain dry and you'll be able to rescue it. Clean the outside of the camera and the lenses with a soft cloth and camera cleaning fluid after every use. Salt water spattered on the focusing area of point-and-shoot cameras will interfere with the camera's automatic focus, and moisture or salt on expensive SLR cameras can damage circuit boards located under lifting panels on the camera body.

To protect your lenses, put a sky or haze filter on each one. If the filter gets scratched, it will cost you a tiny fraction of what a new lens costs. Take a good camera cleaning kit, which includes a puff brush, lint-free lens paper, a chamois cloth, and cleaning fluid. Clean your lenses every few days of use to keep them free from the sticky residue that develops from salt air. Take the camera to a professional shop every few years and ask them to look it over. If they find any signs of mold or mildew, have the camera professionally cleaned.

An underwater camera lets you take those action-packed heavy weather shots. The Nikonos is the top of the line. If you cannot afford a second camera, buy a waterproof housing that protects your existing camera body and lens. These are sold in camera stores for professional photographers. Make sure you get one capable of being used underwater because a direct wave strike can put as much pressure on the seals as diving to moderate depths.

Capturing heavy weather takes practice. The largest seas flatten out when photographed and end up looking tame. Framing the shot helps provide perspective. Try taking storm seas looking astern from the bow, with a dodger or a person in the foreground. For those lovely tropical water photos, use a polarizing filter. The best photos in the tropics are taken at dawn and dusk. At midday, the bright sun washes out the colors, even with a polarizing filter. Ask permission before taking photographs of people.

Other Arts

Beyond the arts and crafts described above, many of our friends pursue a number of more complex artistic activities that are fulfilling, challenging, and rewarding. All of them take some special equipment, but the materials can usually be scavenged as you go along.

- **Woodworking.** A small lathe does not take up much space aboard and can turn out a variety of wooden curios, from paper towel holders to Christmas ornaments. You might scavenge interesting wood from the beach or find small quantities of high-quality wood in the refuse pile at the local boatyard. Though it takes up more space, a router can be used to make name boards for boats.
- **Metalworking.** You can use a small metal punch to make wind chimes, wall hangings, ornaments, and other small trinkets. Exotic metals are harder to come by than wood, but you will almost always be able to find something, if only a steel drum retired from a local band in the Caribbean.
- **Jewelry making.** You can collect objects from the beach to create high-quality jewelry. One couple we knew carried small quantities of precious metals and bartered for the black pearls found in the South Pacific islands. She designed the jewelry and created exotic and beautiful art, and he executed the design with great skill. This requires some investment in specialized tools. However, space requirements are small, and returns are high if you have an artistic sense and a craftsman's quality.

Few activities are totally incompatible with life aboard. One friend of ours even exercised his passion for golf. He carried a set of clubs aboard, and whenever he arrived at a resort destination with a golf course, he loaded his clubs into the dinghy and off he went. He played on excellent courses at five-star resorts in Bermuda, the Caribbean, and Fiji—places he would never have traveled to just for the sake of playing golf. So think flexibly about what you want to do with your free time when you become a voyager, and you'll be challenged and energized by your new life.

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PART IV
Shorthanded Passagemaking Skills

LIVEABOARD SKILLS MAKE up only one set of skills that long-distance offshore voyagers need to master. The day you set sail and don't go back, the day land slips under the horizon, you cross a new threshold in your voyaging life. The skills you need for managing a boat at sea with a small crew include everything from weather forecasting to passage planning, from watch-keeping to emergency management. None of these skills involve rocket science, but the need to master so many new skills in a short period of time can seem overwhelming.

There is much you can do before you set off to be sure your first passage lives up to your expectations. Plan your voyage to take advantage of prevailing winds and currents. Learn the basics of weather forecasting and practice from the safety of your armchair. Make some short offshore passages to figure out how to make meals while underway and how to sleep in a moving boat. Prepare the boat well—inspect all mechanical systems from the engine to the rig and stow everything securely.

Much of the rest will have to wait until you and your crew head offshore on your first long passage. Taking along an experienced couple or a delivery skipper you trust will let you learn the ropes with a safety net. But at some point, when land is many hundreds of miles away and you and your crew are on your own, the sea will test you and your boat. If you've mastered the basic skills, prepared the boat well, and built a working team aboard, you will end up strengthened by the experience.

CHAPTER 18
Global Weather Patterns and Voyage Planning

GLOBAL WEATHER PATTERNS
Prevailing Winds   Ocean Currents   Weather Disturbances   *Planning Tools: Pilot Charts*
VOYAGE PLANNING
One Year, One Ocean   Around the World in Eighteen Months   Circumnavigating in Two or More Years   Eastabout Circumnavigations

WHEN EVANS AND I were preparing for our first voyage aboard *Silk*, we took a sailing course along the Cornish coast of England. There were three couples and one instructor aboard, and each day one person was the designated Day Skipper. That person acted as captain and could be overruled only by the instructor, who allowed each of us to make our own mistakes if we were not endangering ourselves or the boat. On the third day, we had to pass a headland around which the tide ran at close to 5 knots for all but a few hours each day. Our Day Skipper plotted our course, made his calculations, and told us that we would have to be ready to leave at 3:30 a.m. His wife protested bitterly, so he delayed our departure until first light at 5:00 a.m.

The next day, we spent 5 hours trying to tack around that point. I will never forget the lovely old Cornish lighthouse that stood proudly on the high cliff—the one I grew to hate each time we closed with land and found it on exactly the same bearing! We learned a valuable lesson that day. Working with the elements and using them to advantage means a much more comfortable, less stressful, and less dangerous voyage. That holds true whether tacking around a headland or sailing around the world.

Voyage planning begins with an understanding of the winds, currents, and seasonal weather disturbances on each ocean. In conjunction with your overall objectives for the voyage—where you want to go and how long you have to get there—these global weather patterns will shape your route and determine your timing.

GLOBAL WEATHER PATTERNS

It is easy to think of the ocean as a trackless wilderness over which you can chart your own course and follow your whims in deciding which of the many islands you set your sails for next. In practice, sailing routes are dictated by temperature differentials across the earth's surface and by the earth's rotation. Together, these create the global air circulation that defines the prevailing ocean winds. Deviating from traditional routes means bucking those winds and the currents they generate. For those who rely on sail power, the time-honored trade wind routes are still the easiest and fastest way to get from point to point, though not always the shortest.

These routes have their own rhythms. Seasonal weather disturbances determine the safest times to be in certain areas; therefore each ocean has its own cycle of voyaging activity. For example, cyclones form in the tropical South Pacific from December to April. To avoid these storms, most crews leave from the Panama Canal, the U.S. West Coast, or the western coast of Mexico in March or April, toward the end of cyclone season and before the start of the tropical North Pacific hurricane season. They sail across the belly of the South Pacific to arrive in New Zealand or Australia in October or November, before the beginning of the next cyclone season. Instead of spending unlimited time in the legendary South Pacific islands, most cruisers crossing the Pacific average 1,000 offshore miles each month (one week out of four on most boats) in the eight months between March and November. That's why so many crews return to the South Pacific islands the following April or May for a second, more relaxed season.

Global weather patterns will play a large part in shaping your voyage plan, and they will also affect the specific route you take on a particular passage. The Passage Planning section in Chapter 20 returns to the concepts of global winds, currents, and weather disturbances discussed below in the context of developing your passage plan.

Prevailing Winds

Voyage planning starts with a basic understanding of prevailing winds around the globe. At its simplest, air rises at the equator, where it receives the most heat from the sun, cools and subsides as it moves northward or southward toward higher latitudes, and travels back to the equator along the earth's surface (Figure 18-1). The earth's rotation from west to east bends the north-south airflow along the planet's surface, creating areas of easterly winds where the predominant airflow is toward the equator and westerly winds where it is toward the poles.

These air movements resolve themselves into five bands of prevailing winds differing in their directions, strengths, and consistencies:

1. **Intertropical Convergence Zone (ITCZ).** The band within 5° to 10° of the equator lies at the convergence of the northern and southern trade wind belts. Often referred to as the doldrums, it is more properly called the Intertropical Convergence Zone (ITCZ). Boats must cross this area when traveling between the Northern and Southern hemispheres.

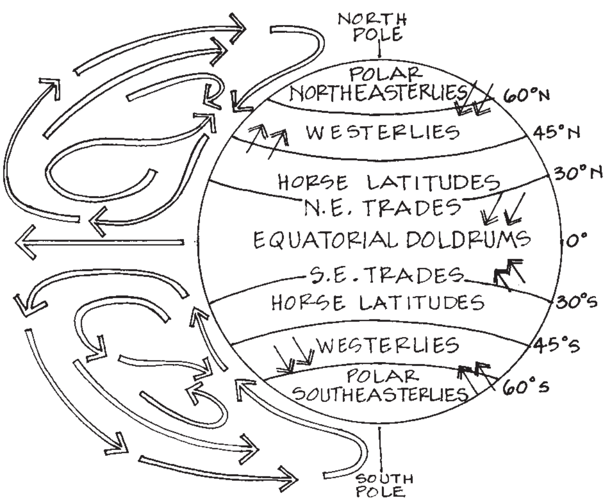
   The trade winds funnel a huge amount of air into this area, where the sun's heat causes it to rise. This creates a predominantly upward airflow and a low-pressure trough. The warm, moist air cools as it rises, creating clouds and squalls. Typical weather in this region includes light and variable winds, frequent squalls with heavy rain, and violent thunderstorms.

   The extent and position of the ITCZ varies by season and ocean. In February and March, it lies just north of the equator and can be as little as a few miles wide. In July and August, the ITCZ can be several hundred miles wide and extend as far as 20°N. In both the Atlantic and Pacific oceans, the doldrums are much narrower—and easier to cross—in the west than in the east.
2. **Trade winds.** The low pressure in the doldrums created by the rising of heated air pulls air in along the surface from the high-pressure systems located at about 30° north and south. The rotation of the earth causes this airflow to bend as it crosses the region between the highs and the doldrums, giving these winds an easterly component. This creates the fabled northeast and southeast trade winds found in the band from about 10° to 30° north and south. Eighty percent of the time, winds blow out of the easterly quarter in this area, with stronger winds in winter than in summer.

   Although low-pressure systems from the higher latitudes do not often move into this area, this is the region where tropical revolving storms form. The warm weather, consistent winds, and lack of low-pressure systems make these ideal latitudes for voyaging, except during the tropical storm season. The east to west "coconut milk run" route used by most circumnavigators is situated largely in the trade wind belt, with forays into the temperate latitudes to escape the seasonal threat of tropical storms.
3. **Horse latitudes or variables.** Large, more or less stationary high-pressure systems extending from about 30° to between 40° and 45° north and south exist in every ocean. Like the doldrums, this band of high pressure is characterized by weak horizontal pressure gradients and light, variable winds. Unlike the doldrums, where tropical air rises and condenses, in this region cool air descends and becomes less humid as it warms at lower altitudes. As a result, squalls and thunderstorms occur infrequently, and the air is usually fresh and clear.

   When ships made runs from the Old World to the New, they often got becalmed in this

Figure 18-1.
The basic circulation of air around the globe determines the prevailing winds at different latitudes. (Lyanne Schuster illustration)



large area of little wind. One of several explanations for the name "horse latitudes" holds that horses in the cargo were thrown overboard as water supplies dwindled. Most of the traditional sailing routes avoid the horse latitudes by traveling east to west in the trades and returning from west to east through the bands of westerlies poleward of the horse latitudes.

4. **Westerlies.** Air from the stationary high-pressure systems flows toward the stationary low-pressure systems nearer the poles. The rotation of the earth imparts a westerly set to these winds, resulting in a 20° wide band of prevailing westerly winds—predominantly northwest in the Southern Hemisphere and southwest in the Northern Hemisphere. These westerly winds result in the Roaring Forties and Furious Fifties of Southern Ocean fame. In the Northern Hemisphere, large landmasses distort the pattern significantly, so the overall effect is less pronounced. Though characterized by a higher percentage of gales and less consistent winds than the trades, the westerlies can be used to make west-to-east passages in either hemisphere.
5. **Polar southeasterlies.** At the poles, the last of the air that rose and headed poleward from the equator cools and sinks, creating polar high-pressure systems. This air is again deflected by the earth's rotation so the prevailing winds run easterly and toward the equator from each pole down to about 60° of latitude. There these polar easterlies meet the prevailing westerlies along a semipermanent low-pressure band, where the converging air is forced aloft.

Ocean Currents

The circulation of air around the planet creates the easterly trade winds and the prevailing westerlies in the higher latitudes. These bands of air movement in turn define the circulation of water around each ocean. Generally speaking, a weak westerly setting current exists in the trade wind belts, and a weak easterly setting current exists in the zone of the prevailing westerlies. These are linked by north-south currents along the landmasses that border each ocean. The actual strengths and day-to-day locations of these currents vary, depending on underwater topography, interference from landmasses, and other factors that scientists are only beginning to understand.

To take the North Atlantic as an example, the northeast trade winds push water before them in the region from 10° to 30° north, thereby creating the westward-flowing North Equatorial Current (Figure 18-2). This

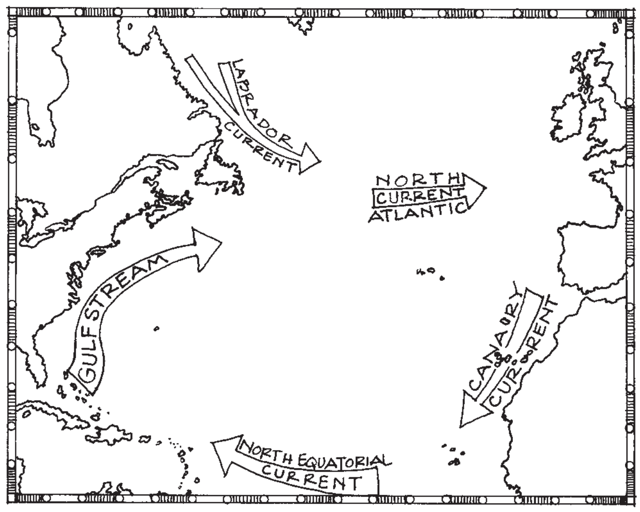


Figure 18-2.
The prevailing winds create the major ocean currents, shown here for the North Atlantic. (Lyanne Schuster illustration)

is a fairly weak current, generally less than a knot, but when it reaches the shallow Caribbean Sea and fetches up against Latin America, it is forced back out through the narrow channel between Cuba and Florida. This is the beginning of the Gulf Stream, one of the strongest ocean currents in the world, which runs along the U.S. East Coast at 2 to 4 knots. The warm water of the tropics flowing through the Gulf Stream makes the Scilly Islands, located some 30 miles southwest of Land's End in England, temperate enough to grow palm trees and orchids.

At the same time, polar northeasterlies create the southward-flowing Labrador Current, which divides when it encounters the Gulf Stream. One leg then flows south between the Gulf Stream and the coast, while the other merges with the much-weakened Gulf Stream, gets reinforced by the prevailing westerlies, and becomes the eastward-flowing North Atlantic Current. The current's strength is now about a knot or so. Most of this current is deflected southward by the European landmass to become (in succession) the Azores, Portugal, and Canary currents, each around a knot in strength. The current reaches the trades and turns westward near the Cape Verde Islands, and there the cycle is closed. The ITCZ separates the circulation between the Northern and Southern hemispheres. In the South Atlantic, the overall circulation is much the same, though it runs counterclockwise instead of clockwise. Similar patterns exist in the Pacific and Indian oceans.

These ocean currents offer mariners a free gift of extra miles made good toward their destination. A 1-knot current will add close to 20 percent to an average day's run on a 30-foot waterline. Choosing to buck that same current means losing 20 percent from the day's run, so going with the current versus going against it makes a 40 percent difference overall. The traditional sailing routes pay almost as much attention to the strongest ocean currents as to the prevailing winds. Since the prevailing winds drive the major ocean currents, there is rarely a conflict between them.

Ocean currents do have a downside, however. Where strong currents exist—such as the Gulf Stream or the Agulhas Current (along the east and south coasts of South Africa)—low-pressure systems bring gale-force winds that blow contrary to the underlying flow of water. In that situation, the waves created by the wind on top of and in opposition to the mass of water being driven by the current are more dangerous than in most offshore gales: they are steeper, larger, and more likely to be breaking. These waves can be more violent than those formed in significantly higher wind speeds in the absence of underlying current. In addition, current-driven crosswaves can develop in the trough of the wind-driven waves. This is the situation we encountered on our first offshore passage between Newport and Bermuda, when a small tropical depression caught us in the middle of the Gulf Stream. The wind-driven waves were over the top of our mizzen mast (35 feet high) and breaking, and the cross seas were 10 or 12 feet high. We have never experienced anything close to these conditions since, even in Southern Ocean storms that lasted more than 48 hours.

Favorable ocean currents offer another incentive to sail with the prevailing winds. As discussed in the Ocean Currents section in Chapter 20, where ocean currents are unusually strong (3 to 4 knots) your passage planning should include options for leaving the current in the event of contrary winds. Besides the Gulf Stream and the Agulhas Current, major ocean currents of 2 knots or more along the trade wind routes can be found near the coast of Brazil, over the top of Australia in the Arafura Sea, and along the west coast of South Africa.

Weather Disturbances

As offshore sailors, we want to limit our exposure to gale-force and higher winds. In general, that means avoiding two types of systems: tropical revolving storms in the tropics, and winter storm systems in the higher latitudes. In the Indian Ocean, the monsoon season creates frequent gales and further complicates the voyage-planning picture for that ocean.

Tropical Revolving Storms

Historically, tropical revolving storms have occurred in all tropical oceans except the South Atlantic, and though they can occur at any time in most oceans, they have tended to be limited to the late summer and fall months. But global climate change may be rewriting the rules.

In the last decade there have been three tropical storms in the South Atlantic, one of which reached Brazil as a Category 1 hurricane. As tropical water temperatures have warmed earlier and stayed warm longer, tropical cyclones have become common in the months before and after the traditional season. The old sailor's saying for the North Atlantic storm season—"June, too soon; July, stand by; August, come she must; September, remember; October, all over"—no longer seems to apply. November and even December hurricanes in the last few years prove that the season is no longer "all over" at the end of October (see the Close Encounter with a Hurricane section in Chapter 15).

At the same time, hurricanes seem to be becoming more intense. The percentage of Category 4 and 5 hurricanes worldwide increased from about 15 percent of total hurricanes in the 1970s to almost 35 percent since 2000. Other regions, including the well-traveled South Pacific, have also been experiencing longer seasons. As a result, it is becoming more difficult for cruising sailors to avoid these storms, yet avoiding them is the only way to ensure the safety of your crew and your boat.

Generally speaking, tropical storm season in the Northern Hemisphere runs from June to November, and in the Southern Hemisphere from December to April. But "seasons" refer to those months with the highest historical incidence of tropical cyclones. In the North Atlantic, hurricanes have occurred in May and December. The western North Pacific has experienced typhoons in every month of the year, though 90 percent occur between early June and late December.

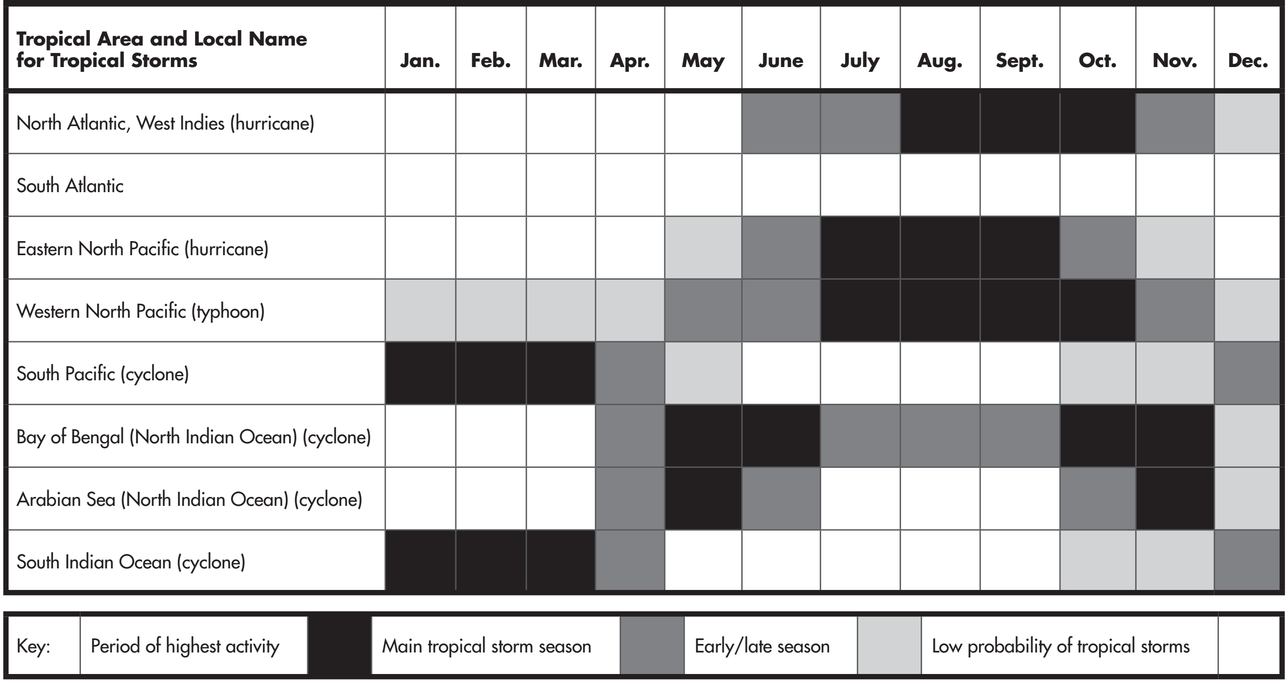
Table 18-1 shows the tropical storm seasons by region, and Table 18-2 shows the average number of storms of different intensities per year. The western North Pacific is the most active basin in the world. In an average year, this basin will experience twenty-six tropical revolving storms, at least eight of which will have winds over 95 knots. Luckily, this is an area very few voyagers visit.

Every tropical circumnavigator will pass through the North Atlantic and South Pacific, so these areas will be considered in some depth.

North Atlantic. The North Atlantic includes the Atlantic Ocean, Caribbean Sea, and the Gulf of Mexico. Although nowhere near the most active region, the storms in these areas tend to affect large population centers and large numbers of cruisers. Seventy-eight percent of the storms here occur in August, September, and October. An average of 3.6 hurricanes occur in the month of September, translating into one every eight days in an average year (Table 18-3).

Seventy-five percent of all hurricanes in the North Atlantic begin as tropical waves that form near the coast of Africa. If water temperature and upper-level winds are

TABLE 18-1. TROPICAL STORM SEASON BY REGION



favorable, a tropical wave develops into a tropical disturbance, then a tropical storm, and finally a hurricane as it makes its way eastward across the Atlantic toward the Caribbean. Thus, crews crossing from the Canaries run the risk of encountering a hurricane at sea unless they wait to make the crossing after the season has ended. To minimize that chance, boats should not leave the Canaries or Cape Verdes before mid-November (though in 2005 there were two tropical revolving storms in December in the area of the Canaries).

Hurricanes forming in the mid-Atlantic may continue through the Caribbean Sea and affect the Gulf States or the western Caribbean and Mexico, or they may follow the Gulf Stream northward to make landfall somewhere on the East Coast of the United States. Hurricanes pose a serious threat from Grenada to Cape Hatteras throughout

TABLE 18-2. AVERAGE NUMBER OF STORMS PER SEASON BY BASIN[1]

Area	Total Tropical Storms (> 34 knots)	Total Tropical Cyclones (> 63 knots)	Category 3+ Cyclones (> 95 knots)
North Atlantic, West Indies	10.6	5.9	2.0
Eastern North Pacific	16.3	9.0	4.1
Western North Pacific	26.7	16.9	8.5
South Pacific	10.6	4.8	1.9
North Indian Ocean	5.4	2.2	0.4
South Indian Ocean (W of 80°W)	10.6	4.8	1.9
South Indian Ocean (E of 80°W)	7.3	3.6	1.6

[1]Average number over 30 years or more; exact time period varies by basin depending on available data.
Source: Compiled from statistics obtained from the NOAA, Accuweather, and Wikipedia websites.

TABLE 18-3. TROPICAL STORMS AND HURRICANES BY MONTH IN THE NORTH ATLANTIC BASIN (1944–2005)

Month	Total	Average
January–April	4	0.1
May	8	0.1
June	35	0.6
July	58	0.9
August	173	2.8
September	224	3.6
October	114	1.8
November	33	0.5
December	7	0.1
Total	**656**	**10.5**

Source: NOAA.

the season. They hardly ever pass south of Grenada, and they affect the U.S. East Coast north of Cape Hatteras on average only once in five to ten years. Grenada, Trinidad, Tobago, Venezuela, and the ABCs (the Netherland Antilles islands of Aruba, Bonaire, and Curaçao) have all been considered safe places to spend a hurricane season. Since 2004, however, when Hurricane Ivan devastated Grenada before going on to affect Venezuela, many insurance companies have moved the exclusion zone for tropical storms southward to include Grenada, Tobago, the ABCs, and parts of Venezuela.

South Pacific. Most tropical cyclones form in the Coral Sea between New Caledonia and Australia and move southeastward to affect the South Pacific islands from New Caledonia to Fiji and farther east. Cyclones occasionally reach as far south as the North Island of New Zealand and as far east as the Tuamotus. Tropical cyclone formation is rare in the eastern South Pacific, and when it does occur it tends to be linked to El Niño.

The relative infrequency of storms in the eastern South Pacific and the desire to spend more than one season in French Polynesia have led more and more cruisers to leave their boats in yards in the Society Islands for cyclone season. But most cruisers still make the run south to New Zealand or Australia for the austral winter to get out of the cyclone belt. An interesting alternative is to head north to the islands lying close to the equator above the cyclone belt. A summer season can easily be passed visiting Tuvalu, Tokelau, Kiribati, and the Gilbert Islands.

Winter Storms

Although not as devastating as tropical cyclones, winter gales outside the tropics can be quite severe. The nor'easters that can wreak havoc along the U.S. East Coast between November and March are examples of these powerful storms. Severe winter gales also occur around New Zealand, South Africa, northern Europe, and the Mediterranean. The period between tropical storm season and the winter gales generally defines the window for traveling between the tropics and the temperate latitudes. For example, most boats arrive in New Zealand after October 1, when the frequency of the winter gales has decreased to nearly zero. They leave again the following fall, in April or May, when the risk of tropical cyclones has subsided and before the winter gales begin.

The window between the end of hurricane season and the onset of winter gales in the North Atlantic has always been a small one, generally considered to be from the first week in November to the last. By December, winter gales have begun in earnest, with the area around Cape Hatteras shedding lows into the Atlantic on a weekly basis. Meeting a full-blown nor'easter in the Gulf Stream poses almost as much risk as a tropical storm. As discussed in the Close Encounter with a Hurricane section in Chapter 15, the advent of November and December hurricanes means that winter storm season and hurricane season have begun to overlap. This makes it almost impossible to eliminate the risk of encountering a late-season hurricane in this area, which means hurricane contingency planning must now become an integral part of voyage planning in the North Atlantic.

Similarly, in the South Pacific, it is becoming harder and harder to pick a weather window to head back to the tropics after cyclone season. Storms have become common through the end of April in the western South Pacific, but by June the winter storms come frequently enough that many people cannot find a decent weather window to get clear of the temperate latitudes. Many crews who waited until June when we were in New Zealand in 2005 ended up missing the tropical sailing season completely. May looks to be the best month for heading north these days, but crews need to pay close attention to the weather and have a contingency plan in case a cyclone forms while they are en route.

Indian Ocean Monsoons

In the northern Indian Ocean, monsoons further complicate the seasonal weather picture. From May to September, the ITCZ moves northward and becomes a large,

PLANNING TOOLS: PILOT CHARTS

Our voyage planning begins with Jimmy Cornell's *World Cruising Routes*, which offers basic routing instructions and recommended timing for almost every conceivable passage around the world. For even more detailed information and additional insights, we also review the *Atlas of Pilot Charts* for the ocean we will be crossing.

One page of the *Atlas* summarizes an amazing amount of information for an entire ocean for a given month, including wind speeds and directions, currents, wave heights, gale and calm frequencies, air and sea temperatures, visibility, ice conditions, and more. Reports from merchant ships, weather stations, and naval units have been averaged over long periods to obtain these data, which are reported by quadrant, with each quadrant being 5° on an edge. Within each quadrant, a wind rose consisting of a circle surrounded by eight arrows along the cardinal points of the compass depicts average wind speeds and directions (Figure 18-3). The length of each arrow indicates the percentage of time winds were reported from that direction, and the number of feathers translates into the average wind strength on the Beaufort Scale. The percentage of calms is shown in the number in the center of the circle.

In addition to the wind roses, detailed descriptions provide information on tropical storms and their tracks, sea temperature, wave heights, incidence of fog, and other hazards. Red lines on the chart indicate the percentage of significant wave heights over 12 feet for different areas in that month. Inset maps on each page show the percentage of gales by quadrant. All this information is invaluable in deciding where you don't want to be when. Although Cornell summarizes most of this information in a very usable form, a look at the *Atlas of Pilot Charts* often clarifies his instructions and suggestions, as well as occasionally opening up options we might otherwise have missed as we work out where we're going to spend the next year and how we're going to get there.

Figure 18-3.
Each page of the *Atlas* is divided into quadrants; in each quadrant, information including wind speed, direction, and percentage of calms is summarized in a wind rose.

low-pressure, almost stationary air mass over Central Asia. There it produces southwest winds, frequent rainsqualls, and occasional violent thunderstorms. In addition to the risk of tropical cyclones, westabout voyagers will face headwinds and very unpleasant conditions. From October to April, the ITCZ with its associated low pressure shifts southward and is replaced by a large high over the Asian landmass. Tropical storms peak in October and November, but by December or early January the tropical storm risk declines, and the air circulation between the high and the ITCZ creates moderate northeast trades. From January through March, westabout voyagers can head across the Indian Ocean to the Red Sea in favorable winds with little risk of tropical storms.

VOYAGE PLANNING

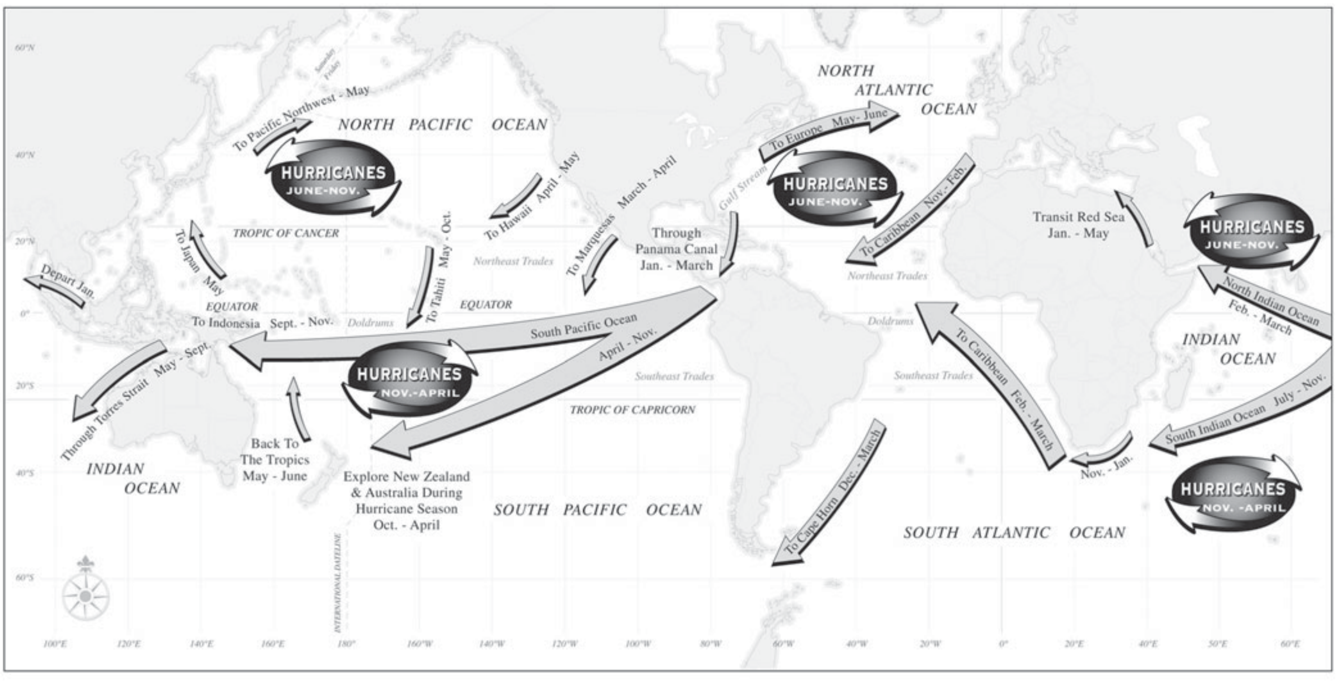
When all these factors are taken into account, the seemingly unlimited landfalls and routes available to a cruising boat crossing an ocean become much more limited. If you are unconcerned about comfort, you have a boat that sails well to windward, and you are not worried by the possibility of encountering a hurricane or cyclone, almost anything goes. Otherwise, you will enjoy your voyage much more if you take advantage of prevailing winds and currents and work hard to avoid storms. The following sections discuss typical itineraries for voyages of different lengths. Figure 18-4 summarizes these constraints and will provide some guidance as you begin voyage planning.

One Year, One Ocean

If you have only a year for voyaging, or if you want to try one year before you commit to two or three, head for a warm-weather cruising ground for a season. Most crews leaving from northern Europe go to the Med. From the east coasts of the United States or Canada, try the Caribbean. From the North American west coast, head for Mexico. If you're leaving from New Zealand or the east coast of Australia, you have all the islands in the western South Pacific to choose from. If you're leaving from Perth on Australia's west coast, sail north to the islands off the Coral Coast and along the shores of the Kimberley region.

To get the most out of a season in the Med, leave in the spring and return in the fall. Elsewhere, head toward the tropics at the end of the tropical storm season and return home as the next season approaches, arriving after nine months to a year of fairly leisurely voyaging. If

Figure 18-4.
Worldwide weather and typical voyage timing. (Paul Mirto illustration)



your voyaging dreams include some significant offshore passagemaking but you are limited to one year, consider circumnavigating the Pacific or the North Atlantic.

In the Atlantic, the standard route leaves the East Coast of the United States in May or June, when the weather has warmed up enough to make night watches bearable but before the beginning of the tropical storm season. If leaving from south of Cape Hatteras, most boats call at Bermuda and then continue across in the band of the prevailing westerlies to the Azores. From north of Cape Hatteras, a direct route can be shaped to the Azores or even to Ireland. Either way, boats arrive in late June or early July. From the Azores, they can sail north to England, Ireland, and Scotland or head to the Iberian Peninsula and the Strait of Gibraltar. By early November, boats begin to congregate in the Canaries, preparing to follow in Columbus's wake to the New World.

The strong winter trades often don't fill in until mid-December, and hurricane season can now be considered active through November, so most boats won't leave until near Christmas, arriving in the Caribbean in January. After spending the winter season in the Caribbean, crews start to follow the warmth of spring up the East Coast, arriving back in their home ports a year after setting sail. European boats follow the same route, cruising northern Europe or the Med for the summer, heading to the Caribbean in December, and crossing back to Europe in May or June.

For those who decide to add a second year halfway through the first, the normal options include wintering over in the Mediterranean or spending an extra year in the Caribbean with a side trip to Trinidad or Venezuela to avoid the hurricane season.

In the Pacific, voyagers have more options on both the outbound and return legs. With eighteen months to cruise, crews from the west coasts of the United States or Canada will head down the coast to Southern California in August or September before the winter storms start. They will depart for Mexico at the end of the hurricane season in November or December and cruise Mexico through the winter months before heading for the Marquesas around March or April. This route offers the best angle for crossing the doldrums and the shortest distance to French Polynesia. With only a year to cruise, west coast sailors will wait to make the passage from their home waters direct to Hawaii or the Marquesas in March or April.

In either case, crews will continue on to Tahiti, arriving in June after the cyclone season has ended, then continue west across the Pacific island chain during the winter trade wind season. Around October or November, they head north to cross the equator before the South Pacific tropical storm season begins, staying south of Hawaii in the North Pacific trade wind belt until after the tropical storm season ends in December.

To return to the west coast, crews can sail east through the light air of the equatorial doldrums, taking advantage of the equatorial countercurrent, to the longitude of the Line Islands, then north to Hawaii; or they can take a zigzag upwind route using long tacks to link tropical islands until reaching Hawaii. They can then spend what remains of the winter in Hawaii and complete their trip in the spring by sailing over the top of the North Pacific high. A few crews might choose a more unusual route, heading north to winter over in Guam or even Japan before crossing back through the westerlies around 40°N the following spring.

Those crews that find themselves in the western Pacific and decide to extend their voyage to a second year will sit out the cyclone season in New Zealand or Australia and return to the Pacific islands during the general exodus between April and June. They can then use one of the routes described above to return to the west coast of North America.

Boats leaving from New Zealand or Australia will need eighteen months to do more than visit the South Pacific islands. They can jump onto the circle at the end of cyclone season, cruise the tropical islands through the austral winter, and then take one of the three routes into the North Pacific in October or November as described above. Crews who want to stay in tropical waters need to wait in Hawaii until the tropical storm season ends in the South Pacific and then sail to the Marqueses or Tuamotus. From there, they can run the trades back across the South Pacific, returning home before cyclone season.

Around the World in Eighteen Months

Assuming that you do not want to run the risk of encountering tropical storms, it takes a minimum of eighteen months to complete a circumnavigation (Figure 18-5). To accomplish this on a boat with a 40-foot waterline, you will spend one day in three at sea, and you will bypass many wonderful places along the way. If you can't afford to take more time and this is your life's dream, however, you can make it around the world this way. The following description starts from North America. Europeans would begin with the Canaries-to-Caribbean crossing, and New Zealand and Australian voyagers would join at the end of the Pacific cyclone season.

From the east coast of North America, the voyage begins in late October or early November, when boats head south to the Caribbean through the ICW or offshore. Passage through the Panama Canal can be made as early as late February to allow an April landfall in the Marquesas (after a stop in the Galápagos) at the end of the tropical storm season. From the west coast, boats work their way south to Mexico in time for a March or April departure

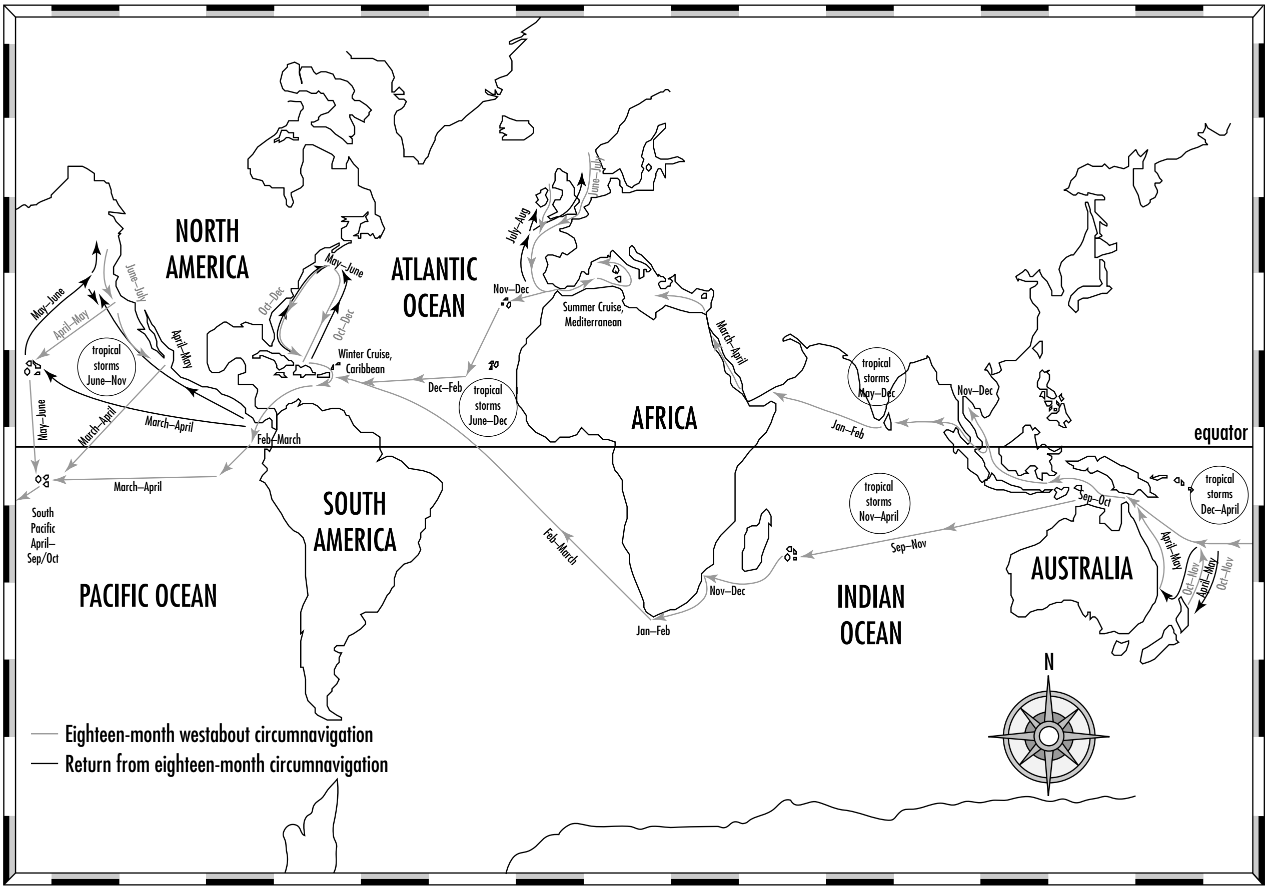


Figure 18-5.
A westabout circumnavigation can be completed in eighteen months as shown, though most crews take three to five years.

for the Marquesas. Alternatively, they head offshore to Hawaii, then south to the Marquesas or Tahiti, timing their arrival for May or June.

To return via the Red Sea, crews need to reach Tahiti by June, Fiji by August, and the Torres Strait by October. They cross the equator to avoid tropical cyclones and spend a few months in Malaysia and Thailand before heading off across the North Indian Ocean in January or February. They travel up the Red Sea in March or April, then cross the Mediterranean to arrive at the Canaries in time for the trade wind passage across the Atlantic in December or January. East coast boats now head north to their home port when the weather warms, arriving back in the late spring. West coast boats won't get much chance to enjoy the Caribbean. They will need to get through the Panama Canal a few months before the Northern Hemisphere tropical storm season begins. After transiting the canal in March or April, they turn north toward home along the coast or via Hawaii, arriving in the early summer.

To return via South Africa, boats have to cross the Pacific even more quickly. They need to reach the Torres Strait no later than early September, then they must cross the Indian Ocean in two months to arrive in Durban before the Southern Hemisphere cyclone season begins. Here they can afford to take a breather and do some sightseeing between the passages that take them around the Cape of Good Hope and into Cape Town by February. By early April, boats need to have crossed the South Atlantic and be back in the Caribbean.

Crews get only a brief respite before heading for home if they are to avoid hurricanes. Those from the east coast need to head north no later than early June to get out of the tropics before the tropical storm season begins and to complete their voyage in eighteen months. Those from the west coast must get through the canal by May if they are to get home without running the risk of encountering a tropical storm in the western North Pacific.

Just for perspective, on our three-year voyage aboard *Silk* we completed an Atlantic circle and then went on to do a circumnavigation from the Caribbean and back in exactly two years. We spent one-quarter of our time passagemaking over the first two years. We found that percentage of passagemaking to be high, but it was acceptable. In the last year, we spent over a third of our time on passage over the course of 14,500 miles from New Zealand back to the East Coast of the United States.

We would have enjoyed that more if we had spent another leisurely year in the Pacific or a year in the Caribbean before returning home. If you only have two years and you're not totally committed to circumnavigating, you might want to consider an extended Atlantic or Pacific circle.

Circumnavigating in Two or More Years

If you have more than eighteen months to invest in a circumnavigation, you will spend much less time at sea and much more time learning about the cultures you have sailed so far to enjoy. But much of the basic timing remains fixed by the realities of seasons, winds, and currents. Assuming you do not want to spend cyclone season in Tonga or Fiji, the Pacific must still be crossed between May and November. The South Indian Ocean must be crossed in the same time frame, and the North Atlantic between November and April. Most people spend additional time by adding a year in the Pacific, the Mediterranean, or the Caribbean.

If we had had an extra year on our first voyage, we would have added a circumnavigation of Australia timed to keep us south of the tropics during cyclone season. Other people spend a second year in the Pacific by returning to Fiji or Tonga to visit the island groups to the west—Vanuatu, the Solomon Islands, New Caledonia, and Papua New Guinea. They spend the next cyclone season in subtropical Australia or in the Northern Hemisphere in Singapore or Phuket, Thailand. Those returning by the Red Sea often spend an extra year or two cruising in the Mediterranean before heading back across the North Atlantic to the Caribbean and then home. Both routes converge at the Caribbean, and many crews choose to spend two seasons there, heading north or south of the hurricane belt before June and returning to the tropics in December.

Eastabout Circumnavigations

Although most circumnavigations are completed from east to west, it is possible to complete a circumnavigation from west to east traveling predominantly in the westerlies. Such a voyage will entail much greater variability in wind strength and direction, as well as a higher percentage of gale-force winds (refer back to Figures 5-1, 5-2, and 5-3). Passagemaking will be done in the summer months; during the winter months the crew will either spend time in the tropics or winter over in the temperate latitudes. That means an eastabout circumnavigation takes longer, a minimum of three years in the Northern Hemisphere if tropical storms and winter storms are to be avoided.

Eastabout voyages also offer many more variations in routes and timing than trade wind voyages. Figure 18-6 shows one option for timing that minimizes exposure to tropical storms. Starting from the East Coast of the United States, the voyage would begin with an Atlantic crossing in May or June. The crew would then spend the summer cruising Europe and head into the Med for the winter. They would make the passage down the Red Sea in February or March, in time to use the early-season southwest monsoon winds to get across the Indian Ocean in April and early May before the start of the tropical storm season. Those who wished to avoid the often tempestuous southwest gales that can accompany the monsoon could travel down the Red Sea as early as December and head east against the light northeast winds that prevail in January, February, and March.

Once in Thailand or Malaysia, crews have a number of choices. For those interested in the North Pacific, the route that minimizes typhoon risk would begin by cruising Indonesia and Malaysia from west to east for six months or so, ending in Papua New Guinea. Crews would then head north to Guam in January or February and then on to Japan in March or April. After cruising Japan for a few months, they would run across the North Pacific to the Aleutian Islands or Alaska in June or July. Alternatively, they could cruise the Philippines to Guam to Japan or the Philippines to Hong Kong to Japan, but the timing on these routes would involve a higher risk of encountering a typhoon.

The option that runs the lowest risk of encountering tropical storms would be to cross into the Southern Hemisphere before the tropical storm season begins in December and cruise Australia through the southern summer. These crews would then join those from Australia and New Zealand and head back to the tropics in April or May to work eastward across the Pacific using one of the options described above in the One Year, One Ocean section.

Any of these routes will bring crews to the Pacific Northwest sometime during the Northern Hemisphere summer. After cruising the area for several months, boats would make their way south to arrive in Mexico after the tropical storm season has ended. They would then continue down the coast to pass through the Panama Canal in February or March, and spend a few months cruising the western Caribbean. They would need to be safely tucked away in Venezuela or north of Cape Hatteras before the start of hurricane season in June or July.

European crews would join this route in the Med; Australian and New Zealand crews would join in the Pacific islands east of the Torres Strait. This route would almost double the mileage of a tropical circumnavigation and

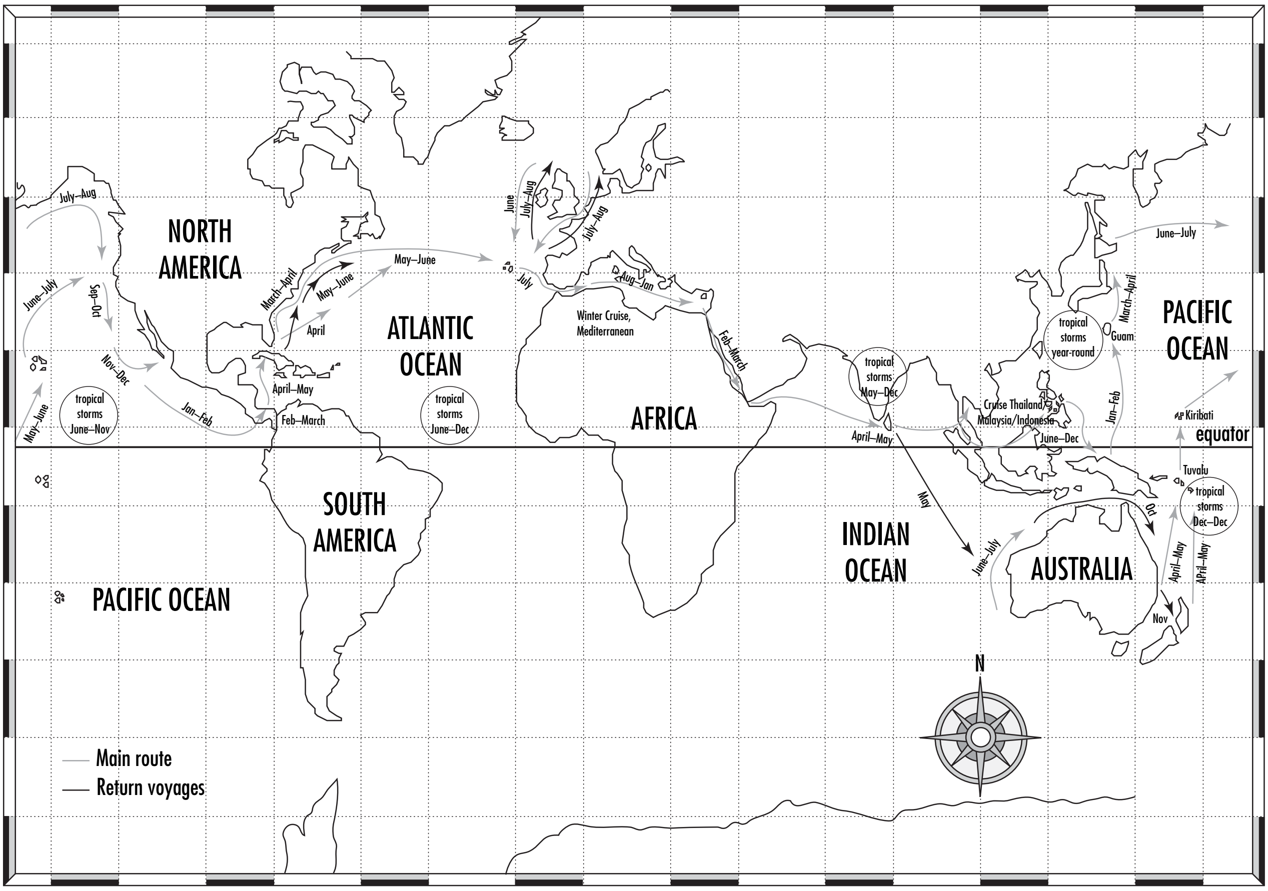


Figure 18-6.
A Northern Hemisphere eastabout circumnavigation takes a minimum of three years if storm seasons are to be avoided.

take a bit over three years to complete. The only way to do it faster would be to make passages during the winter or tropical storm seasons.

Southern Ocean eastabout routes also tend to take several years to complete unless the crew is willing to do several months of nonstop passagemaking in the Roaring Forties. To avoid the worst of the weather, the passages between South America and South Africa, South Africa and Australia, Australia and New Zealand, and New Zealand and South America need to be completed in the summer months. If cruisers are to spend any time cruising these areas in those months, they will not want to do more than one of these passages a season. It will take a minimum of four years to comfortably complete a circumnavigation this way.

On *Silk*, we completed an Atlantic circle and a circumnavigation in three years. On *Hawk*, we have alternated between the northern and southern high latitudes. In seven years on *Hawk*, we have sailed over 50,000 nautical miles and not completed our second circumnavigation.

In retrospect, we did not allow enough time for our first voyage. For those who are taking a sabbatical, try to arrange four or five years. If you can only get away for a year or eighteen months, consider exploring one ocean thoroughly rather than rushing headlong around the world. But whatever your time frame, pay attention to the wisdom of the ancient sailing routes for the most comfortable and fastest, though not necessarily the most direct, passages.

CHAPTER 19

Weather Basics and Onboard Forecasting

NOW THAT GPS has eliminated the daily position fix, a navigator has more time and energy for studying the weather. Evans and I have spent much of the past decade working with top weather routers, studying GRIBs (see the Downloadable Weather Files section below) and weather faxes, and observing the sky and the sea. We have learned to pick good weather windows for leaving on a passage and managed to avoid a few serious storms while underway. However, weather is the very definition of a chaotic system. Even supercomputers cannot predict what will happen beyond 24 hours with any certainty.

The offshore voyager can make use of weather information in the following ways:

- **Voyage planning.** As discussed in the Global Weather Patterns section in Chapter 18, the prudent mariner uses historic information on prevailing winds, currents, and the timing of tropical revolving storms to determine the most favorable sailing routes. This is the single most important step in avoiding heavy weather.
- **Departure weather window.** When setting off on a passage, sailors try to pick a good weather window. That means favorable winds that will give them a good start toward their destination and moderate conditions that will allow them to acclimate quickly. Given the resources available onshore for weather forecasting, most voyagers quickly master the art of picking a departure weather window.
- **Routing decisions.** Ideally, forecasts would help voyagers avoid intense lows and take advantage of strong favorable winds, but the tardiness and inaccuracy of most forecasts, as well as the relatively slow speed of most cruising boats, make routing less useful than might be expected. Still, there are times when forecasts can help crews find better weather than they would have had otherwise.
- **Sail handling decisions.** Sailors want to know how much sail to carry for the next 6 to 12 hours. Most important, they want several hours' warning of an impending gale so they can prepare. Barometric pressure, sea state, cloud formations, and wind direction tell the experienced voyager at least as much as forecasts can about what will happen in the near term.

This chapter begins by examining weather basics—how systems form and move within the temperate and tropical latitudes, and how to forecast from deck level without outside assistance. It then discusses the various outside weather tools available to crews aboard offshore boats and offers advice on how to make the best use of them. Finally, it considers how to translate a weather forecast into concrete departure, routing, and sail handling decisions.

WEATHER BASICS

Meteorologists work at a serious disadvantage when trying to forecast conditions offshore. They face a paucity of barometric pressure, wind speed, and wind direction measurements at sea, information that is necessary for interpreting satellite data. Intense low-pressure weather systems can develop in 12 to 24 hours, yet it takes time to prepare a broadcast and then disseminate it. By the time a forecast for the next 12 hours reaches you at sea, it can be up to 6 hours old. In more remote waters, forecasts get rebroadcast over a cruising net once a day. There, the forecast for the next 12 hours may actually be for the 12 hours just gone by. We have on numerous occasions received a forecast for strong winds after we were already experiencing them. Yet in almost every such case, changing wind directions, cloud cover, and barometric pressures warned us of the approaching weather 6 to 12 hours before the wind increased.

In port, weather forecasts are readily available from VHF broadcasts, weather faxes posted in the local marina or chandlery, Internet weather sources, and sailors who share their expertise with others. Even in remote coastal waters, some government, radio net, or individual will be broadcasting a forecast of some sort over the high-frequency radio. But at sea, where weather matters most, outside forecasting assistance becomes more limited and less accurate. Hands-on forecasting becomes critical.

Good deck-level forecasting starts with an understanding of weather disturbances at different latitudes, how they form and how they move, and what winds and barometric pressures accompany them. You can begin to develop these skills right now. Start monitoring the weather out your window and compare it with the forecasts. Buy a barometer and keep it in the house, and use it to figure out when systems are approaching and when they're moving off. Begin to experiment with your own forecasts. Pay particular attention to forecasting wind speeds and directions rather than precipitation. It won't be long before you'll be more accurate for your own location than the local weather forecaster.

Temperate and High Latitudes

The Prevailing Winds section in Chapter 18 looked at the wind patterns formed by air circulation around the globe. If the weather picture ended there, things would be simple. But a variety of weather disturbances alter the general pattern of air circulation.

In the temperate and high latitudes, what we call "weather" is actually the visible manifestation of interactions along the edges of huge air masses many thousands of miles across. These interactions create pressure gradients and temperature differentials that cause air to flow in different ways than it otherwise would. This in turn creates weather systems with their associated clouds, winds, and precipitation. Forecasting begins with an understanding of how these weather systems develop and move and what characteristics define them—including cloud cover, precipitation, and barometric pressure. The mariner needs to translate this "bird's-eye view" to a "deck-level view" to forecast short-term weather at sea without outside assistance.

Creation of Weather Disturbances

The circulation of air around the planet results in the prevailing winds discussed in Chapter 18, but it also creates large, relatively stable air masses composed of horizontal layers of air whose temperature and humidity reflect the origin of the air mass. For example, an arctic air mass develops over the ice fields of the planet's poles and is characterized by cold temperatures and low humidity. Maritime tropical air masses with high temperatures and high humidity develop over tropical oceans. Although these air masses are remarkably stable and the air within them extremely homogeneous, air masses that border one another can be sharply different. These boundary zones are called fronts, and the sharp change in the weather that can accompany them is familiar to anyone who has experienced a sudden 30° drop in temperature with the passage of a cold front.

Air from one air mass gradually replaces the air from another along a front line. Almost no mixing of the two air masses occurs; rather, fronts comprise zones of transition from one air mass to another that range from 5 to 60 miles in width. The general weather picture consists of successive disturbances along these frontal zones as two conflicting air masses clash at their borders. These clashes and the fronts they create take place in three dimensions, for the exact characteristics of the horizontal layers within each air mass will differ, and their interactions across the front will also differ. This is part of the reason why weather is such a complex subject. What happens many thousands of feet above the earth's surface can be quite different from what is happening at the surface and will affect the weather experienced on the ground.

All fronts are characterized by predictable temperature changes and wind shifts. The discontinuity in temperature implies a discontinuity in density (cold air is denser, or heavier, than warm air). This further implies a discontinuity in pressure, with the colder air column exhibiting a higher atmospheric pressure at its base than the warmer air column. Differences in pressure cause the movement of air and, hence, the creation of wind. Simplistically speaking, air flows from areas of higher pressure toward areas of lower pressure.

Meteorologists capture information about relative pressure visually by plotting the observed pressure from reporting stations all over the forecasting region and then connecting points of equal pressure. The lines created by this process are called isobars and are generally plotted at intervals of 4 millibars. You can think of them as analogous to the depth contours on a nautical chart or the elevation contours on a topographic map. The resulting

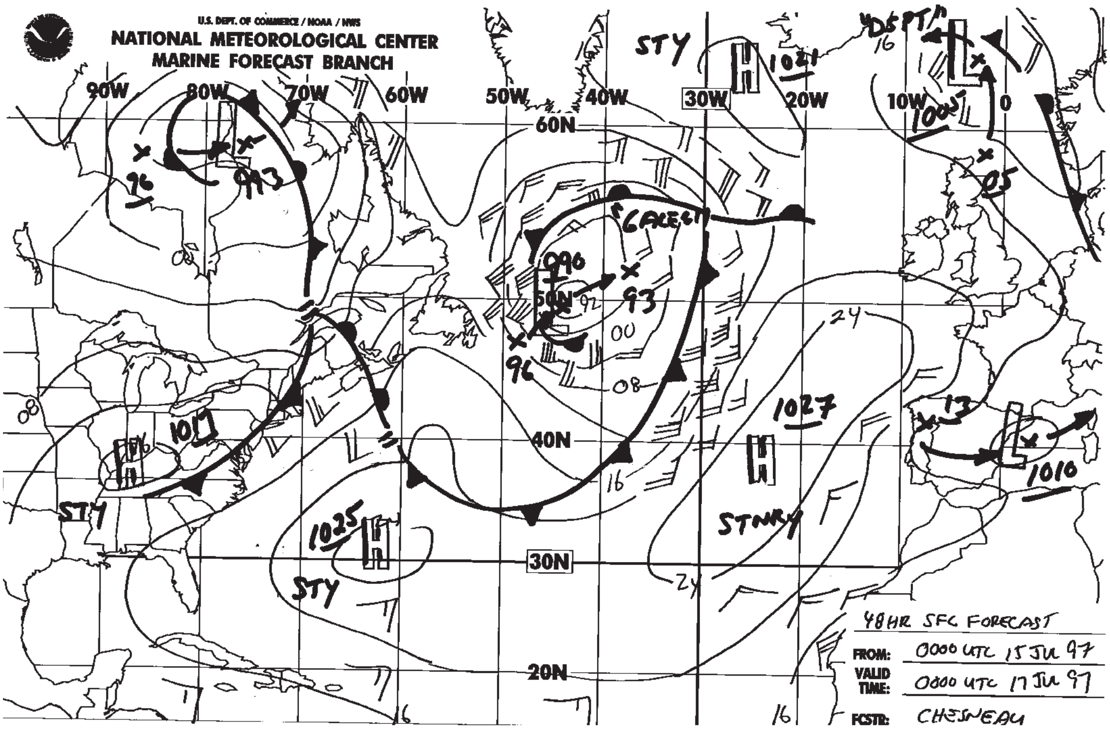


Figure 19-1.

A typical synoptic chart shows isobars, wind speeds and directions, barometric pressures, and low- and high-pressure systems. (Illustration courtesy Michael Carr of Ocean Strategies)

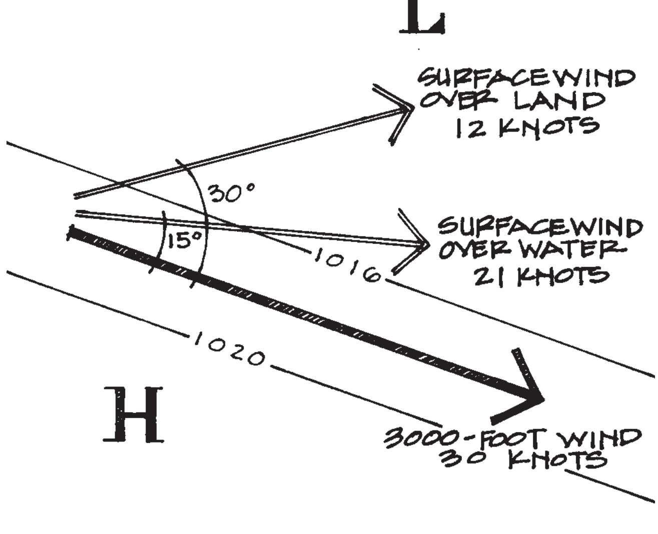
weather map is called a surface analysis chart or synoptic chart (Figure 19-1), and the Weather References section in the resources for this chapter in Appendix 1 includes some resources for learning how to read one.

There is a well-defined relationship between the isobars on a synoptic chart and the actual wind speed and direction. The closer together the isobars are, the greater the pressure gradient and the stronger the wind. Rather than blowing parallel to the isobars in a cyclonic movement from high to low pressure, the wind direction is deflected by the rotation of the earth and by friction from the ground. Over water, the wind blows at an angle of about 15 degrees to the isobars from the area of high pressure toward the area of low pressure (Figure 19-2). At ground level over land, where there is more friction, the angle increases to 30 degrees.

In a frontal system, the difference in temperature and hence pressure between the two air masses means that the isobars cannot remain parallel. A sudden shift has to take place at the front line when the air temperature changes. This is captured on a synoptic chart by the fact that the isobars in a frontal system are "kinked." Where the 1008-millibar line crosses the frontal line in Figure 19-3, the pressure must increase with the movement from warm air to cold. Indeed, if you extend that isobar in a straight line after crossing the front you will intersect the 1012-millibar line on the other side. These kinked isobars point from lower pressure to higher pressure and are accompanied by a wind shift, as shown in Figure 19-3. If you stand facing the wind before the front arrives in a Northern Hemisphere frontal system, you can expect a wind shift to the right (clockwise) on the other side of the front line. In the Southern Hemisphere, the shift will be to the left (counterclockwise).

Figure 19-2.

The amount of friction between the air and the ground changes the relationship between wind angle and wind speed to the isobars on a synoptic chart. (Lyanne Schuster illustration)



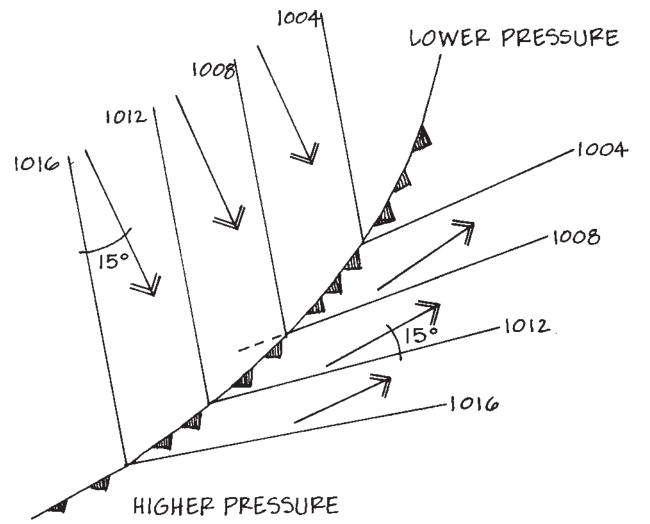


Figure 19-3.

The temperature change across a front line creates a pressure change and a wind shift. If you were standing on the right side of the illustration facing the wind, the wind would shift to the right (clockwise) when the front passed over you. (Lyanne Schuster illustration)

The earth's rotation and prevailing winds mean that these air masses and the interfaces along which they interact are not stationary relative to an observer on the ground. As can be seen on the local weather forecast any evening, they swirl across the surface of the globe. We experience the passage of a front as gusty winds and squalls, with sudden changes in temperature, pressure, and wind direction.

Under certain conditions, two air masses can have a more dynamic interaction across a front line. The fronts begin to differentiate, the pressure gradients become more pronounced, and eventually a low-pressure system is spawned. Although this process of *cyclogenesis* is not completely understood, the basic steps leading to the formation of a low-pressure system are well described. These offer many insights into what can be expected at sea when a low and its associated fronts pass over.

The process starts with a stationary front along the boundary between two air masses (as shown on Day One in Figure 19-4). Stationary fronts are the least well understood of all frontal types. Unlike other fronts, one air mass is not replacing another. Therefore, the wind blows parallel to the frontal surface, but in opposite directions on either side of the front. The weather associated with these fronts is generally mild, though clouds and light precipitation are not uncommon.

As their name implies, these fronts may not move at all, or they may oscillate back and forth over the same area many times. But they are very unstable, especially if characterized by hot, humid air on one side of the front and cool, dry air on the other side. Stationary fronts may remain in place for days on end, or they may start

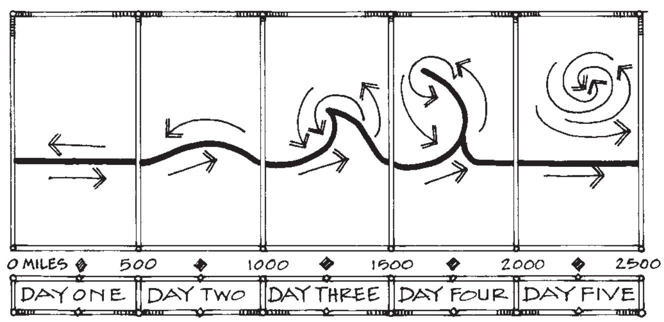


Figure 19-4.

Development of a low-pressure system in the Northern Hemisphere. (Lyanne Schuster illustration)

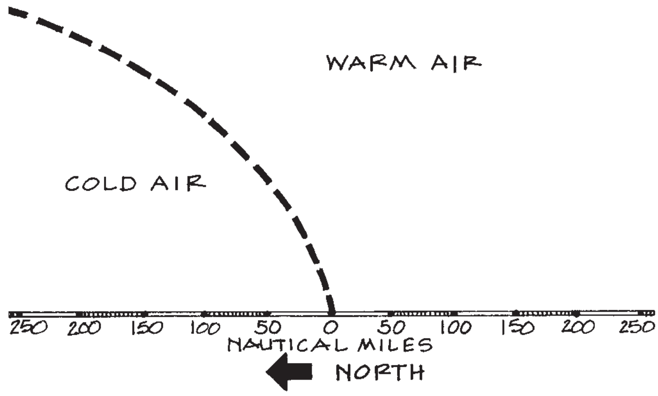


Figure 19-5.

Along a stationary front, the vertical surface of the front slopes in the direction of the cold air. The cold air mass is effectively burrowing under the warm air. (Lyanne Schuster illustration)

to change quite rapidly and create a new low-pressure system in less than a day. Forecasters watch these fronts carefully for the characteristic signs of a developing low.

In the stationary front located in the Northern Hemisphere shown in Figure 19-4, the winds consist of a cold easterly wind to the north of the front line and a warm westerly wind to the south. The vertical surface of the front line slopes in the direction of the cold air (northward) since the cold air is heavier than the warm (Figure 19-5). In essence, the cold air is burrowing under the warm. All along the surface of the front there is a strong and almost instantaneous wind shift from east to west, which is called wind shear. This causes waves to form on the frontal surface in much the same way as they do when wind blows against water. This wave action creates oscillations on the vertical surface of the front. At Day Two in Figure 19-4, a bulge has formed at ground level that is somewhat more stable than the stationary front itself.

By Day Three, the system has fundamentally altered. Air is being replaced across the frontal surface, creating two types of fronts. To the west of the kink or bulge, cold air from the north is replacing warm air to the south along a cold front. To the east of the kink, warm air from the south is replacing cold air to the north along a warm front. The wind pattern has fundamentally altered as well, and the characteristic wind shifts that normally accompany front lines have become established. At the kink where the cold front meets the warm front, an area of slightly lower pressure has developed. At this point, if the wavelength of the developing frontal wave is between 400 and 1,800 miles, the wave is unstable and will continue to steepen and grow in amplitude. The pressure gradient becomes more compressed, and the system intensifies. When a circular airflow has been established around the low-pressure kink, the winds have become cyclonic. The low-pressure area then becomes a fully formed extratropical cyclone, also known as a depression or a low. In the Northern Hemisphere, as shown in Figure 19-4, the air circulates around the low-pressure area in a counterclockwise direction; in the Southern Hemisphere circulation is clockwise.

Cold fronts and warm fronts differ in several respects, but the most critical for the next phase of development is that cold fronts always move faster than warm fronts. On Day Four, the cold front overtakes the warm front, and the warm air is forced aloft. This creates the fourth and final type of front, called an occluded front. The low-pressure area is said to be filling. Over the next 24 hours or so, the occluded front will dissipate and leave only the low-pressure area itself—a mass of whirling homogeneous air. The energy from differences in temperature and humidity that created the system has been depleted. The pressure gradient and its associated winds will dissipate fairly rapidly unless a new energy source is found, as could be the case if it travels over water that is considerably warmer than its own air. By the end of Day Five, the stationary front will have been reestablished, and the area of low-pressure and cyclonic winds will be rapidly dissipating. The entire system may have moved several thousand miles during this process.

A low-pressure system and its associated fronts, therefore, comprise an area of mixing between two air masses, an area in which differences in temperature and humidity cause a complex circulation and great instability. The opposite of this is a high-pressure system (high or anticyclone). A high is an area of generalized circulation within an air mass characterized by great stability and higher pressure relative to surrounding air. Highs are much less complex than lows, yet our understanding of exactly how they form is even more rudimentary. Generally speaking, anticyclones develop when cool, high-altitude air compresses as it sinks to the earth's surface.

For this information to be useful at sea, we need to translate this general understanding of how weather patterns form and disperse into a way to predict the next 6 to 12 hours of weather. To accomplish this, we must profile these systems in terms of barometric pressure, wind speeds and directions, associated cloud cover, and precipitation.

General Characteristics of Weather Systems

Well-developed highs and lows directly or indirectly create most of the weather experienced in the temperate latitudes. As can be seen from Figure 19-4, the forces that create a low-pressure system dictate a counterclockwise air circulation in the Northern Hemisphere. Since wind blows across the isobars at an angle of 15 degrees from high pressure to low pressure, the wind arrows on a synoptic chart would angle inward toward the low's center. In a Northern Hemisphere high, the wind angles outward from the center in a clockwise direction. In the Southern Hemisphere, wind directions are reversed: a high is characterized by counterclockwise circulation, and a low by clockwise circulation. Table 19-1 summarizes other characteristics of highs and lows.

Unlike the semipermanent lows and highs discussed in Chapter 18, low- and high-pressure systems can move at considerable speed across the surface of the earth depending on surface and upper air winds. From a stationary point on the ground, observed conditions reflect the speed and direction of movement of the entire weather pattern. Weather on the ground, then, can be viewed as a series of snapshots that must be strung together in order to identify the weather system and predict future weather.

North of about 30° north or south of 30° south, weather systems move from west to east with the prevailing high-altitude westerly winds of the jet stream. Thus, highs, lows, and fronts form a parade of weather patterns moving one after the other from west to east. Their movement will be affected by—among other things—other weather systems around them, high-altitude winds and pressure gradients, changes in temperature over the land or water, and encounters with semipermanent highs and lows.

Given their well-defined air circulation and pressure gradients, highs and lows show characteristic patterns of barometric pressure changes and wind shifts. What you observe at sea will depend on whether the high or low is passing to the north or south of you and in which hemisphere you are located. Figure 19-6 summarizes the pressure changes and wind shifts to be expected in these situations.

From the standpoint of forecasting at sea, there are several important points to be made about Figure 19-6:

- **Barometer change without wind shift.** If the barometer changes rapidly (more than a millibar an hour) without any accompanying wind shift, then the

TABLE 19-1. WEATHER CHARACTERISTICS OF HIGHS AND LOWS

Weather Characteristics	Highs	Lows
Overall weather	Generally fair—clear skies, light winds, and good weather	Stormy—dense cloud cover, strong winds, precipitation
Range of sizes	200–2,000 miles, most often in the upper half of the range	200–2,000 miles, most often in the lower third of the range
Average speed	Winter: 565 nm per day; Summer: 390 nm per day	Winter: 600 nm per day; Summer: 430 nm per day
Northern Hemisphere circulation	Downward, outward, clockwise	Upward, inward, counterclockwise
Southern Hemisphere circulation	Downward, outward, counterclockwise	Upward, inward, clockwise
Barometric pressure	High—most often a rapid rise on approach and slow fall on retreat	Low—most often a rapid fall on approach and slow rise on retreat
Winds	May be strong at outside edge, light for hundreds of miles across center	Increasingly strong as center of low approaches; may be small lull at center
Clouds	Usually only in the periphery	A wide variety over all altitudes
Temperature	Stable for long periods of time	Fluctuating; gradual warming followed by sudden change to cold
Risk to mariners	Very little; strong winds may exist in leading edge	Strong winds and high seas

center of the system is moving directly toward or away from you.

- **Similarity in conditions.** The wind direction and pressure changes in a dispersing high can resemble those in a building low. A falling barometer and a southerly wind in the Northern Hemisphere could mean that a high-pressure system is retreating (A on Figure 19-6) or that a low-pressure system is approaching (B on Figure 19-6) or both. A weather forecast or weather map offers the easiest way to distinguish between the two. Otherwise, a rapidly falling barometer and lowering and thickening clouds signal an approaching low.
- **Locating low pressure.** Based on the way the wind blows across isobars at sea, you can locate the center of a low by using Buys Ballot's Law. If you stand facing the wind with your right arm outstretched in the Northern Hemisphere, the center of the low will be about 15 degrees behind your arm. In the Southern Hemisphere, low pressure sits 15 degrees behind your outstretched left arm.
- **Remembering circulation patterns.** A simple rule of thumb will remind you which way systems rotate in each hemisphere: high-pressure systems in both hemispheres reinforce the trade winds. The trades are easterly winds, and highs interact with the trades along their southern edges in the Northern Hemisphere and their northern edges in the Southern Hemisphere. Therefore, a high rotates clockwise in the Northern Hemisphere and counterclockwise in the Southern. Lows rotate in the opposite direction in each hemisphere.
- **Crossing systems.** Unfortunately, many things can complicate the diagrams in Figure 19-6. Sailing north or south instead of east or west, you may move through an advancing low into a retreating high. *Cols*, areas of light and shifty winds between low- and high-pressure systems, and the tail ends of frontal systems at some distance from the low pressure that spawned them can also create confusing conditions at sea. The best way to resolve these issues is with a synoptic chart. If one isn't available, you cannot expect to know exactly what pattern is affecting you at all times—nor do you need to. You will know if the wind is likely to become stronger or reach gale force, which is what really matters.

As shown in Figure 19-9, low-pressure systems spawn warm and cold fronts. These can extend for many hundreds of miles from the low, and mariners can experience the frontal systems associated with a low without passing through the low itself. Because the isobars are packed most tightly around the center of the low, the farther from the center of the low the frontal system is crossed, the less severe the weather will be relative to the weather in the frontal system near the low's center.

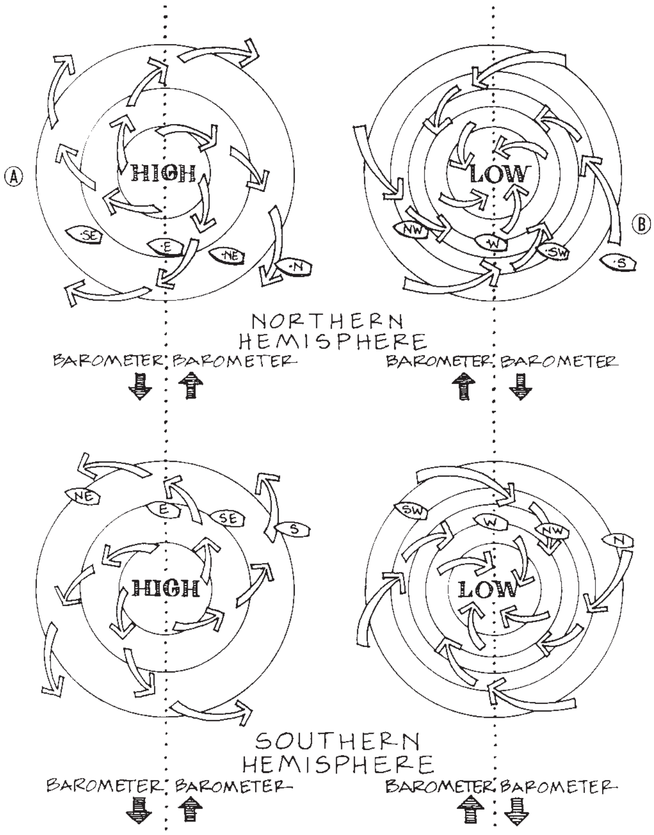


Figure 19-6.

By understanding wind shifts in conjunction with barometric pressure changes, you can predict what wind shift you will experience in the next 24 hours. (Lyanne Schuster illustrations)

Even more so than highs and lows, distinct changes in the major weather indicators mark a frontal system as it approaches, passes over, and then retreats. These weather characteristics are summarized in Table 19-2 for warm fronts and cold fronts.

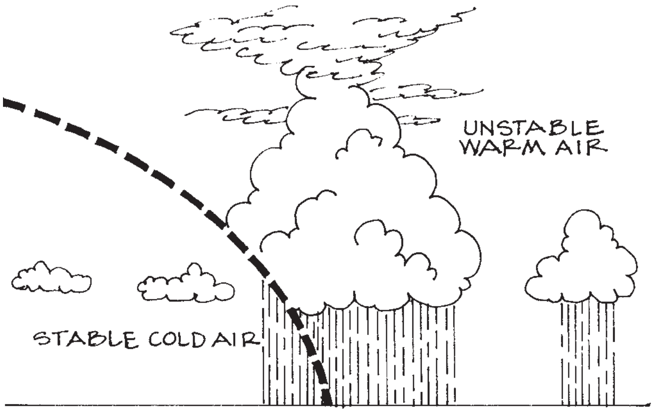
Cold fronts are characterized by a very short zone of transition, which makes them more dynamic and volatile than warm fronts. Along the leading edge, where cold air is replacing warm, the warm air is forced to rise. If the warm air is unstable, it will condense and create a band of squalls and thundershowers within 50 to 100 miles of the leading edge of the front line (Figure 19-7). Even if the warm air is fairly stable, some shower and squall activity will occur right at the front line where the warm air is being forced upward.

In certain conditions, dangerous line squalls can precede the passage of a cold front by anywhere from a few hours to half a day. These zones of extreme instability form infrequently, only when the winds above the cold frontal surface are moving in the same direction but at a faster speed than the cold front itself. This cold air prevents the warm air from rising in advance of the front and traps the layer of warm, unstable air between the two cold air layers. A band of violent weather oriented parallel to the cold front and moving eastward at about the same speed develops. This band is characterized by extreme gustiness and torrential downpours. These line squalls appear as rapidly advancing bands of boiling black clouds on the horizon.

In a warm front, warm air replaces cold. Since warm air is less dense, the colder air must be receding. The warm air ascends over the top of the receding cold air

TABLE 19-2. WEATHER CHARACTERISTICS OF WARM FRONTS AND COLD FRONTS

Weather Characteristics	Warm Fronts	Cold Fronts
Clouds	Lowering and thickening over course of 24–48 hours before front, lifting rapidly after, clearing more slowly	Lowering and thickening within a few hours before front, clearing quickly afterward
Overall weather	Heavy precipitation preceding front, light drizzle or fine rain after	Heavy rain, thunder, and squalls at front line, clearing quickly after front line
Winds	Increasing before, sudden shift at front line, steady after	Increasing and squally before, sudden shift and squally at front line, gusty after
Pressure	Steady fall, level at front line, little change after	Moderate to rapid fall, sudden rise at front line, slow rise after
Temperature	Slow, steady rise throughout	Sudden drop at front line
Average speed	Winter: 360 nm per day; Summer: slower	Winter: 600 nm per day; Summer: slower
Risk to mariners	If warm air is unstable, thunderstorms may develop along front line	Extremely dangerous line squalls can develop 50–300 miles in advance of cold front



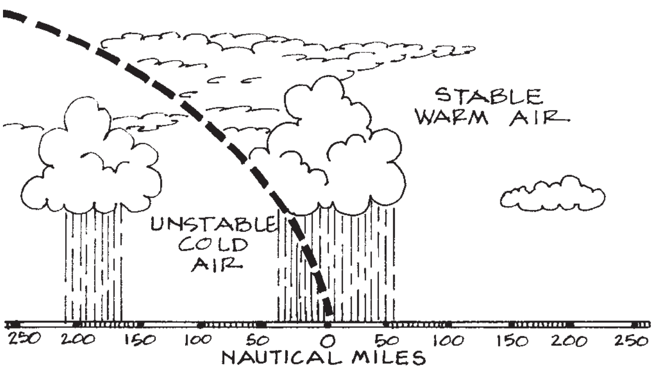


Figure 19-7.
In a cold front, the frontal system is relatively narrow, with clouds building only 100 miles or so in front of the line. (Lyanne Schuster illustrations)

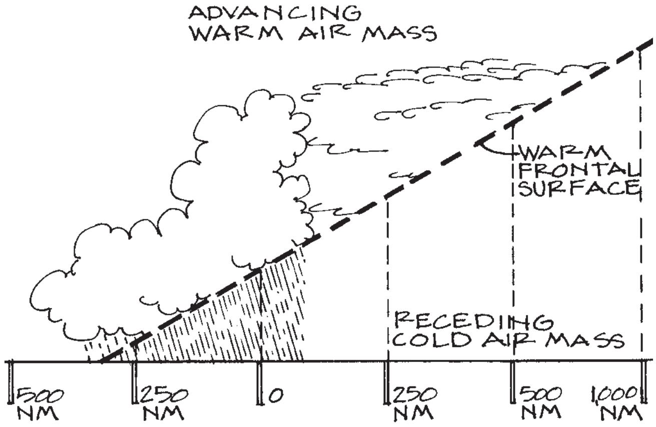


Figure 19-8.
In a warm front, the first clouds may be sighted up to two days before the system arrives. (Lyanne Schuster illustration)

mass, and the interaction between the two creates an extensive cloud system that extends up to 1,200 nautical miles in front of the front line. This translates into a much broader zone of transition, so the entire system is considerably less violent than in the case of the cold front. The cloud system and associated precipitation are illustrated in Figure 19-8. High-level clouds that lower and thicken gradually announce an approaching warm front as much as two days prior to its arrival. During that time, you will experience several days of cloudy, wet weather and breezy conditions. Thunderstorms in the vicinity of the front line pose the most serious hazard from a warm front.

As discussed above, air is not being replaced across a stationary front. Such fronts are characterized by clouds and light precipitation reminiscent of a warm front, but milder. Stationary fronts pose little danger to the mariner as long as they remain stationary, but they can become a hazard if a low-pressure system develops suddenly along the front line. This is one situation where you may well be in the low-pressure system before you receive the gale warning.

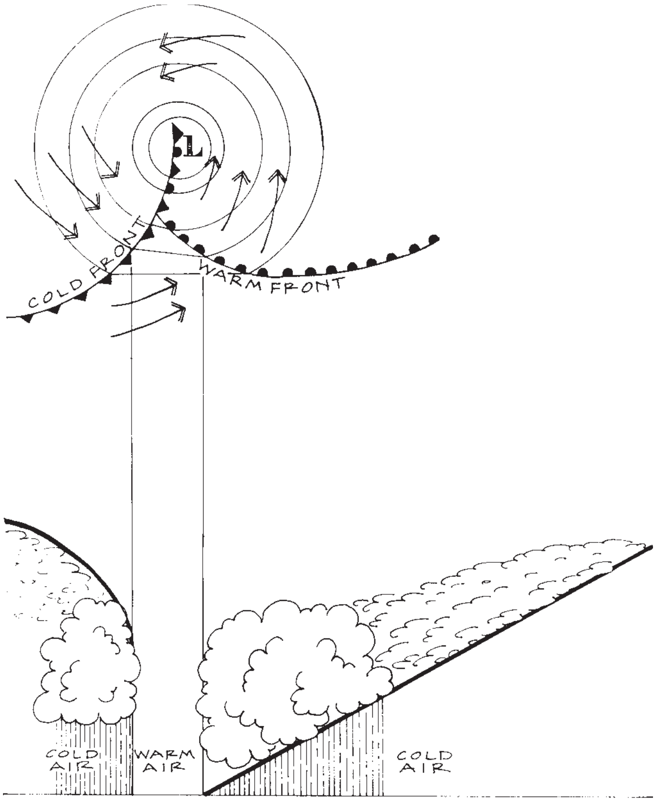


Figure 19-9.
Passing through the frontal systems associated with a low results in a complex but predictable series of weather changes. (Lyanne Schuster illustration)

An occluded front results when a cold front overtakes a warm front, and the warm air is forced aloft. Occluded fronts are highly unstable, since the warm air and cold air fight for position within the front line. They are characterized by precipitation on both sides of the front and by a broad band of clouds like those associated with warm fronts. An occluded front will look and act much like an unusually violent warm front when approaching and

TWO WEATHER PHENOMENA TO WATCH FOR

Two weather phenomena can create very strong winds without following the normal patterns illustrated by the figures and charts in this chapter. These are referred to as meteorological bombs and squash zones.

Meteorological bombs are low-pressure systems that deepen by 1 millibar per hour or more for a period of at least 24 hours in a process known as explosive cyclogenesis. These typically occur in the temperate latitudes during the winter months and result in what meteorologists refer to as hurricane-force (HF) cyclones. These systems occasionally enter the subtropics in the late fall or early spring.

On average, more than twenty HF cyclones per year have been detected in the North Atlantic and North Pacific during each winter season since 2001, with improved detection resulting in more being identified each year (see the Weather References section in the resources for this chapter in Appendix 1). As the name implies, winds often exceed 60 knots, and we have met people who have experienced winds of up to 100 knots in these small, compact, fast-moving systems. Luckily, these conditions do not last long, almost always less than 24 hours and often less than 12. The HF conditions tend to occur within approximately 400 miles poleward of the cyclone center in the region of cold air behind an occluded front. In the 2004–2005 winter season in the North Atlantic and North Pacific, well less than half of the HF cyclones that occurred were forecast 48 hours in advance by NOAA. Although infrared satellite imagery and 500-millibar (upper-atmosphere) charts can provide some warning with expert reading, by far the best way to avoid these dangerous storms is to stay out of the temperate and high latitudes during the winter months.

Squash zones occur where a low-pressure system gets forced up against a stationary high, reinforcing the winds where the edges of the systems overlap. If your course is taking you parallel to the isobars between a high and a low that are locked in place and all but stationary, you may experience gale-force winds under a clear sky with no change in the barometer for days. In the tropics, another type of squash zone occurs when high-pressure systems in the temperate latitudes interact with the trade winds to create "reinforced trades" (see the Weather Disturbances within the Tropics section below).

Squash zones rarely bring storm-force winds and can provide fast—though sometimes uncomfortable—sailing as long as you are heading downwind. In the temperate latitudes, they can be detected most easily on 500-millibar charts as a split in the upper-level flow where a trough of low pressure is riding over a stationary ridge of high pressure. But whenever you pass between a low-pressure system and a strong, stationary high, be on the lookout for tightly packed isobars in the area between the two and expect strong winds.

In the Queen's Birthday Storm in June 1994, a cruising rally en route to Tonga from New Zealand got caught by a meteorological bomb traveling southeast out of the tropics that slammed up against a strong, stationary high over New Zealand, combining these two potentially dangerous weather disturbances into a superstorm. The resulting winds were recorded at up to 90 knots, and the highest seas measured 100 feet. Sixteen crews set off EPIRBs, twenty-one people were rescued, but seven boats and three lives were lost. The low-pressure system was first detected at noon local time on Friday, June 3, and within 24 hours winds had reached storm force without a gale warning being issued. Storm-force winds continued for more than 48 hours. Fortunately, these two phenomena rarely occur together. Unfortunately, both phenomena are almost impossible to forecast from deck level and remain difficult to forecast even by professionals.

passing over, but the temperature drop and rapid clearing afterward will resemble a cold front.

You will encounter just about every type of weather when passing through the frontal systems associated with a low. The weather changes reflect the passage of the warm and cold front, reinforced by the low-pressure system (Figure 19-9). Passage through the nonfrontal section of the low (the top edge in Figure 19-9) would be the same as if passing through a low without associated fronts (see Figure 19-6).

Given the characteristics of various weather systems, the forecasting horizon of 6 to 12 hours at sea should begin to make sense. With cold fronts and compact lows, the cloud formations will extend only 100 miles or so in front of the system. The forecasting horizon can stretch to 18 hours with warm fronts alone or in association with low pressure, where cloud cover extends up to 1,000 miles in front of the system. Though most sailboats will not have enough time to position themselves with respect to an approaching storm, they will have enough warning to prepare for gale conditions.

As our understanding of weather increases, the complex picture drawn over the last few pages does not get any simpler. While outside forecasting tools will provide an answer to the question "What's going to happen next?" their accuracy will be much greater if you can interpret the language of wind, water, and sky to understand what's happening *now* and to place yourself accurately on a weather chart.

Deck-Level Forecasting in Temperate and High Latitudes

So how do you turn all this information into useful short-term forecasts at sea? You need to combine good observation with cautious interpretation. Be aware of the small signals you receive from the surrounding elements. You will be amazed at the variety of faces the sea can wear—the seemingly infinite combinations of wind, cloud, wave, and sky that make each passage day different in character and mood from the one before. These small differences inform the practiced observer. Taken together, they greatly increase your ability to accurately interpret a forecast received by short-wave radio or weather fax.

But these signs must be interpreted with care. As the Greek poet Aratus wrote 2,300 years ago in *On Weather Signs*, "It is a good rule to look for sign confirming sign. When two point the same way, forecast with hope. When three point the same way, forecast with confidence."

When forecasting at sea, you want to identify signs that indicate a change in the weather. Most of the time, you will be experiencing fine weather, and you will want to know if the good weather will continue or deteriorate. If bad weather is on the way, you will want to know exactly what type of weather to expect and how much preparation is required. If you are in bad weather, you will want to know how much longer it will last and when you will be able to make sail once again.

Table 19-3 summarizes the signs of continuing stable weather and the early signs of approaching change seen 24 to 48 hours ahead of an actual deterioration. Most signs of a change indicate an approaching warm front or low, since these give you more warning than an approaching cold front. Find three or more signs that point to the same change, and you can forecast with confidence.

TABLE 19-3. INDICATORS OF CONTINUING GOOD WEATHER OR A POSSIBLE CHANGE IN TEMPERATE LATITUDES

Indicators	Continuing Good Weather	Possible Change
Barometer	Steady, rising slowly	Falling slowly
Clouds	Clear sky or a few puffy cumulus clouds Very thin high clouds that seem to evaporate High clouds without cohesion—wild, torn look Soft, delicate-looking clouds	High clouds in long, harsh streaks (mare's tails) Sky covered with whitish film Clouds with sharp edges or blown-off tops Clouds moving in different directions at different heights
Temperature	Stable Heavy dew or frost at night	Rises or falls markedly Humidity increases
Sea state	Settled Swell and waves from same direction	Confused Swell not from same direction as waves
Wind speed	Generally steady, slight rise and fall over course of day Very slowly increasing or decreasing	Strong winds in early morning Dying away completely for 6–12 hours
Skies	Sky is clear and light blue to dark blue Moon shines brightly Jet contrail disappears immediately or not visible at all	Sky becomes hazy Large halo circling moon or sun Jet contrail lingers thickly before falling apart
Sunset	Setting sun looks like a "ball of fire" Sun sets on a clear horizon Green flash	Setting sun is purplish or bruised looking Sun sets into cloud bank that obscures the horizon Bright yellow or pale yellow sunset
Sunrise	Gray sky at dawn Sun rises from clear horizon	Red, yellow, or bruised-looking sky at sunrise Sun not visible until high above horizon because of cloud cover

TABLE 19-4. INDICATORS OF APPROACHING WEATHER SYSTEMS			
Indicators	**Low-Pressure System**	**Warm Front**	**Cold Front**
Barometer	3+ mb fall in 3 hours when barometer below 1005 mb	Slow but steady fall	Moderate to rapid fall
Clouds	Clouds lower and thicken gradually	Clouds lower and thicken over the course of 24–48 hours	Clouds appear, lower, and thicken within a few hours
Temperature	Slow fall	Slow rise	Unchanged
Winds	Increasing steadily and shifting (see Figure 19-6)	Increasing steadily without shifting	Increasing and becoming squally without shifting
Sea state	Large swell with decreasing period		

Clouds provide a wealth of information to the experienced mariner, but they can be terribly confusing to the neophyte. It helps to remember these basic rules: low, puffy clouds moving with the prevailing wind indicate stable conditions; high, flat clouds moving rapidly or in a direction contrary to the prevailing wind signal a change in the higher altitude winds, which will eventually bring a change in the weather. If those clouds lower and thicken over a 6- to 12-hour period, get ready for a blow.

Given several signs of an impending change, you will want to know exactly what is coming. Over the next 12 hours, the indicators in Table 19-4 will help you identify the approaching system and judge its severity.

The barometer provides useful information on the passage of major systems, but much of the accepted wisdom about barometric pressure changes fails to hold up in the real world. The What the Barometer *Really* Tells You sidebar below provides insights into how best to use this valuable forecasting tool at sea.

On the frontal side of a low, early indicators can be difficult to distinguish from a warm front. A steady drop in the barometer indicates that the front is likely to be accompanied by a low. A cold front's narrow zone of transition makes it the most difficult to forecast. You will get only a few hours' notice from changes in the cloud cover and very little help from the barometer until the system actually arrives. The dangerous line squalls that can precede a cold front cannot be forecast with any certainty.

If you see a large swell whose crests are gradually getting closer together moving at an angle to the prevailing wind, a very large system is approaching, and you need to be fully prepared. Such a swell may reach you 48 hours in advance of the depression and can be an excellent warning sign. With smaller systems, you won't notice the swell until the system is closer, and it will take several hours to determine if the period is increasing or decreasing. If it is increasing, breathe a sigh of relief. You managed to avoid a major storm front.

Once you are in the midst of gale-force winds and heavy seas, your only concern will be when you can expect the weather to improve. Generally speaking, the faster the system develops, the more intense it will be, and the more quickly it will dissipate. An old saying captures this concept: "Long foretold, long past; short warning, soon past."

Table 19-5 summarizes the major indicators that relief is in sight. When a storm system first shows signs of moving off, you are actually at your most vulnerable. You are ready for the storm to be over and glad of any decrease in wind speed, yet a lull in a storm with a period of diminished winds is often followed by a resumption of the gale in all its fury (see the What the Barometer *Really* Tells You sidebar below). Be cautious about putting up sail if the barometer has not yet begun to rise. If necessary, use the motor to steady the boat in the waves and recharge the batteries until the barometer is rising at a slow but steady rate.

TABLE 19-5. INDICATORS THAT WEATHER IS IMPROVING			
Indicators	**Low-Pressure System**	**Warm Front**	**Cold Front**
Barometer	Levels off, then starts to rise	Levels off	Sudden rise in pressure
Clouds	Clouds lift gradually	Clouds lift gradually	Clouds lift rapidly
Temperature	Steady	Slow rise	Sudden drop followed by slower drop
Winds	Decreasing steadily	Steady to decreasing	Gusty, no longer squally

TABLE 19-6. WEATHER PROVERBS

Weather Sayings	Explanation
"Quick rise after low foretells a stronger blow," and *"When rise begins after low, squalls expect after a blow."*	A rapidly rising barometer does not indicate fair weather. Only when the rise has slowed can you expect the weather to moderate.
"Mackerel skies and mare's tails, make lofty ships carry small sails," and *"If clouds look as though scratched by a hen, get ready to reef your topsails then."*	These two sayings both refer to well-organized, coherent high clouds that mark the leading edge of a warm front or a low. If the clouds are disorganized, soft looking, and not oriented in the same direction, the weather will continue fair.
"When clouds appear like rocks and towers, the earth's refreshed by frequent showers."	A developed thunderhead looks like a tower, and the surrounding clouds at the base are often rounded like rocks.
"If the rain's before the wind, then your sheets and halyards tend. If the wind's before the rain, all will soon be fine again."	This applies to both squalls and lows. In a low, the rain will reach you first on the leading edge of the warm front with the body of the low still behind it. If the wind reaches you first, it is probably caused by the depression. Rain will come with the cold front, signaling the low's passage. For a squall, this saying predicts with great accuracy whether you need to reef.
"Rainbow to windward, foul fall the day. Rainbow to leeward, rain runs away."	This saying is used to predict if a nearby squall will rain on you. It assumes squalls are moving with the prevailing wind, which is not always the case.

Some of the old weather proverbs will help you remember certain weather signs. These sayings describe only one sign, so don't trust them implicitly. Look for a couple of other indicators that point in the same direction. Table 19-6 contains a number of proverbs that work equally well in both hemispheres.

Tropical Latitudes

Most of the time, the weather in the tropics lacks the dynamism found in the temperate and high latitudes. No borders exist between large air masses of different temperatures and humidity, so fronts are generally not found within the tropical latitudes. No constant parade of highs and lows marches steadily eastward. Yet the tropics spawn the most violent and destructive storms known to mankind—hurricanes, or tropical cyclones. The endless cycle of energy in the higher latitudes seems to get compressed into a few spectacular displays of nature's strength in the tropical latitudes.

Much more than in the higher latitudes, global air circulation dictates tropical winds. Yet "weather" still occurs in the form of disturbances that enter the tropics from the higher latitudes and in the interactions between the northeast and southeast trade winds. Although tropical weather should be more straightforward than higher-latitude weather, less time has been spent studying it, and many questions remain unresolved. From a sailor's perspective, wind speeds are more moderate and more consistent in direction than in the higher latitudes. This makes sailing more manageable and weather forecasting more straightforward most of the time.

Weather Disturbances within the Tropics

Systems from outside the tropics occasionally influence tropical weather. Frontal systems and even an occasional low from the temperate latitudes may invade the tropics from time to time, and high-pressure systems may interact with the trade winds to create "reinforced trades" with winds in excess of 30 knots for many days. Aside from tropical revolving storms, there are two types of weather disturbances peculiar to the tropics: the Intertropical Convergence Zone (ITCZ) and tropical waves. The latter, also known as easterly waves, spawn tropical cyclones when conditions are favorable.

Following are descriptions and characteristics of these weather disturbances:

- **ITCZ.** As discussed in the Prevailing Winds section in Chapter 18, the area where the northeast trades meet the southeast trades along the equator is called the ITCZ, or the doldrums. The movements of the ITCZ create tropical rainy and dry seasons that replace the four seasons of the temperate latitudes. The ITCZ migrates north and south over the course of the year, lagging behind the seasonal movements of the sun by about two months. Many areas in the tropics experience two rainy seasons as the ITCZ migrates over them, and two dry seasons after it has passed.

  The ITCZ is associated with the formation of tropical cyclones, so cruising seasons dictate that voyagers will be in the opposite hemisphere from the ITCZ most of the time. When the ITCZ is located near trade wind routes, as is often the case early in the trade wind season near the Canaries

WHAT THE BAROMETER *REALLY* TELLS YOU

There are several "rules" about how to use the barometer to predict weather, yet during our circumnavigation aboard *Silk*, these rarely seemed to work in practice. While we were ashore building *Hawk*, we decided to test these rules scientifically. To do that, we downloaded data from the National Data Buoy Center (NDBC) website (see the Weather Websites section in the resources for this chapter in Appendix 1). We ended up with a total of over three years' worth of hourly data from four different weather buoys, two located on the U.S. East Coast and two on the West Coast, as described in the Offshore Sailing Conditions section in Chapter 5.

When I read weather books before we left, words like "veer," "back," "build," and "diminish" left me picturing gradual changes over periods of several hours or days. But the twenty periods of gale- or storm-force wind in the buoy data showed that frontal boundaries bring with them abrupt changes in wind speed and direction, temperature, and pressure. The pressure jumps up in huge leaps, the wind swings through 180 degrees and climbs 30 knots in minutes, and even the temperature can rise or fall by 30° or 40° in a surprisingly short time.

From these data we derived three "lessons learned" with respect to forecasting with the barometer, all of which I found counterintuitive. Yet we have seen these lessons confirmed again and again, in dozens of gales we have sat through at anchor and the few we've encountered at sea.

1. **The most dangerous conditions generally occur on the rise of the barometer, not on the fall.** The buoy data showed that wind speeds and wave heights were anywhere from 10 to 30 percent higher when the barometer began rising after the passage of the center of a low-pressure system than they were when the barometer was falling. When pressure stops dropping, the barometer often levels out for anywhere from a few hours to a half a day. During this period, the wind may drop or die away completely, though large seas remain, and too little sail area can leave a boat vulnerable to being rolled. An almost instantaneous wind shift accompanies the first uptick of the barometer, and in most cases, the wind returns to gale or storm force within a few hours. The sudden change in wind direction and its opposition to the waves already running cause the waves to build much more quickly than normal, and confused seas with large breaking waves can result.
2. **Wind shifts help predict the severity of weather on the rising barometer.** Given that the most dangerous period in most gales occurs in the first few hours of the rising barometer, we would like to know how severe the winds might be on the rise before we're in the midst of them. The buoy data show that wind shifts experienced around the time the barometer begins to rise help predict how strong the winds will be on the rise.

   We have learned to pay careful attention to the wind shifts when the barometer bottoms out. A sudden shift through 90 degrees or more (from southwest to northwest in less than 10 minutes) around the point when the barometer reaches its nadir almost always indicates a rise symmetrical to the fall, with winds equal to or greater than those already experienced. A more gradual series of wind shifts (southwest to west to northwest over the course of several hours) suggests we will experience gale-force winds on the rise, though there may be a delay of as much as 12 hours before they arrive. Even more changes in wind direction suggest the barometer will rise slowly and there is a reasonable chance that gale-force winds have ended.
3. **Traditional rules don't do well at forecasting gales.** The standard rule of thumb—that a drop of 3 millibars in 3 hours precedes gale-force winds—proves the exception rather than the rule when examined in the context of the buoy data. In the real world, this rule regularly fails in one of three ways.

   First, the rule results in far too many "false positives" in the data by predicting literally hundreds of gales that never materialize. Adding the stipulation that the barometer falls below 1005 millibars during the 3-hour period reduces the number of false predictions to 23. Gale-

(continued on next page)

force winds actually followed a drop of 3 millibars in 3 hours when the barometer fell below 1005 millibars about half the time.

Second, gales do occur with an almost stable barometer at high barometric pressures. In several cases in the buoy data, the barometer never drops below 1015 millibars and barometric pressure barely changes, yet winds exceed gale force for a prolonged period. These "clear gales" or "squash zones" result when a low pushes up against a strong, stationary high-pressure system as described in the Two Weather Phenomena to Watch For sidebar above.

Finally, in many cases where the barometer does accurately predict a gale, the warning comes too late, after the wind has reached gale force. In general, the barometer tends to move in lockstep with the changes in wind speed, with the largest changes in pressure almost exactly mirroring the highest wind speeds.

Expecting a barometer to forecast the next 6 hours of weather based on the current trend is a bit like expecting the depth sounder to forecast whether or not the boat will be aground in the next 6 hours. The depth sounder provides a trend line—the water is shoaling or it is getting deeper—but it can't guarantee that trend will continue. On its own, the depth sounder does little more than offer a last-minute warning just before the boat goes aground. But in conjunction with an accurate chart, the depth sounder becomes incredibly useful for predicting whether or not adequate water lies ahead.

In exactly the same way, the barometer can be used to find a position along the isobars of a synoptic chart, and predictions of future weather can be made based on the boat's current position on the chart. Changes in pressure can then be used to verify whether systems are moving as forecast, and to alter the prediction as appropriate if they are not. When sailors didn't have synoptic charts, they would have been more than happy with a rule of thumb that accurately predicted a gale half the time. But using a barometer in conjunction with a synoptic chart greatly increases its usefulness.

in the Atlantic or the Marquesas in the Pacific, its position is generally reported in the high-seas forecast. The ITCZ must be crossed when moving between hemispheres, and violent squalls and severe thunderstorms often characterize its boundary with the trade winds. Good weather forecasts can help to determine its location, its width, and the severity of the weather along its edge.

- **Tropical waves.** These are the fronts of the tropics. Unlike higher-latitude fronts, they do not occur along the boundary between two air masses. Rather, these wavelike troughs of low pressure result from an oscillation in the easterly air current of the trades as it interacts with the stationary high-pressure region located in the horse latitudes. Also unlike higher-latitude fronts, tropical waves move from east to west with the trade winds.

  The air across the front is relatively homogeneous in humidity and temperature, so these waves are not characterized by pressure changes. They are characterized instead by a gradual wind shift from northeast to southeast in the Northern Hemisphere, and from southeast to northeast in the Southern Hemisphere. Clouds and bad weather often occur after the front line has passed, with rain and wind for several hours to half a day. Tropical waves become tropical cyclones when upper-level winds above and water temperatures below favor the formation of cyclonic circulation. Tropical waves occur most frequently during the tropical cyclone season, though they can occur anytime and are common in the eastern North Atlantic and South Pacific early in the trade wind season. Figure 19-10 shows a tropical surface chart prepared by the National Hurricane Center that shows two tropical waves.
- **Tropical depressions and cyclones.** These fearsome storms differ from extratropical cyclones in several ways. First, they develop out of easterly waves and not along a front line between two air masses. Second, they have a core of warm, moist air through which they draw energy from the tropical waters. Extratropical cyclones have a cold core, and they quickly die out when they become separated from the energy of the front line that spawned them. Tropical cyclones are relatively small and not accompanied by fronts. They average only 400 to 500 miles in diameter, which is half to a third the size of a well-developed extratropical cyclone, but their sustained winds can reach 120 to 150

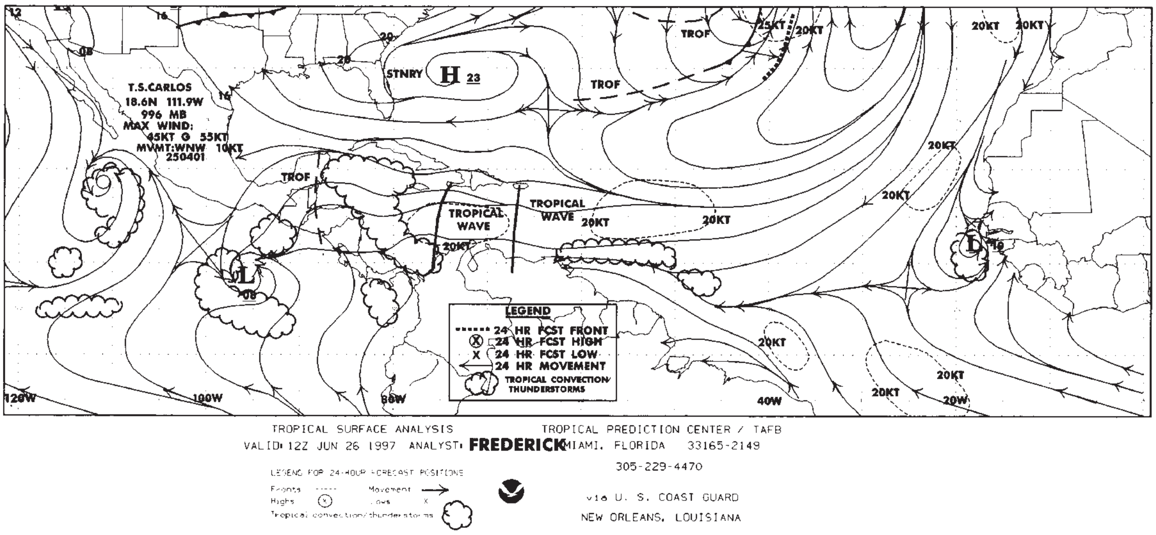


Figure 19-10.
Tropical surface analysis charts show the locations of tropical waves. (Illustration courtesy Tropical Prediction Center)

knots—more than double the wind speeds that extratropical cyclones normally attain. They often follow erratic paths, sometimes recrossing their own tracks, whereas extratropical cyclones travel from west to east. The combination of small size, changing direction, and destructive wind speeds means that tropical cyclones are often life threatening and always represent a great risk to the mariner. The only certain way to avoid them is to leave the tropics during cyclone season.

- **Frontal systems and lows.** Strong frontal systems from the temperate or high latitudes do wander into the tropics on occasion. Frontal passages in the South Pacific are marked by light winds that shift to the east or northeast and may die altogether as the front approaches. After the front line crosses your position, the wind shifts to the southwest and blows strongly for 6 to 12 hours before gradually moving back into the southeast. When the southeast winds return, they can attain gale force if a high fills in behind the front.

  On the western side of the South Pacific, the weather picture is complicated by high-pressure systems that regularly move off the hot, dry landmass of northern Australia. Between these highs, a low-pressure trough sometimes develops in the tropical latitudes above 20°S. These lows do not stay in the tropics long but tend to head southward to the temperate latitudes. Occasionally, a trough will become a low-pressure system moving from west to east through the subtropics—the area between 22.5° and 30° south. The area from Fiji to Tahiti may experience the low's northernmost edge, though generally the winds do not reach storm force. This phenomenon occurs most frequently in May and June, the beginning of the South Pacific cruising season, when boats are heading northward from New Zealand. These lows can sometimes undergo explosive cyclogenesis to become meteorological bombs, as described in the Two Weather Phenomena to Watch For sidebar above.

- **Reinforced trades.** Highs also move through the temperate or subtropical latitudes, and their flow can reinforce the trade winds to create gale-force winds that last days or even weeks. This phenomenon occurs most frequently in the middle of the winter season (July and August in the southern latitudes). A similar phenomenon creates the Caribbean Christmas winds, which generally occur between mid-December and the end of January throughout the Caribbean basin.

Deck-Level Forecasting in the Tropics

The barometer offers little assistance in forecasting in the tropics. Weather disturbances are generally not characterized by large pressure changes, and barometric pressure undergoes a diurnal variation that may be as much as 2 to 3 millibars. Weather-driven pressure changes can easily be masked by this variation.

Wind directions are also much more consistent in the tropics. An occasional front extending toward the equator from the temperate latitudes will bring a temporary shift, but in most cases the winds will be back into the eastern quarter within 6 to 12 hours. Large swells of constant period are another common feature of tropics sailing.

Without the barometer and wind shifts, you must depend on sea state and cloud conditions to forecast the next 12 hours. Table 19-3 can be used as a framework for forecasting in the tropics. In settled tropical weather, you will wake to a gray dawn that will gradually lighten to blue. When you walk the decks, you will leave footprints in the dew. By noon, puffy cumulus clouds will wander by overhead against a dark blue sky. The sun will drop into the sea like a ball of fire (and, sometimes, with a green flash), and then the moon and stars will shine bright and clear.

You won't be faced with frontal systems often, but you will have to manage tropical squalls. A squall is essentially a downdraft created by cooling air rising off a tropical sea. The result is increased wind ahead of and under the cloud (and diminished wind behind). Squalls build during periods of increasing temperature during the afternoon as pockets of warm air rise through the cooler air above. Eventually, the air mass will have cooled enough to begin falling, creating a downdraft. In the evening, when the temperature drops, the process accelerates, creating more substantial downdrafts. The biggest squalls are therefore the oldest ones—those collapsing last. For that reason, the worst squalls often happen late at night. Earlier in the evening there will be more frequent squalls, but they will be less potent.

Since the upper-level air doesn't always move in the same direction as the surface winds, squalls sometimes move at an angle to the prevailing wind, and they quite often bring a wind shift. Although the direction of shift will not be predictable from day to day, all squalls on a given day will tend to shift the wind in a consistent direction. Most big squalls will increase the wind speed by 10 to 15 knots, which means life can get pretty exciting if the trades are blowing at 25 or 30 knots.

The best way to judge the severity of a squall is by its height—the taller the cloud, the bigger the downdraft. This technique works well at night, as you watch stars disappear behind the cloud. On a really squally night the seas often get quite confused due to the frequent wind shifts. The waves often travel with the squall for some time, which creates a long effective fetch. The wind and seas usually arrive together, so watching the waves under the leading edge of squalls can tell you about the wind.

Following are some useful tips for managing squalls:

- **Rain versus wind.** The saying about rain before wind in Table 19-6 applies equally to squalls. If the rain hits first, the wind, when it comes, will be strong. But if the wind increases before the rain arrives, the rain heralds the end of the wind.
- **Reading the rain.** If the black wisps under the squall that mark the rainfall are straight down, there is little wind within the squall. If they are swept off to one side, beware!
- **Reading the water.** If the water underneath the squall looks like fog or smoke, expect a heavy downpour and a great deal of wind. If the water looks white and churned up, then there is a hard rain without too much wind. If the water turns a darker color than the water in front of the squall, the squall carries a lot of wind and little rain.
- **Reading direction.** You can be quite certain that a squall is going to hit you when a black cloud band arches from it to you. Measure the gap between the cloud and the top of the mast with your fingers and see if the distance decreases. If so, the squall is "lifting its skirts," and you will soon be under them.
- **Feeling the temperature.** Finally, if the temperature drops suddenly when a squall is visible on the horizon, you can be fairly certain you will rendezvous with it. Get out the soap!

If you see a black band of billowing clouds across the entire horizon, reef down and prepare for a violent encounter. Though line squalls are unusual in the tropics, they can happen.

There are also some false squall signs that can be confusing. When cloud bands cross the sky, they sometimes look as if they converge at the horizon. This is a trick of perspective; the cloud bands are actually parallel. The convergence can make it appear as if a large mass of clouds lies on the horizon, which can easily be mistaken for an approaching squall. If the clouds ahead appear to part as you approach, or if the cloud mass on the horizon is white and fluffy without darker areas, the chances of squall activity are slight.

When the sun rises behind one of these cloud masses, the backlighting can make the clouds look black, and a massive line squall appears to be approaching. Although squall activity is not unusual in the first few hours after the sun rises in the tropics, the squalls will stand out as separate dark clouds close to the boat when the sun comes up. If there are fluffy cumulus clouds overhead but no clearly developed squalls, most likely the cloud bank on the horizon will turn white as the sun climbs into the sky.

Weather forecasting in the tropics is more straightforward than in the higher latitudes, but you will still find yourself making plenty of sail changes in squalls and wind shifts.

ONBOARD WEATHER RESOURCES

In the last decade, the amount and quality of weather information available has increased radically, along with the ways to communicate it to a sailboat underway. But these systems are not essential aboard an offshore boat. Aboard *Silk*, we learned deck-level forecasting and became fairly good at predicting the next 6 to 12 hours of weather. Those with limited resources can still do the same, and they will not often be in worse weather than those with sophisticated systems aboard.

During our seven-year, high-latitude voyage aboard our Van de Stadt Samoa 47, *Hawk*, we have made use of just about every source of weather information available to a crew on a boat at sea. But making the best use of this wealth of information takes practice, a good general knowledge of weather, and an understanding of the strengths and shortcomings of each weather source. To make the best decisions aboard, we have learned not to rely on one source of weather information. Instead, we combine several sources of data with our own deck-level forecasting to come up with a general weather picture and determine our optimal routing.

We currently use five external sources of weather information (see Table 19-7). Four can be accessed through a high-frequency radio transceiver; of these, three are virtually free. Combining these sources gives us a much better map of the weather systems and their likely movement than we could get from any one source. We then use our own observations of true wind direction, cloud cover, and barometric pressure to determine where the boat actually is positioned on that weather map and predict what weather we will actually experience in the next 12 to 24 hours.

Weather Fax

Most countries disseminate various types of weather information by weather fax several times per day. These include synoptic charts and satellite images as well as 12- and 24-hour prognoses (with some providing prognoses up to five days). These can be received via a dedicated weather fax machine or through a high-frequency radio receiver attached to a laptop computer via a sound cable. The laptop must be loaded with a software program to read the charts (see the Weather-Related Software section in the resources for this chapter in Appendix 1). Once

TABLE 19-7. COMPARISON OF ONBOARD WEATHER RESOURCES

Type	Hardware Required	Cost per Forecast	Pros	Cons
SSB/weather fax	• High-frequency radio receiver, fax software, and a laptop computer, OR dedicated fax receiver and thermal paper	• Weather faxes free, multiple types available at least once each day	• Can get forecasts for periods of up to 5 days • Wide range of information available, including satellite pictures, synoptic charts, and prognoses	• Propagation unreliable, but transmitters tend to be more powerful than for ham nets • Available only on a schedule; have to download multiple faxes to get long-range prognoses
Ham/SSB voice nets and high-seas forecasts	• High-frequency radio receiver	• Free to listen • May be small donation to participate	• Actual weather info from boat reports • Routing suggestions	• Radio propagation unreliable • Available only on a schedule • Quality of forecast and advice over high-seas nets varies depending on skill and experience of person generating forecasts
GRIB files or text high-seas forecasts off Internet	• Satellite phone OR high-frequency radio transceiver and modem • Laptop computer • MaxSea, RayTech, or other software to analyze GRIB files • Weather fax software or Saildocs to get high-seas text forecasts	• Free off high-frequency radio • About 6 minutes/$10 for a chart or 2 minutes/$3 for a 5-day GRIB file or text forecast over Iridium phone	• Can get 5-day forecasts from GRIBs • No propagation issues with Iridium • Complete range of information available on demand	• High-seas radio propagation unreliable • Expensive over Iridium phone • GRIB data is raw output from a computer weather model, which has not had any human quality control—requires interpretation
Inmarsat-C	• Special Inmarsat-C receiver (~$3,000) • Laptop computer	• Twice-daily text weather free in most areas	• No problems with propagation • Information of National Weather Service quality	• Relatively short outlook—12–24 hours
Shore-based weather router	• Some sort of communications equipment—laptop with SatC or satellite phone OR high-frequency radio transceiver	• Costs from $100 for a limited departure package to $1,000+ for a passage	• Typically trained meteorologists, but get résumés to make sure • Detailed, individual forecasts with good accuracy over first 24–48 hours	• Expensive • Routing advice sometimes suffers from limited experience with cruising boats • Forcast accuracy declines after 24–48 hours

WEATHER CHARTS AND THEIR USES

The outside assistance available to you at sea will be a function of the gear you choose to purchase. A wide range of weather charts offers information to the knowledgeable user. You can receive most of the following via weather fax or through an SSB connected to a laptop computer:

- **Synoptic or surface analysis chart.** As already discussed, the basic marine weather chart depicts conditions at the earth's surface (see Figure 19-1). In most areas, charts can be obtained for current conditions and for prognoses of the next 12, 24, 36, 48, and 96 hours.
- **Satellite weather images.** Satellite images may be either visible or infrared. We have all seen visible satellite images on the nightly news, with clouds swirling forward over the face of the globe (Figure 19-11). Satellite photos can also be taken with an infrared camera and color enhanced for ease of use (Figure 19-12). These images allow forecasters to analyze cloud temperature, shape, and density. Infrared data can also be used to detect warm fronts, warm airflows, tropical cyclones, and the location of a warm current such as the Gulf Stream.
- **500-millibar chart.** Although a surface analysis chart shows pressures at the earth's surface using isobars, a 500-millibar chart shows the height and temperature contours of various weather features at 500 millibars of pressure, which is roughly the level of the jet stream (Figure 19-13). Height contours are shown as continuous lines and labeled in meters above sea level. Arrows show wind direction and speed at this level. The understanding of the interaction between upper-level weather features and surface weather has been improving. From these charts, a knowledgeable user can detect the early formation of lows and determine the likely direction of movement of surface weather disturbances.
- **GRIBs.** Gridded binary files (GRIBs) can be downloaded in a surface chart that shows forecast wind speeds and directions using wind arrows. (For more on GRIBs, see the Downloadable Weather Files section below.) This looks much like a pilot chart, but the weather shown in each quadrant is the forecast weather, not the average over time (Figure 19-14). These are useful for a quick overview of wind direction and wind speed over a large sea area for the next several days. When we want to make sure nothing untoward is coming our way, we'll download ten GRIB files showing the next five days at 12-hour intervals. By flipping through them and watching how the wind arrows change, we can determine how low- and high-pressure systems are moving around us. Make sure to verify the data using one of the other onboard resources, as there has been no quality control at the source.

Figure 19-11.
A visible satellite weather image. (Courtesy Michael Carr of Ocean Strategies)

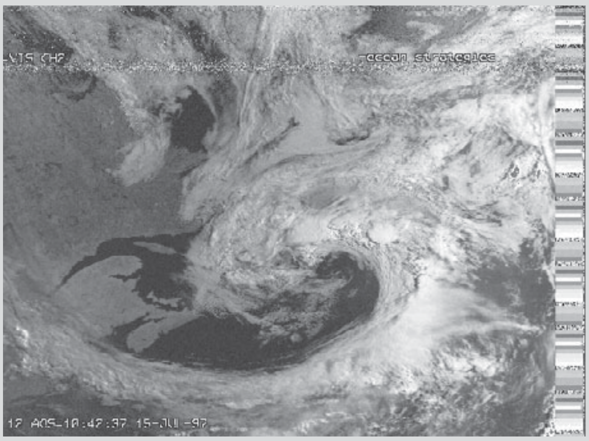
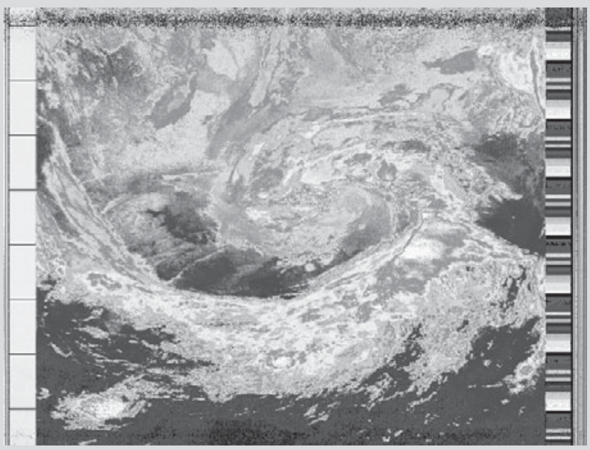


Figure 19-12.
An infrared satellite image. (Courtesy Michael Carr of Ocean Strategies)



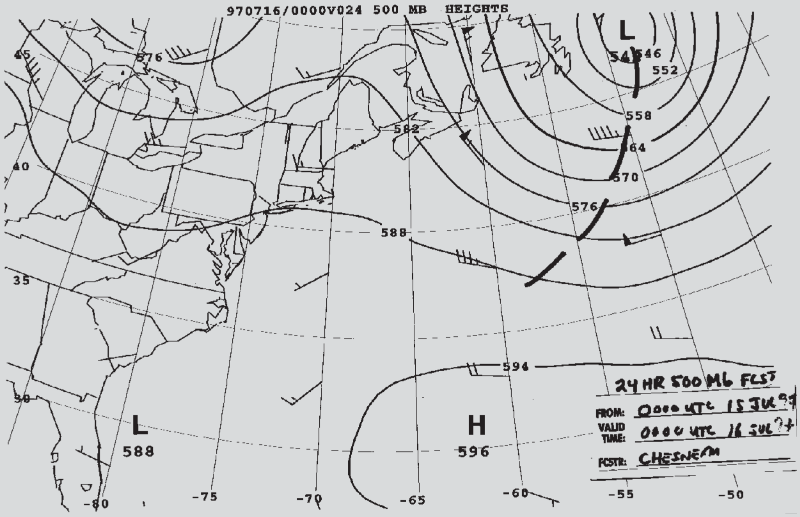


Figure 19-13.
A 500-millibar chart. (Courtesy Michael Carr of Ocean Strategies)

From a forecasting point of view, these tools provide all the elements that have been discussed in the Weather Basics Section above. The surface analysis chart provides barometric readings and wind speeds and directions. Satellite imagery provides temperature and cloud cover information. The 500-millibar chart provides information on upper-level winds, which the mariner surmises from observing cloud shapes and sky clarity.

Figure 19-14.
A wind speed and direction GRIB.

the system has been set up, faxes can be received without charge. Weather faxes provide the easiest and least expensive way to receive weather information aboard, but reception depends on radio propagation. Further, the faxes cover large areas and therefore lack resolution. Although they identify the largest systems and their movements, it can be difficult to determine the exact conditions you might experience in the next 24 hours.

When local wind and sea conditions do not correspond at all to those shown in a current synopsis, it's most often because systems have moved faster or slower than expected. By comparing our barometric pressure and its trend, as well as the wind direction and wind speed, to those shown, we can usually place ourselves against the major weather features and determine whether the systems are moving slower or faster than forecast. We can then figure out what weather we're likely to have for the next 12 to 24 hours.

High-Seas Radio Nets and Forecasts

Most countries transmit voice forecasts for offshore waters over the high-seas radio several times a day. These include a synopsis and forecast by sea area. In addition, someone in almost every ocean runs a weather net for yachts crossing that ocean. Herb Hilgenberg, better known as *South Bound II*, has for many years run such a net in the North Atlantic and often handles fifty boats or more at a time. Although the quality of the weather advice depends upon the experience and skill of the person running the net, simply listening to these nets provides a wealth of useful information. Any boat equipped with a high-frequency radio can participate. An inexpensive short-wave receiver like the Sony all-band receiver we have on *Hawk* can be used to listen in to these nets, and this represents the smallest hardware cost of any of the options for getting weather information aboard.

Typically, the net operator will open with an overall synopsis and forecast for the reporting area and will then check in with each boat, asking each one to report its current position and conditions including wind speed and direction and wave heights before issuing a localized forecast for the next 24 hours. Even if the forecast is completely off base, knowing what other vessels are actually experiencing in the area provides a heads-up if bad weather is on the way and can, in conjunction with our own conditions, help us determine the actual location of major weather features.

To help us track this, we use a piece of paper ruled with latitude and longitude lines that covers most of the reporting area. During the overview, we mark the position of the major weather features and their forecast directions and speeds. Then we mark the actual wind speeds and directions at the positions reported by the vessels checking in with the net, as well as our own wind speed and direction. If the wind speeds and directions don't correspond well with the major features in the forecast, it's often because systems have moved more quickly or more slowly than predicted, and by shifting the major features slightly we can align them with what's been reported and get a better sense of the actual situation and our likely weather over the next 24 hours. In temperate latitudes, if boats a couple hundred miles to the west of us are experiencing gale conditions, we can be reasonably certain we will be in for bad weather in the next day or so.

Using the same sheet for three or four days running, with different-colored markers, gives a good feel for the speed and direction of major weather systems. Thus, this window into the actual weather conditions around us allows us to build our own synoptic chart of the current situation and forecast what will happen over the next period, and this on many occasions has proven more accurate than downloaded weather faxes.

Inmarsat-C Forecasts

Inmarsat-C provides professionally prepared broadcasts meant for commercial traffic, similar to the Navtex forecasts available coastally. These include a synopsis of major weather features and a forecast by sea area disseminated four times daily. Inmarsat-C provides worldwide coverage independent of radio propagation. It requires an investment of about $3,000 in hardware and can be accessed only via a laptop computer; the forecasts themselves are free.

Forecasts cover the following 24 hours with a 12- to 24-hour prognosis. This is useful for deciding what sail to carry for the next watch but is less useful for determining which direction to go or what avoidance tactics to take for systems several days away. Again, by diagramming the synopsis on a piece of paper marked with latitude and longitude and tracing the situation over several days, we can gain a good feel for how systems are moving. By placing our position on this chart and taking into account our own barometric pressure and wind direction and speed, we can usually figure out where we are in relation to these systems and get a better idea of what weather we're likely to experience over the next few days.

Downloadable Weather Files

With the advent of high-seas communications systems capable of carrying e-mail offshore (see the High-Seas Communications section in Chapter 8), it has become possible to download weather information from the Internet. Boats not equipped with Inmarsat-C can download marine text forecasts directly from NOAA or via e-mail request through Saildocs (see the Weather-Related Software section in the resources for this chapter in Appendix 1). In addition, most sailors download the gridded binary files better known as GRIBs.

These special-request files are obtained by accessing NOAA weather databases to retrieve information tailored to the user. They offer almost unlimited flexibility in selecting weather information, with the user specifying the reporting area, the type of information required, and the forecast period. The information that can be downloaded includes wind speeds and directions displayed as wind arrows, surface pressure, 500-millibar charts, and wave heights for up to fifteen days ahead (though accuracy declines markedly after the first 24 to 48 hours). To download them on a boat requires some way to access the Internet, a laptop computer, and software to read the GRIB files.

GRIB files can be downloaded from several different sites on the Internet (see the Weather-Related Software section in the resources for this chapter in Appendix 1), each of which includes an explanation of how GRIB files work and how to access them through that site, and provides software for reading the files once downloaded. Most cruisers use their high-frequency radio and a Pactor modem to access GRIBs from one of the providers. We use a satellite phone to download GRIBs and read them using MaxSea software. While downloading each GRIB costs nothing more than the phone or radio time, there may be a small annual fee for accessing the sites to download the files.

The ease and convenience of downloading GRIB files makes them popular on cruising boats. With weather faxes you have to be ready to download on someone else's schedule, and you will need to download several faxes to get prognoses for different time periods. GRIBs are available on demand. You can choose to download them for as many periods as you wish and for whichever part of the ocean you designate. For this reason, GRIBs have become the preferred method on most boats for obtaining long-range forecasts.

GRIB files are raw data plucked from NOAA databases without human intervention. They are not quality controlled, and they require interpretation by the user. They may not show compact systems such as meteorological bombs and tropical depressions because these systems can be smaller than the GRIB resolution. Further, they don't show local land influences on the weather. As a result, we have found them much more useful in the open ocean than when coastal cruising. Even at sea, their accuracy varies, as does that of any forecasting tool, and we have learned to be skeptical of anything they show beyond 24 hours. On the other hand, they have often given us several days' warning of large, well-established, intense high- and low-pressure systems, allowing us to maneuver as these approached.

Weather Routers

Professional weather routers provide tailored forecasts including recommendations on which way to go to avoid bad weather or find good winds. This service comes at a price—from $100 to $1,000 or more for a passage—and most weather routers have built a business serving racing crews willing to pay for any edge to win offshore races. Given the wealth of weather information now available to the navigator while offshore, a shoreside weather router is worth paying for in two situations: if you have little experience interpreting weather data and want a second opinion, or if you are making a passage through an area with volatile weather where other sources of weather information are limited. To access a weather router, the boat needs to be equipped with some type of long-distance communication. This means voice or e-mail communications over a high-frequency transceiver or satellite phone.

Most weather routers provide a synopsis of the major weather features and forecasts of wind strength, direction, and wave height at 6-hour intervals for periods of three to five days. They will also make routing suggestions and give recommended waypoints to be reached in a specified period of time. As with GRIB files, we find that the accuracy of these forecasts generally declines rapidly after 24 to 48 hours, and we have occasionally had forecasts that fell apart after 6 or 8 hours. Also as with GRIB files, weather routers are best at picking out large, stable features that might have a big impact on our sailing, such as deep low-pressure systems or widespread areas of stable high pressure. Routers are, after all, accessing the same sources of data and the same models as the GRIB files; their added value is the interpretation they bring and the cross-checking they can do against other weather sources to give you as accurate a forecast as is available.

In our experience, getting good advice from a weather router depends upon several things:

1. **Find the right weather router.** The router should be a trained meteorologist with a proven record working with shorthanded cruising boats, not just the big racing boats whose crews will always be looking for more wind.
2. **Provide accurate estimates of your boat's performance.** The router needs to understand your boat's average speeds upwind and downwind so recommendations reflect your daily averages in

different conditions. Be realistic in making your estimates. *Hawk* is a relatively fast and capable boat, but we have to constantly remind ourselves that we sail a lot slower (particularly close hauled) when shorthanded on passage than when day sailing, because the waves are much bigger and we are much more tired.

3. **State your preferences with respect to wind speeds and directions.** We don't mind running downwind in winds of 35 or 40 knots, but we'll do almost anything to avoid going upwind into those same conditions.
4. **Be clear about what information you will find useful and ask for additional information if they are not providing it.** We always ask for the center barometric pressure of highs and lows and the pressure they expect us to see as fronts pass through. This allows us to place ourselves relative to large weather features and to know when to expect the next frontal system.

USING WEATHER INFORMATION

As discussed at the beginning of this chapter, we use this weather information in three ways: to pick the best weather window for a departure, to modify a route plan based on changing conditions, and to make sail handling decisions for the next 12 to 24 hours. Different weather sources are available to us for each of these three purposes, and the usefulness of different types of weather forecasting varies for each. More information is better, and we access as many sources as we can before leaving on passage and once underway.

Departure Window

Several weeks in advance of our proposed departure, we start paying close attention to the weather. We download weather faxes and GRIB files, and we access Internet weather sites at Internet cafés. Most countries have an excellent weather website with a full range of weather charts available. The Weather Websites section in the resources for this chapter in Appendix 1 lists a few online resources we have found particularly useful. The Picking Your Weather Window section in Chapter 20 looks in detail at how we go about picking a weather window in the tropics and temperate latitudes.

Weather routers will put together a departure package including a forecast of wind speeds and directions, a recommendation for when to leave and what route to take, and, on the U.S. East Coast, recommendations for routing through the Gulf Stream. For someone who has not yet developed forecasting skills, this is worthwhile, especially on a short passage where a good weather router should be able to find a weather window that will last the length of a passage. More experienced cruisers usually rely on their own weather sources to find a departure window unless leaving from a particularly difficult area. Almost all the charter boat crews based in Puerto Williams, near Cape Horn, used weather routers to help them cross the 600-mile-wide Drake Passage to Antarctica.

Routing Decisions

Many new cruisers believe that good weather information can keep them out of heavy weather and light air outside the tropics. Yet stable high-pressure systems with large expanses of light air tend to be thousands of miles across, making it difficult to sail around one. In the temperate and high latitudes, a slow front will be moving at 10 knots (240 miles per day) and a fast one at 30 knots (720 miles per day). We only rarely get more than two days' accurate warning of the direction and speed of an approaching system, even using weather routers. A crew aboard a typical cruising boat capable of sailing 120 to 150 miles per day will not be able to do much to position the boat in that time frame. To really take advantage of weather routing in the temperate and high latitudes, a boat needs to be able to make good 300 miles per day.

Although you may not be able to speed up, you can always slow the boat down, and this tactic can keep you out of heavy weather when moving between the tropics and higher latitudes. On passage from Fiji to New Zealand, some boats about 300 miles in front of us reported on the radio net that they had 50 knots of wind, waterspouts, and lightning. Though we still had perfect sailing weather, we reduced sail and slowed the boat down for two days to let the whole mess pass under us. We have done this on several occasions and feel strongly that this is the most effective action the crew on a normal cruising boat can take to avoid bad weather underway.

In the tropics, the longer-range forecasts available from GRIB files or a weather router should add significant value when trying to find the shortest route across the doldrums or to avoid the turbulent weather in the vicinity of the ITCZ. Yet in the real world, we have found forecasting accuracy to be very poor in these areas. High-seas forecasts from nearby countries usually offer greater accuracy. The rest of the time in the tropics, most crews rely on SSB nets and the occasional fax or GRIB to keep them apprised of the weather. The conditions that determine sail handling, such as squalls and temperature variations, are too local to be picked up by forecasts.

Sail Handling Decisions

Once underway, good weather information is much more useful on the micro level of determining what sails to carry for the next 12 hours rather than the macro level of trying to route the boat around low-pressure systems and fronts. With a forecast showing stable weather and light winds for several days, we'll put up one of our large, light-air sails. If the forecast shows a lull preceding a strong front, however, we'll shorten sail and motor for a few hours until the front arrives.

But once again, the crew has to be able to interpret current conditions to be sure they make sense in light of the forecast. If we are supposed to be moving into the center of a large high, we want to see a rising barometer and a wind direction and wind shifts consistent with high pressure. If we don't, we'll take a close look at the synoptic chart and try to figure out where we actually are in relation to the major features. We might find that the high has moved through faster than anticipated, and we're already beginning to experience the effects of the low behind it.

Lessons Learned

How do we prioritize these resources? How can you decide what weather information to invest in if you have limited funds?

Our first priority is always the high-seas forecast, including all weather warnings. This can be received as a voice broadcast over a high-frequency radio or as text over Inmarsat-C, a high-frequency radio, or an Iridium phone. The high-seas forecast is the most reliable source for gale and storm warnings and information on tropical depressions.

Our second priority is synoptic charts, which are most easily received as weather faxes. These have been put together by trained weather professionals and often include handwritten notes where a new low is forming or a high has become stationary (see Figure 19-1). Such analysis and interpretation is lacking in GRIB files.

Other charts, particularly the 500-millibar charts, get incorporated into the high-seas forecasts and synoptic charts by people with far more skill than we have to interpret what they say. They are not worth downloading unless you are interested in becoming a weather guru. That's not to say that some cruisers don't become good enough at forecasting to find things in these charts the professionals miss, but for most of us the time and effort is just not worth the reward.

Our third priority is GRIB files. Due to the lack of quality control and interpretation, we try to correlate what we see with one of our two primary sources before acting on it. GRIB files have not been vetted and can easily miss major developments, but they are the quickest and easiest way to get a long-term forecast and a look at how things will change over time, providing valuable warning of systems that may still be several days away.

An all-band receiver with a laptop computer will provide you with voice broadcasts and weather faxes. You can add GRIBs to the list by equipping the boat with a satellite phone or high-seas radio and modem.

We have used weather routers only on long passages in the high latitudes where we thought we would not have good access to other weather sources. They have proven useful in spotting long-range trends and giving us some idea of where we might want to be five or six days down the line, but at least a third of the time the forecast does not develop as anticipated. On our sixty-day Southern Ocean run from the Beagle Channel to Perth, Australia, we were routed into the centers of large high-pressure systems on several occasions. Although we found this preferable to ending up in a storm, it was still frustrating. At the same time, we often found it comforting to have a "second opinion" when faced with the Southern Ocean's complex weather systems and rapidly changing conditions. If you have the money and lack confidence, it may be worth paying a weather router to help with your first few passages.

Beyond that, in our seven years using all these weather sources aboard *Hawk*, we've come to five conclusions about weather forecasting:

1. **As sailors, we have one big advantage over nature—time.** An old saying states, "A sailor with time always has fair winds." Using prudent voyage planning to avoid storms, waiting in port before leaving, slowing the boat down to allow a system to pass in front of us, taking a longer route to avoid having to go to windward—even turning around and sailing the other way—are all effective ways to avoid bad weather that require nothing more than patience.
2. **Most of the weather information out there is coming from the same databases.** Access to two good independent weather sources aboard—say, marine weather nets and weather faxes or GRIB files and Inmarsat-C—will be sufficient for the needs of most cruisers. Additional weather sources won't offer much beyond redundancy, though they may add to peace of mind.

3. **Your role does not end with receiving the forecast.** Even a weather router is limited to virtual information; you are the only one who knows exactly what you are experiencing real time. You still have to reconcile the weather predicted in the forecasts with the wind direction, sea state, and sky to come to your own conclusion about what the next 12 to 24 hours will bring. Each source of information can be viewed as a single aid to navigation. To figure out exactly where you are on the weather chart, you need to reconcile those sources of information with the evidence of observed sea and wind conditions.
4. **All this weather analysis is difficult once in heavy weather.** It is not fun, and often not productive, to sit in the nav station and stare at a computer screen when you are tired, wet, and seasick. The laptop is also vulnerable if exposed to salt water or concussion. We have learned to extract as much weather information as possible when in nice weather and not to count on getting much more than the high-seas weather forecast when in bad weather.
5. **A word of warning: The wealth of information we have aboard *Hawk* has not always been welcome.** We sometimes find that when we should be enjoying a perfect sailing day we're worrying about a front or a gale that's still several days away and may never materialize. Yet we haven't chosen to give up this information. Bypassing one bad storm or avoiding several days becalmed offsets, for us, the time and effort invested in understanding what's going on around us.

CHAPTER 20
Preparing for Passage

When we left Newport to head for Bermuda on our maiden voyage aboard *Silk*, we were proud of how we had prepared the boat. We thought we had done everything right. We had spent weeks finding a place to stow everything aboard. Three days later we were in the worst storm we have encountered in 90,000 nautical miles. The bilge pump was clogged with sawdust and wooden plugs. Water slopped over the cabin sole with every roll; books floated in the water. Wet clothes lay scattered throughout the main cabin. Seasickness prevented us from tackling the hopeless mess below. The most important lesson we learned from that storm has served us well throughout the rest of our voyaging: For offshore conditions, if it seems “good enough,” it isn’t; if it seems bulletproof, it just might do.

Our prepassage routine developed from that first passage experience and reflects the fact that we are both prone to seasickness over the first few days at sea. Our preparations are designed to keep us safe until we find our sea legs. Those preparations start with passage planning weeks before we leave. A few days before we plan to leave, we complete our final shoreside preparations while we look for a good weather window. In the last few hours, we concentrate on preparing the boat. We seek to minimize our activities the first day or so out and prepare for as many contingencies as possible. Thorough preparation leaves us free to enjoy the wonders of passagemaking.

PASSAGE PLANNING

After considering your overall voyage and developing a voyage plan as described in the Voyage Planning section in Chapter 18, each passage you embark on should take advantage of prevailing winds and ocean currents. Even so, you still need to determine the exact route that will allow you to sail as safely and efficiently as possible. Since you can never know exactly what you will encounter along the way, this plan should be flexible. Develop a passage plan for average conditions and modify it based on what you experience.

Several tools will assist you in developing this plan. *Admiralty Ocean Passages for the World*, published by the British Admiralty, or *World Cruising Routes* by Jimmy Cornell (see the Navigation Needs and Ship’s References section in Chapter 11) offer route-planning advice for every major passage around the globe. The NGA (National Geospatial-Intelligence Agency) or Admiralty passage chart and the volume of the *Sailing Directions* for the route in question provide information on hazards that may be encountered. Although not essential, the *Atlas of Pilot Charts* discussed in Chapter 18 (see the Planning Tools: Pilot Charts sidebar) can be very helpful in answering specific questions such as at what latitude to sail across the North Atlantic in a given month and whether it makes any difference to make the passage in, say, late May versus early June. Routing programs such as MaxSea (see the Onboard Software section in the resources for Chapter 8 in Appendix 1) and computerized versions of the pilot charts contain the same information and can be useful in passage planning. The Developing an Initial Passage Plan section in Chapter 24 illustrates this whole process using a passage we made from the Cape Verde Islands to Mar del Plata in Uruguay.

To determine your route, you need to know the ports of entry at your destination. In most countries, you can

PREPASSAGE BUREAUCRACY: OBTAINING VISAS

Passage planning also means making sure you will be legal when you make landfall. To enter many countries, you need a visa. Exactly what countries will require you to obtain a visa before entering will depend upon your nationality. Along the trade wind routes, U.S. citizens must have a visa to enter Brazil, French Polynesia, New Zealand, and Australia. Europeans need visas for the United States, New Zealand, and Australia. The Information on Formalities by Country section in the resources for this chapter in Appendix 1 lists some sources for information on visa requirements.

Some of these countries will issue a temporary visa upon arrival, but it often pays to plan ahead and get a three- to six-month visa at the consulate or embassy of the country prior to landfall, especially where language might be an issue. Check the requirements for the countries along your route a few months in advance, and then figure out where you will be able to get a visa if you need one. Obtain your visa as close to when you set sail for the country as possible. This way, you can be sure it will still be valid when you arrive.

Request the longest visa duration possible, and specify a multiple-entry visa so that you can fly home and return without having to get a new visa issued. In a country like Australia, a multiple-entry visa is required to visit some of the offshore islands. While we were on Christmas Island, a French single-hander arrived from Darwin with a single-entry visa for Australia. Even though his visa had not expired, the local authorities would only allow him to take on water, insisting that he leave immediately thereafter.

When you apply for the visa at a consulate, you will be required to provide passport photos and passports, show your ship's papers, and—for many countries—show proof of financial resources sufficient to maintain you while you are in the country. That usually means copies of bank statements proving that you have a specified sum of money per person per month for the duration of your visit. In some cases, a credit card with a high credit limit ($5,000 to $10,000) meets the requirement.

You may also be required to show proof of boat insurance. A few countries worry about having to repatriate indigent, shipwrecked sailors. Proof of additional financial resources may be accepted in lieu of insurance. French Polynesia is more obvious about its intent. It requires that each person aboard post a bond equal in amount to the return airfare from Tahiti to their home country. The bond is reimbursed only when the yacht is clearing out of French waters. Although many voyagers object to this, very few find a way around it.

In the aftermath of the September 11, 2001, terrorist attacks, the United States tightened all of its immigration procedures including those for obtaining visas. All foreign nationals except Canadians and Mexicans are now required to obtain a visa prior to arriving in the country. In addition to the requirements detailed above, for long-term visas the process includes a mandatory interview in a U.S. consulate or embassy. For more information, see the Information on Formalities by Country section in the resources for this chapter in Appendix 1.

only make landfall at ports with customs and immigration facilities. These ports are listed in pilots or guidebooks and are well known within the voyaging community. Your course should take you along the most direct path to a port of entry. You will also need to find out whether or not you need to have a visa before arriving in the country, and if so, you may need to obtain it before setting out (see the Prepassage Bureaucracy: Obtaining Visas sidebar above).

The shortest distance between where you are and where you want to go is called the *great circle route*. This course takes into account the curvature of the earth's surface to minimize the distance. Calculating it used to be part of the navigator's art, but a GPS now provides the great circle route between two points at the push of a button. But the navigator still plays a role. The course obtained from the GPS will often need to be modified based on wind strengths, ocean currents, and specific hazards.

Wind Strengths

Passage-planning books offer specific advice for each route, but two general considerations underlie most such advice. First, the width and wind direction of the trade wind belt varies from east to west in the Atlantic and Pacific oceans. Second, average wind strength increases over the course of the trade wind season.

The trade wind belt narrows significantly from east to west in the Atlantic and Pacific oceans, and the winds in

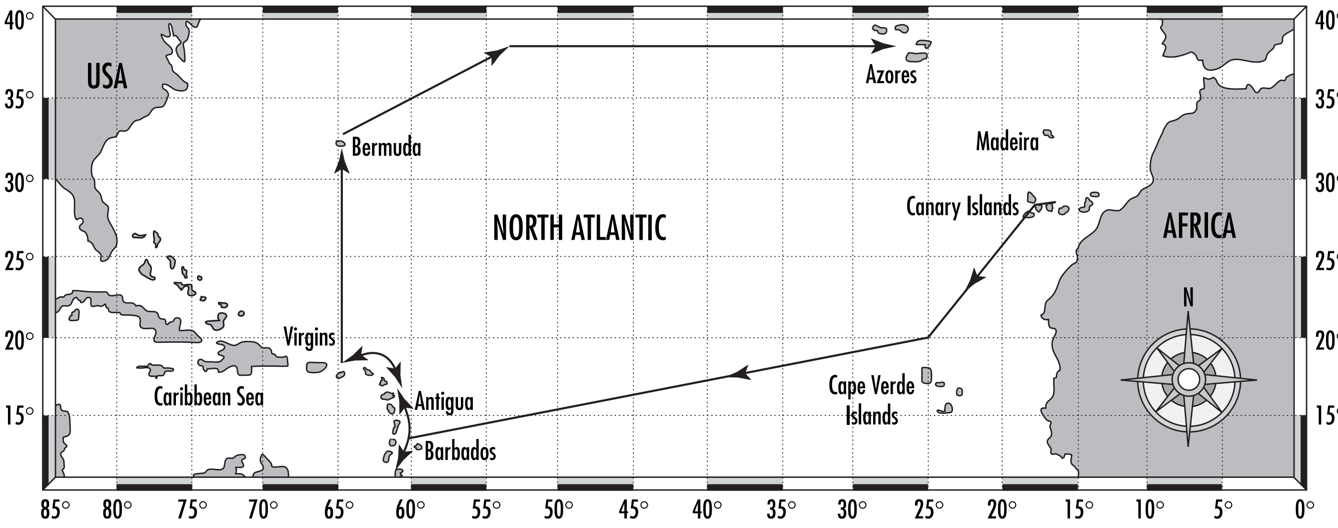


Figure 20-1.

Atlantic circle routing tactics. From the Canaries to the Caribbean, head south almost to the Cape Verde Islands before turning west for the Caribbean; on the return voyage, sail north to the band of westerly winds at around 40°N before turning east.

the eastern parts have a more pronounced northerly or southerly component, with north-northeast and south-southeast winds commonly occurring in the Northern and Southern hemispheres, respectively. In the western Atlantic and Pacific oceans, the easterly component dominates. By adding a few hundred miles to the great circle route to take advantage of these two factors, you might reach port a few days earlier. In general, on a westabout circumnavigation, sail close to north or south outside the trades and sail west within the trades.

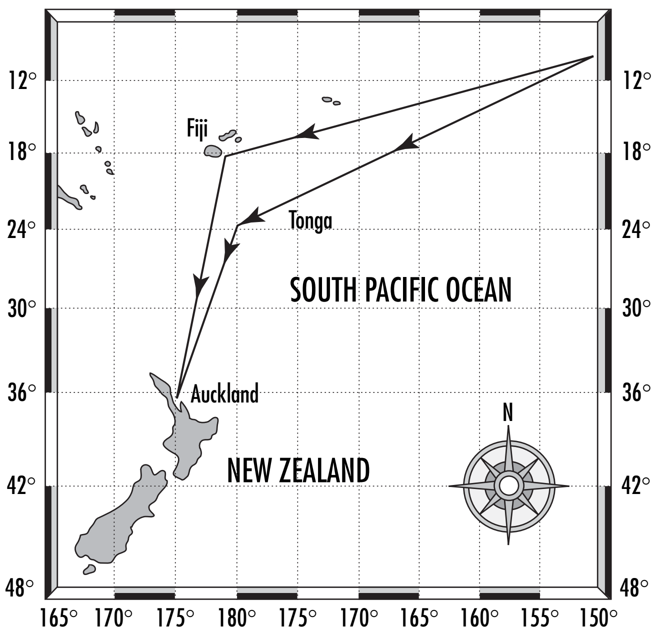
The traditional advice for a Canaries-to-Caribbean passage—"Sail south until the butter melts, then head due west"—illustrates this strategy. By sailing south into the trade winds on their eastern end, boats enter where the trade wind band reaches farthest north. They then make southing while the prevailing wind direction is more northerly (Figure 20-1). These directions mean you will sail the legs of a (rough) right triangle rather than the hypotenuse. Thousands of sail-driven vessels have proven this route faster than heading directly for the Caribbean across the relatively windless horse latitudes. On the return voyage, yachts sail north to Bermuda, then angle their way northeast up to about 40°N before turning east for the Azores.

The strategy of sailing north or south outside the trades and west in the trades works for most passages that enter or leave the trade winds. When entering the trades from the higher latitudes, sail north or south into the trades and then turn west toward your destination as shown in Figure 20-1. Before leaving the trades, sail as far west as possible, and then run north or south toward higher-latitude destinations (Figure 20-2). When crossing the doldrums, enter them at their narrowest point and then turn due north or south to cross them (Figure 20-3).

The trade winds vary significantly in strength depending on the season. On our first voyage aboard *Silk*, we left the Canary Islands for the Caribbean in late October. Although we knew that the trade winds did not really establish themselves until after Christmas, we underestimated what that would mean for our passage. What winds we had were light and fluky, with the frequent violent squalls characteristic of the doldrums.

Figure 20-2.

Leaving the trades. Typical routes to New Zealand from Tonga or Fiji.



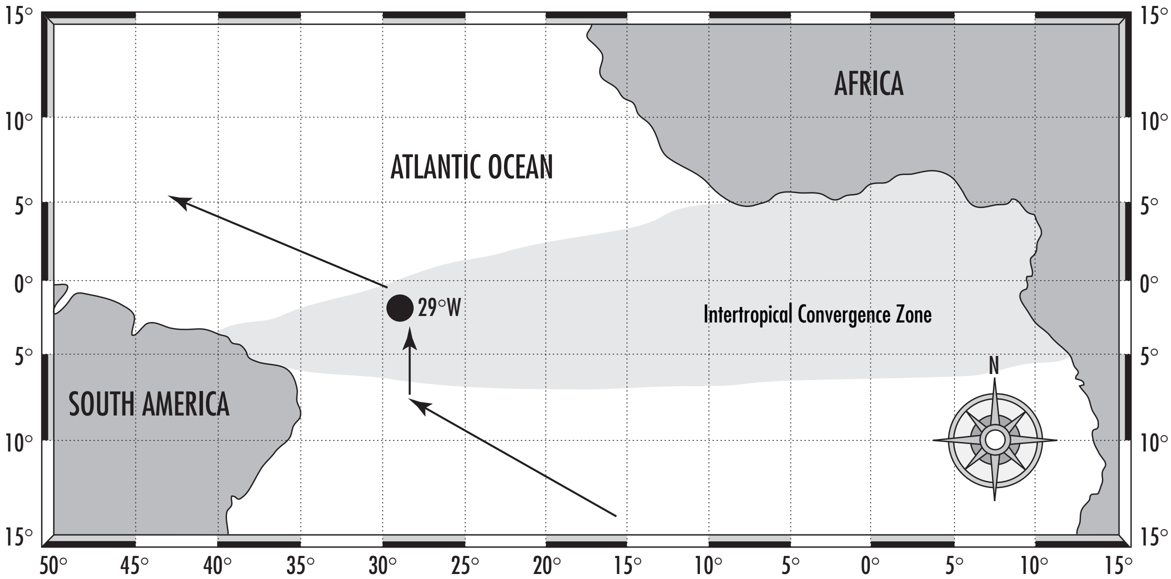


Figure 20-3.
Crossing the doldrums in the Atlantic Ocean in February. Cross at right angles before heading west in the trades.

We needed twenty-six days to sail the 2,600 nautical miles—one of the slowest and longest passages of our entire voyage. We were not impressed with our first experience in the trade winds; the average true wind speed was about 10 knots.

Friends of ours on similar-sized boats who waited and left in mid-December or early January had twice the wind and took a third less time. For the fastest and least frustrating trip, wait for the trade winds to fill in before you set off. The trades blow most strongly when the ITCZ is at its farthest reach in the opposite hemisphere, which means in the winter months. The strongest winds are in January and February in the Northern Hemisphere and July and August in the Southern Hemisphere, when reinforced trade winds are quite common.

Ocean Currents

You also want to find the strongest favorable current possible. Ocean currents tend to be fickle, hard to find, and harder to keep track of once found. When we least expected it, we would suddenly realize that we were getting a 2-knot boost from somewhere. Then it would disappear, often where our charts and references said it should be strongest. Although charts and routing books can get you into the approximate area, finding weak currents often depends on luck or the reports of other boats.

Strong and potentially dangerous currents such as the Gulf Stream and Agulhas Current require more planning. Low-pressure systems that would normally pose little hazard can create dangerous breaking waves where wind and current conflict. When heading up the U.S. East Coast or down the eastern coast of South Africa, voyagers want to take advantage of the 3- or 4-knot boost from the current without finding themselves in the dangerous waves a low can bring. To do that, mariners need accurate information on the location of the current and the weather for the period when they will be in the current.

Thanks to the biennial Newport-to-Bermuda race, entire books have been written on locating and navigating the Gulf Stream. Gulf Stream maps are readily available both from private weather routers and from the Navy on the Internet (see the Gulf Stream Charts section in the resources for this chapter in Appendix 1). The position of the Agulhas Current can be approximated using an infrared satellite chart, but no detailed charts and forecasts exist as they do for the Gulf Stream.

The position of the Gulf Stream shifts slowly, so a chart downloaded at the beginning of a passage will be roughly correct for the week or so you might be on passage. Accurate weather forecasts are more problematic. In only a few places, such as leaving from Florida to head to the Bahamas, can you get a reliable weather forecast for the entire period you will be in or near the current. Approaching the east coast of the United States or South Africa, boats must cross the current at the end of a passage with weather moving off the coast toward them. There is no way to time your arrival at the current with any certainty or to know what weather will greet you when you get there. The first time you cross, focus on doing it safely without too much regard for speed or style.

Although luck plays a role in avoiding bad weather in these currents, you can control some of the risk. First, you need to know when you have entered the current. Instruments make locating the current straightforward. When traveling with the current, you will see a large difference between your boat speed over the ground and through the water. If crossing the current, you will notice a difference between your compass course and your GPS course. Even without instruments, the following signs indicate that you have reached one of these large ocean currents:

- **Bird and marine life.** These currents carry with them a wealth of aquatic life that feeds larger marine creatures. Flocks of birds overhead, pods of dolphins around the boat, whale sightings, and large schools of fish indicate that you have entered the current.
- **Water color and temperature.** When approaching these warm-water currents from colder water, you can often see a clear demarcation between the gray-green water of the temperate latitudes and the cobalt blue water of the tropics carried by the current. Water temperature will change dramatically as well, rising by 10° to 20° even in the summer months. A thermometer can help locate warm and cold currents.
- **Cloud formations.** The churning mixture of warm and cold water at the edge of the current often results in a relatively low cloud bank. Near the center of the current, the scattered cumulus "cotton balls" of trade wind skies predominate in good weather.

Once you have located the current, your next step depends on whether you want to cross it or use it for some free miles toward your destination. If you want to get across as painlessly as possible, the next 24 hours of weather become critical. If a low is on the way, consider heaving-to and waiting for it to pass before entering the current. If the weather looks clear and you decide to cross, don't underestimate how much you will be set by the current. Use the GPS to establish a course over ground that will leave you upwind and upcurrent of your destination.

If your goal is to hitch a ride, run with the current about 10 to 15 miles inside its landward edge. Both the Agulhas and the Gulf Stream currents flow most strongly there, and if the weather starts to deteriorate, you can head inshore, out of the current, to reach waters where the waves will be more manageable. When sailing along the east coast of South Africa, the traditional approach is to make for the 100-fathom line when the barometer starts to drop. Just be careful not to get too close to land and end up on a lee shore in a gale.

Other Hazards

Once you have planned a route based on prevailing winds and currents, you need to make sure you will avoid all nearby hazards. Review the chart, the pilots, and the routing books and consider the following sorts of hazards before finalizing your route:

- **Small islands.** Small islands in midocean can be incorrectly charted by several miles. Many chartplotters do not even show every island at small scale; when you're looking at a large expanse of ocean, an island may not show up until you zoom in. To be safe, check your course on a paper chart or zoom in and follow the route on the chartplotter. We keep a minimum of 5 miles between us and any small islands or reefs along our course to be certain current or wind shifts can't set us onto land. If your planned route takes you closer than that, adjust it. For high islands or at night, establish visual contact to be sure you have passed the island safely.
- **Reef and shoal waters.** In the Pacific in particular, there are extensive reefs and shoals that are unbuoyed and unlit. Between Tonga and Fiji and in the Coral Sea between New Caledonia and Australia, routes are complicated by reef systems that are uncharted or for which several positions have been reported. In other areas, freestanding reefs enclose a lagoon 10 miles long or more with nothing but a tiny sand islet above water level. Minerva Reef, south of Tonga, and Beveridge Reef, between Palmerston atoll and Niue, are two examples in the Pacific that are favored voyaging stops in settled weather. Unless you plan to stop in one of these areas, give them a wide berth and don't try to establish visual contact.
- **Seamounts.** Underwater mountain ranges exist on the ocean floor in many parts of the world. In a few places, these mountains rise to within 100 feet of the sea surface. When certain types of ocean waves hit such an underwater obstruction, they can rise up—tsunami-like—to create freak waves. This happened to us between Cape Town and St. Helena on *Silk*. In relatively settled conditions, a single breaking wave about 20 feet high running almost perpendicular to the prevailing wave train came out of nowhere and caught us beam-on. The boat was knocked down, quite a bit of equipment was damaged, and we almost lost our engine when water entered the diesel tank breather located in the cockpit. Two other crews we knew had similar experiences within a few miles of underwater mountains, one between Australia and Indonesia in the Arafura Sea, and one south of Madagascar. Adjust your route to allow 10 miles between you and any seamounts that come within 100 feet of the surface.

- **Fog-prone areas.** Although you are unlikely to encounter fog in the tropics, you may have to deal with it in parts of New Zealand, the west coast of South Africa, England, and parts of the eastern and western coasts of the United States and Canada. If your route includes fog-prone areas, be sure you have a bell and an air horn aboard and that you know how to signal and understand the signals of others. Review the rules for navigating in fog, and check the chart for alternate ports where entry would be relatively risk free in low visibility.
- **Ice.** If you encounter ice on a trade wind voyage, you'd better check your navigation! But in the high latitudes, ice can be a serious hazard. To navigate safely in these areas, ice charts need to be downloaded daily over fax or a high-seas radio and reviewed carefully. Ice warnings are also broadcast during high-seas forecasts. If making passages through waters where ice can be found, such as Newfoundland to England in the summer months, check these reports before you leave and modify your passage plan to avoid the danger.

After adjusting your course to reflect these hazards, you are ready to depart. You have your game plan, and you are ready to modify it based on the actual winds and currents you experience. The Modifying the Plan Based on Actual Conditions section in Chapter 24 uses our passage from the Cape Verde Islands to Uruguay to illustrate how we modify our passage plan based on what we encounter along the way.

PASSAGE PREPARATIONS

You have completed your passage planning, and in a few days you will depart. You have started to look for good weather. You now begin to prepare the boat to head offshore. Leaving for a passage always involves a whirl of last-minute activities, including topping up supplies, stowing belongings, and finding places for new treasures. You will also need to go over the boat thoroughly to make sure she is in passagemaking condition. When you find the right weather window, you'll make one last run ashore to clear customs and to buy perishable items. After another few hours of final preparations aboard the boat, you will be ready to head out to sea!

Provision Planning

Depending on where we're leaving from, it may be necessary to fill the boat completely, as described in the Starting from an Empty Boat section in Chapter 14. But for most passages, we will already have a range of supplies aboard. About a week before we leave, I do a quick inventory to make sure supplies are not running low in critical areas: flour, pasta, canned goods, and so on. I also refer to my inventory list of meals that I can prepare from these supplies and make a list of menu possibilities so that I won't have to think too much during the first few days offshore.

When we first started passagemaking, I tried to recreate shoreside meals without regard to the sea state or our stomachs' state. I often ended up frustrated and seasick. Over time, I have learned to be flexible and plan a range of possible meals for different weather conditions. I also evaluate the galley stability and crew appetites before deciding what to make. As I think through my menu options for a passage, I divide meals into the following categories and make sure I have enough of each:

- **Premade, easy-to-cook, early-days meals.** Over the first few days, more than a few minutes in the galley with propane fumes and cooking odors will make either of us seasick. But we are also likely to get seasick if we do not keep our stomachs busy with nourishing food. I premake meals for the first few days of the passage—sandwiches and salads for cold meals, and leftovers or casseroles that only need to be heated for hot meals.
- **Light-air, hot-weather meals.** We do not have large appetites in the tropics, especially when the wind is light, the boat is rolling, and the temperatures are in the high 90s. In those conditions, we prefer lots of small snacks as opposed to one big meal. We also want to minimize the heat generated from cooking. We cook when it is coolest—early in the morning or just after dark. At these times, we prepare foods to be eaten cold later, such as a whole-grain salad or bread, and we supplement this fare with fresh fruit and vegetables for up to two weeks, and after that with dried and canned fruit, olives, pickles, peanuts, and salads made from canned vegetables.
- **Heavy-weather meals.** In the worst conditions, the only way to cope is to minimize cooking. To give the crew hot, substantial, easy-to-eat food, you need meals that can be made in one pan with minimal preparation and eaten with a spoon out of a bowl or mug. Hearty soups and stews are best, either canned or freeze-dried. We use as many as three cans per day in cool weather. Take enough to keep everybody well fed over the course of a three-day blow.
- **Celebratory meals.** Most crews use food to celebrate passage milestones. I always plan something special for any "event"—from birthdays to equator crossings. I try to include a few favorite dishes for each of us. I also plan three or four extravagant

meals to combat low morale or celebrate whale sightings. Many crews bring along a couple of bottles of fine wine and a bottle of champagne for these celebrations.

You may eventually be able to cook a three-course dinner while underway in a gale, but start with more modest goals. Avoid any menu item that involves more than a tablespoon or so of hot oil or grease during the first few days of a passage. Be realistic about prevailing conditions and your own ability to manage them. With a little forethought, you will be able to turn out basic, nutritious meals while you're finding your sea legs, without compromising your safety or your stomach.

Picking Your Weather Window

Once you're at sea, you have to make the best of whatever weather comes your way. Before you leave, you have access to sophisticated weather forecasting and the luxury of selecting your weather, but even then, the best you can hope for is two to three days of favorable winds and five days with a small likelihood of bad weather.

When you start looking for your weather window, you are looking for a favorable forecast confirmed by your own short-term forecasting and consistent with weather patterns in the area. Broadly speaking, systems move from west to east outside the tropics, but every major landmass has a weather pattern that varies with the season. Nor'easters often wreak havoc along the U.S. East Coast; southerly busters may greet you near South Africa; the Mediterranean's myriad winds may send you flying along your course or have you hove-to for a day or more. These patterns cannot be readily intuited; they must be learned.

In addition to the knowledge shared by sailors and seamen who know the waters, you can get information on local weather conditions from pilots and sailing directions, from synoptic charts and general forecasts, and from high-seas roll calls during weather nets. These may even convince you to modify your initial passage plan.

A few weeks before we were planning to leave the Caribbean for Ireland, we started watching the synoptic charts and listening to the roll call of boats that had already left. It soon became obvious that although it was April, winter storms were still originating as far south as Florida and affecting the area between the Caribbean and Bermuda. We had intended to follow the normal sailing route north to Bermuda, but tracking these weather patterns convinced us to avoid that area completely and head northeast through the horse latitudes.

Just as weather differs between the tropics and the temperate latitudes, so does departure strategy. In the tropics, we are concerned mainly with avoiding fronts and their associated westerly winds. In the higher latitudes, we time our departure to take advantage of the strong but favorable winds after a cold front passes in a low.

Temperate Latitudes

Experience is the only teacher when it comes to balancing waiting for a good weather window against leaving right away and dealing with whatever is out there. For longer passages, you will have to accept what you are dealt in terms of gales or calms after the first two or three days. But when you depart, you can pick a weather window that will give you time to acclimate. When we select a weather window, we look for three things:

1. **Favorable forecast.** That means a favorable wind direction and moderately strong wind. Light winds often accompany a high moving in and end up leaving us becalmed after a few days at sea. We do not mind leaving in gale-force winds as long as they are from behind. Like most offshore boats, both *Silk* and *Hawk* like to run downwind in strong winds, and we are generally quite comfortable as long as the seas are manageable.
2. **Weather signs that substantiate the forecast.** We have learned not to trust a favorable forecast that we can't confirm with our own observations of sky, clouds, wind directions, and barometric pressure. We are more comfortable believing a long-term forecast when the short-term forecast agrees with our own predictions.
3. **No known lows that could move across our early route.** If a low is on the weather charts and moving toward our route, we are inclined to wait another day or so to let it pass. We have often been forced to break this rule in the high latitudes, where a weather window of two to three days is the most you can hope for and where we expect a gale per week on average. We do try to make sure we have two or three days of good weather ahead, as that gives us adequate time to acclimate before the first gale arrives.

We prefer to leave after the front half of a low has passed over our position. Once the wind shifts into a favorable direction, we leave on the "back" of a gale that is forecast to be followed by a strong high. We can expect strong but favorable winds through the second half of the low, followed by winds from much the same direction as the leading edge of the high comes over us. With this weather pattern, we are almost guaranteed fast downwind sailing for four or even five days after leaving port.

A strong low and a strong high are both dominant enough weather features that they are unlikely to be mistaken or to allow anything else to develop spontaneously. Many people prefer leaving on the leading edge of a rapidly filling high. This makes the first few days less boisterous, with calmer sailing within 24 hours or so of leaving. They find the risk of being becalmed in the high preferable to the possibility of being beaten up in a low. This strategy is best used where the high is well developed and strong, as indicated by its center pressure and by closely spaced isobars that extend several hundred miles inward from its edges. Otherwise, the high may be too weak to prevent the sudden formation of a low.

Tropics

When leaving one tropical destination for another, we rarely have to wait for a weather window. Settled trade wind conditions offer the best guarantee of good weather for the first few days. On the few occasions when the forecast or our own observations indicate unsettled weather, we wait until the front or low has passed before setting off. A high moving through the subtropical latitudes causes reinforced trades and means boisterous downwind conditions, but it reduces the chances of encountering a frontal system for up to a week after its passage.

When you leave from a tropical port to sail into higher latitudes, luck plays a large role in determining your weather. If you are sailing from Fiji to New Zealand or from Réunion to South Africa, the weather window you select to leave on carries you only through the first few days in tropical latitudes. You cannot predict what weather will await you by the time you reach temperate latitudes. The best assistance on these passages comes from a boat that is sailing a day ahead of you and reporting their weather on the roll call.

Final Shoreside Preparations

Once we're offshore, it always takes a few days to figure out where we've stowed our sea legs. Until then, we both feel a bit as if we are drunk. Our feet never end up quite where we try to put them, we are often lethargic and dull-witted, and everything from sail changes to cooking takes twice as long as expected. We are at our most vulnerable these first few days—not just to seasickness, but also to mistakes in judgment that could affect our safety. Our prepassage preparations are designed to keep us safe and make life easier while we reacclimate to being offshore.

After being in port for weeks or months, part of the process of getting our sea legs back is getting our sea eyes back—the second sense that automatically notices anything that isn't stowed well. If we have been sitting in a marina or harbor for several weeks, we always try to take a short sail to a bay where we can anchor and sort ourselves out before we actually leave. That sail is typically punctuated by at least one minor crisis, from a poorly stowed shelf to renegade dish soap.

In the days before we clear out, we perform a "delivery captain's inspection" of the boat (see below), top up all supplies, set everything up to minimize the likelihood of seasickness, and stow everything securely for offshore work. Most of our friends follow similar prepassage routines, though many have relaxed their preparations as they've gained experience. We maintain a rigorous discipline in passage preparations, largely because of the lessons we learned from our first storm. Our fanaticism has stood us in good stead on several occasions when the sea turned ugly.

Delivery Captain's Inspection

A little boatkeeping before departure goes a long way toward making sure the first few days are trouble free. Before we leave, we always do a quick inspection from the bottom of the keel to the top of the mast.

Ensuring **hull integrity** comes first. We try to make the boat as close to watertight as feasible. We check that there are no leaks around the seacocks or stuffing box, all the hose clamps are tight and in good condition, and the seacock handles work properly. We inspect around high-load areas like the chainplates, mast step, and rudderpost to make sure there are no signs of stress cracks or softness.

The **rig** and **sails** come next. We clean the mast track and lubricate it with a Teflon spray or with dish soap. While up the mast, Evans does a cursory inspection of spreaders, tangs, fittings, and the masthead crane. We check that all lights on the mast and on deck are functioning.

On the first passage of the season, we thoroughly inspect the mast and all its fittings (as described in the Revitalize the Rig section in Chapter 4). We check all the running rigging and end-for-end any that show chafe or wear, and tighten the lifelines and inspect the lifeline fittings. We go over the sails to make sure they are in good condition. We fix any loose threads or chafed areas and add chafe protection as needed.

The **steering system** comes third. On the primary steering we make sure all the bolts are tight, the quadrant is tight on the rudder shaft, there are no cracks in any welds, all sheaves run freely, all gears are lightly greased, and all wires are tight with no broken strands. On passage we will be using autopilot or wind vane steering 99 percent of the time, so we inspect the wind vane, looking for any cracks in the welds and inspecting the control lines for chafe. We also lubricate the wind vane blocks and the steering drum. We top up the hydraulic oil in the electric pilot and inspect it for any signs of oil leaks or corrosion on the electrical terminals.

Next we take a look at the **engine**. We make sure the battery water is topped up, the belts are tight, and the oil and filters are clean. We also clean the Racor filters and raw-water strainer. We check that we have spare oil, filters, and belts.

Evans dives and takes a good look at the **bottom**, checking the rudder, prop, zincs, and the condition of the bottom paint. The rudder and prop must turn freely without binding. He uses a dental pick to remove any barnacles growing on the prop blades or between the rudder and the boat's underbody. Stray electrical charges in marinas or busy anchorages can destroy zincs in a short period, particularly those affixed to the propeller, so he inspects them and replaces them if necessary.

The difference between a clean bottom and a dirty bottom can mean a knot or more of boat speed on a light-air passage. Those using hard bottom paint can scrub off any grass or barnacles that have taken hold. Soft bottom paint shouldn't be scrubbed, but it will benefit from the sail to a nearby anchorage.

On a new or new-to-you boat, make sure to clean the bilge thoroughly. Almost every new boat has pieces of fiberglass, wood plugs, sawdust, and fiberglass dust left over from the boatbuilding process. If these are not removed, they will clog up the bilge pump if the bilge gets flooded.

Although you can never prevent or foresee every eventuality, these preparations minimize the chances that you will find yourself dealing with a minor emergency in the first day or so at sea. Like picking a weather window, they give you confidence that you won't have to deal with any nasty surprises before you are acclimated.

Topping Up

Except where clean sources are unavailable, we top up our fuel and water before leaving. After topping up the tanks, we put some Vaseline on the seals of the deck fills and tighten them down to prevent contamination from salt water or dirt. We fill any extra jerry jugs and our propane tanks if needed.

By this time, the major provisioning is done, and only the perishable provisioning remains. To prepare for that, we clean the icebox and the crates we use for produce storage with a Clorox solution and leave them to air out for half a day. Then we head off to the local farmer's market, farm store, or farm stand. If we have transportation—a rental car, a taxi, or a friendly local—we'll purchase everything at once.

Otherwise, we buy what we need in several trips. We start by purchasing the heavy items that are least perishable—potatoes, onions, citrus, apples, and so on. If we're cruising warmer waters and ice is available, we purchase 50 pounds and cool the icebox. If we need to top up things like drink mixes or flour, we buy a few additional supplies. Then we go back to the farmer's market for all the real perishables, everything from avocadoes to zucchini. All this gets stowed in our storage crates as described in the Provisioning Tips and Tricks section in Chapter 14.

Arranging Stowage

When we head offshore, we want absolutely everything to be in a place where it will stay secure through a knockdown. Paying particular attention to the following areas will make the first few days at sea less eventful and more enjoyable:

- **Restock galley containers.** I keep small amounts of most baking and cooking ingredients within easy reach of the cook's strapped-in position in the galley. Extra quantities are stowed in less accessible areas that I consider my onboard "market." Before a passage, I always go "shopping" and refill the galley containers with flour, sugar, salt, pasta, rice, and so on. With my galley fully stocked, I don't need to get anything out of stowage until I have regained my sea legs.
- **Premake meals.** I premake whatever meals I have decided on during my provisioning planning. I also make sure that a variety of snacks and drinks are readily accessible.
- **Restow heavy things as low as possible.** In light or heavy weather, sailing performance will be adversely affected by weight high in the boat or in the ends. If you have been cruising with two anchors on the bow, restow one low in the boat along with extra chain. If you are making a windward passage, stow the second anchor below as well. Tools, cans, spares, and other heavy items should be returned to their normal homes.
- **Prepare emergency equipment.** Check emergency equipment before heading off. Take apart the abandon-ship kit and check everything to make sure it is still in working order. Replace the water with fresh, change the food, and repack and restow the kit. Test the EPIRB battery to make sure it is in working order (406 MHz EPIRBs come with a test switch that checks battery condition, signal burst, and strobe operation). Inventory the medical kit, restock the seasick medications, and replenish day-to-day supplies such as Band-Aids and cold remedies.

These preparations are designed to make the first few days at sea as trouble free and efficient as possible. In addition to preventing seasickness, they allow us to concentrate on sailing the boat until we acclimate to being at sea once again.

The Last Few Hours

The day has come. The weather window looks perfect, and your other preparations are finished. You need to clear customs, throw away any garbage, and buy those last few perishable groceries. Then you need to stow everything securely, set sail, and leave land behind.

We need about 2 hours after we return to the boat from our last trip ashore. We bring the dinghy aboard together, then I work belowdecks while Evans works above. Once we have each completed our respective tasks, we switch and inspect each other's work. After weeks or months of not sailing the boat, Evans often finds that I have forgotten to secure the fiddle that holds a hundred CDs, or I find he has led a sheet the wrong way through the lifelines. Right before we start the engine, one of us does a quick once-over to be sure the engine oil is topped up and filters and fittings are ready to go.

Final Trip Ashore: Clearing Out

The visa, if required, is not the only paperwork you need before setting sail for your next destination. Before you can clear in to a new nation, you must have cleared out from somewhere else. No universal rules exist for clearing out, but the brass ring is a certificate of clearance, which will be required for you to clear in anyplace else, and you'll go as many times around the merry-go-round as necessary to get that piece of paper. In St. Helena, a tiny dot in the South Atlantic, we had our clearance after one 5-minute visit to customs. In Durban, it took multiple visits to immigration, customs, the port authority, the yacht club, and the police. All that just to clear out to another South African port!

Paradoxically, one of the most difficult countries for U.S.-registered vessels to clear out of is the United States. Coast Guard regulations state that a U.S.-flagged pleasure boat need only obtain clearance when leaving for a foreign port if it is engaged in trade, has visited a "hovering vessel," or is not in compliance with U.S. laws. Although Bermuda, the Caribbean nations, and Mexico have learned to live without clearance forms from Americans, other countries may not be so accommodating. To formally clear out of the United States, you will need to obtain Customs Form 1300, "Vessel Entrance or Clearance Statement" (see the Information on Formalities by Country section in the resources for this chapter in Appendix 1).

Below-Deck Preparations

Our first concern below is to make the boat comfortable for living aboard at sea. *Hawk* was designed so that in rough weather we don't ever have to go forward of the navigation station.

Our dedicated sea berths are just aft of the companionway and set up with bunk boards and lee cloths. Our passage clothing gets stowed in canvas pockets that line the hull outboard of our sea berths. The head is just to starboard of the companionway steps; we stow our foul-weather gear in a wet locker there as we come down below. The galley is to port and just forward of the companionway. We stock it with easy-to-prepare passage food stowed in the lockers that are easiest to access. Seasickness remedies are put in a handy galley drawer. The navigation station lies just aft of the head. Good hand grips and bracing surfaces are within easy reach throughout the whole area. Although we specifically chose and organized *Hawk* to make her easy to live aboard on passage, most boats can be set up so that activities are focused around the companionway.

No matter how your boat is set up, there are several things you will need to do to ready it for offshore down below. If your quarter berth or pilot berths are used to stow items in port, you will need to rearrange stowage for passagemaking. I start preparations below by removing all the items we keep in the quarter berth or sea berth in the aft cabin, stowing them securely in the forepeak. Lines and pad eyes under the forepeak cushions are used to lash everything down.

The rest of my preparations are designed to minimize our time below during the first few days, when we are both prone to seasickness. These include the following:

- **Sea berths.** We make up any of the sea berths that might get used so I won't have to make up a different bunk the first night out. We stow our passage clothes in canvas stowage pockets along the side of each of our bunks (Figure 20-4). To assist the off-watch if that person has to get up suddenly, and to enable him or her to stay in the bunk at other times, we position a variety of tools within reach from our sea berths. Flashlights and sailing knives are stowed in Plexiglas holders, and an inclinometer and compass are mounted on the bulkhead at the head of our bunks (Figure 20-5).
- **Soundproofing stowage.** Beyond making sure that all fiddles and shock cords are in place, we inspect the stowage areas to make sure nothing will break or keep us awake in a rolly sea. I make a "noise inspection" of each locker by trying to shift the contents with my hands, and I inspect each drawer by opening and closing it several times. I stuff towels, socks, and rags between items to keep them quiet and prevent them from shifting.

Figure 20-4.

Passage ready: our sea berths are set up with lee cloths in addition to the boards; passage clothing is located in the pockets outboard of each bunk and also serves as padding against the hull.

Figure 20-5.

An inclinometer and compass mounted on the bulkhead at the head of our sea berths keep the off-watch apprised of what's happening above, and knives and flashlights are within easy reach if a quick rush to the deck is required.

- **Stormproofing stowage.** In areas that are more open, like the stowage behind our settee in the main saloon, I use netting to contain everything and be sure it can't get launched across the boat in a knockdown (Figure 20-6). A fine-weave plastic mesh that zips into place over our storage lockers will capture anything that escapes the lockers (as shown on the lockers in Figure 20-7). Make sure each drawer and locker latches firmly when closed for the last time, so they don't pop open on the first tack. Finally, I lock all hatchboards, refrigerator covers, and locker lids with whatever locking mechanism we have organized.
- **Hatches and ports.** We make it a rule to leave with all ports and hatches closed and dogged just to be sure we don't miss any. I clean the edges with a multipurpose cleaner and put a bit of Vaseline on the gaskets of the ports before dogging them securely. This creates a watertight seal and keeps the gaskets from drying out and becoming brittle in hot, dry tropical weather.
- **Hatchboards.** If the weather starts to deteriorate, hatchboards may need to be put in quickly. On *Hawk*, we only need to close our watertight door (refer back to Figure 4-5). On *Silk*, we left with the bottom board in place and the others stowed within reach of the companionway.
- **Emergency preparations.** We make sure all emergency gear is accessible. I check that our safety harnesses and tethers are in the stowage pockets by our sea berths, that the abandon-ship kit and EPIRB are where they are supposed to be, and that any water jugs we would take with us if we had to abandon ship are accessible.
- **Heavy-weather equipment.** We stow anything we might need to use in heavy weather in accessible places on the cabin sole. Our drogues get stowed behind our diesel heater against a bulkhead (Figure 20-7). Line bags are stowed on the cabin sole in the forepeak. Storm sails that are not hanked on and stowed on deck get put on the sole of the head. This way, we will not hesitate, even if we're seasick, to put out a drogue or put up a smaller storm sail.

Preparing for the worst before we leave port allows us to relax and enjoy our first few days at sea. Even if we encounter bad weather unexpectedly, we need no more than 20 minutes to batten down the boat and set our storm sails. Our prepassage routine ensures that we leave confident we are well prepared and have minimized the chances of seasickness or injury while we find our sea legs.

Figure 20-6.
In addition to shock cord over large items like the CD player, well-secured netting contains smaller items in an open storage area.

Figure 20-7.
Our drogue stowed in the main saloon. Note the mesh covers over the lockers above and the dinghy boots and boat shoes stowed in a handy spot by the diesel heater.

Figure 20-8.
Decks cleared for action: jacklines run, dorades and hatches sealed, trysail and staysail hanked on and ready to fly, side decks clear, and nothing stowed on deck.

On-Deck Preparations

Sails need to be set up for the first day at sea based on the forecast and your own observations of the current conditions. We prefer to set up several potential sail combinations to meet changing conditions for the first 24 hours or so. For moderate to strong winds, we preset a reef in the main and hank on our largest staysail with sheets attached. The trysail is hanked on and stowed in its bag on the deck. The jib is furled and the furling line cleated.

In calmer conditions, when we plan on using the furling jib, the staysail and trysail are hanked on and stowed in their bags (Figure 20-8). We lead the staysail sheets through the appropriate genoa track blocks and tie them off to the forwardmost handhold on the coach roof. The trysail sheets are stowed in the bag with the trysail. If the weather deteriorates and we have to reduce sail, we don't have to carry the staysail and trysail forward and hank them on. With the main, trysail, staysail, and jib readily available, we can manage any winds over 10 knots without having to set up another sail.

Beyond setting up the appropriate sail combinations for the expected winds, the following things need to be done before leaving port:

- **Dinghy.** Stow your dinghy securely. Deflate inflatable dinghies and stow them below. Lash rigid dinghies to good dinghy chocks. You can tie oars inside a rigid dinghy or store them below. Don't lash oars to handholds on the cabin trunk where they could interfere with your grip. Stow your outboard below or cover it and attach it to the stern rail. Stow gasoline on deck or in a sealed locker that drains overboard.
- **Wind vane.** Set up the oar, vane, and control lines. Adjust control line tension based on expected wind conditions.
- **Jacklines.** If jacklines are not permanently on deck, you'll need to set them up. We use two 55-foot lengths of 1-inch tubular nylon webbing with 3⁄16-inch Spectra line threaded through it. We cleat them tightly to bow and stern cleats using several layers of figure eights. Attach jacklines only to pad eyes or deck cleats. Other deck hardware is unlikely to survive a roll.

On *Silk*, the only thing we stowed on deck during a passage was our hard dinghy, which we lashed to teak chocks bolted through the deck. On *Hawk*, our high-latitude sailing agenda has made us even more conservative, and we do not stow anything on deck while on passage (Figure 20-8). If we ever get hit by a breaking wave, we don't want it to rip away a dinghy or our jerry jugs, or to destroy a solar panel or an outboard engine. We firmly believe that everything on board should have a place down below where it can be secured, if not for the entire passage, then at least for heavy weather.

The very last thing we do is plug the deck pipe for the main anchor chain. We never want to be maneuvering around port without the ability to drop an anchor. We leave our main anchor attached to the chain and ready to run until we have actually left port and are in open water with our sails up. Then one of us goes forward, lashes the anchor, unhooks the chain and attaches it to the deck pipe plug, and wedges the plug into the pipe (refer back to Figure 4-10). On the way back to the cockpit, we lower the courtesy flag of the country that we are leaving. From that moment, we consider ourselves offshore, and our passage routines take over.

CHAPTER 21
Basic Passage Routines

We always experience a thrill when land slips under the horizon and Evans and I are alone again with *Hawk* on an empty ocean. At that moment, I feel a mixture of apprehension and excitement. After weeks in port, the sea often seems overwhelming and a bit frightening. At the same time, I look forward to releasing shoreside worries and slipping into a world defined by the sea's natural rhythm.

After three or four days, we are completely under the spell of the sea. Sunrise and sunset mark the beginning and end of each day, and the little crosses on the chart mark our progress across the vast ocean. Taking care of the boat and keeping her moving toward our destination occupy most of our attention and almost all our energy. With whatever time is left, we take care of ourselves—sleeping, eating, and socializing. After a week or so, these routines merge into a seamless round punctuated by rare meetings with other vessels, moments of breathtaking natural beauty, and exciting interactions with marine life.

TAKING CARE OF THE BOAT

At sea, the boat is your world, and her needs must be your first concern. Taking care of a boat on passage means keeping her moving well in the right direction, navigating to avoid any hazards, changing sails in response to actual or expected wind changes, repairing any damage and doing preventive maintenance, and watching out for other vessels operating in the area. On some days, these activities could fill 24 hours for a crew of four or more. On other days, a crew of two can become bored at sea.

I have already discussed most of the things you do to take care of the boat: sail handling (Chapter 5), using self-steering (Chapter 7), navigating (Chapters 8, 15, and 20), finding and fixing potential maintenance problems (Chapter 13), and weather forecasting (Chapter 19). On most boats, the watchkeeping system provides the framework within which all of this gets done. A person or group of people is designated as "on watch" and responsible for the vessel while another group is "off watch" and able to see to their own needs. The off-watch is always available to assist if necessary.

A watchkeeper keeps watch—for other vessels, for changes in weather, for chafe on a line—for anything that could create a hazard to the safety of the vessel or her crew. Finding a workable way to keep a proper watch 24 hours a day often proves the most challenging aspect of passagemaking for doublehanded crews. Like most couples, we had to experiment over the course of thousands of offshore miles to find a system that allowed each of us adequate sleep while ensuring *Hawk*'s safety—and ours.

Doublehanded Watchkeeping

The risk of a collision at sea exists at all times and in all conditions. Keeping a proper watch means someone is actively scanning the horizon 24 hours a day, with the length of each watch determined by how long a person can remain alert and observant. Many shorthanded crews do not live up to this standard. Single-handers cannot possibly keep a proper lookout round the clock. Doublehanded crews can do so only if both crewmembers are well rested and not incapacitated by seasickness or injury.

All crews, no matter how small, must maintain a proper watch in known shipping lanes and within 100 miles of land where the shipping traffic increases and coastal hazards exist. That includes situations where the vessel is hove-to near land, whether in bad weather or waiting for enough light to enter port. While we were in Ireland, a cruising boat was run down by a freighter off Cork. Her single crewmember was below at the time and survived only because the boat was steel and a seaman saw the boat's mast over the freighter's side. The year after we left New Zealand aboard *Silk*, a freighter ran down a cruising boat with a family of four aboard 30 miles off the North Island in bad weather; three of them died. At the time of the collision, the boat was cruising under autopilot and the on-watch crewmember was below checking the vessel's position. The freighter that ran them down was running without lights in strong winds and big seas. Both situations might have turned out better if the crews had hove-to 60 to 80 miles from land and made the final approach in daylight and good weather.

While collision midocean is a concern, the vastness of the ocean renders it unlikely. As far as I know, the chances of a midocean collision between a sailboat and a freighter outside of major shipping lanes have never been calculated. But the chances seem slim indeed. For us, spotting another vessel at sea causes a minor uproar because it happens so seldom. Despite the rarity of seeing another boat, a proper watch should always be the goal—on any vessel, in any situation.

That said, watchkeeping is one of those areas where theory bears little relationship to practice. A healthy and competent crew of three or more can and should maintain a good watch at all times. Smaller crews on longer passages away from known shipping lanes must trade off the risk of a collision against the risks that come with fatigue—poor judgment, slowed reactions, dislocation, irritability, and a lack of initiative. Each crew has to balance the requirements of watchkeeping against the very real need for sleep.

Almost all crews modify their watch schedules over time as they develop skills, gain confidence, and learn their bodies' rhythms. This section uses a survey of thirteen couples to look at typical shorthanded solutions to watchkeeping and then discusses some standard watch schedules for doublehanded crews.

Survey of Thirteen Voyaging Couples

To find out a bit about how shorthanded crews handle watchkeeping on offshore boats, I did an informal survey of thirteen cruising couples who have completed passages without additional crew. Eight were experienced couples who had sailed at least 5,000 nautical miles; five were inexperienced couples who had completed one or two offshore passages of five days or more. Table 21-1 summarizes the results.

TABLE 21-1. WATCHKEEPING SURVEY RESULTS

	Experienced Couples	Inexperienced Couples
Total number of couples	8	5
Daytime watchkeeping:		
Watch schedule in place	1	3
No watch schedule, but someone on deck	7	2
Nighttime watchkeeping:		
Watch schedule in place	8	5
Rigid watch schedule	2	5
Flexible watch schedule	6	0
Each person takes same watches each night	2	0
Watches rotated over passage	6	5
Average watch length:		
< 4 hours	1	4
~4 hours	4	1
> 4 hours	3	0

The data in this table illustrate how watchkeeping changes as couples gain experience:

1. **Informal daytime watches.** Daytime watchkeeping becomes less formal as couples learn to work together to keep someone on deck at all times without a specific watch schedule.
2. **Flexible nighttime watches.** Overnight watch schedules tend to become less rigid over time. Instead of assigning specific hours, couples agree in general to the watch schedule and then modify it based on how each is feeling. Experienced couples evolve their watch schedules to make best use of their individual sleep patterns and allow the on-watch more flexibility in determining when to change the watch.
3. **Longer watches.** Most of the experienced couples started out with 2-hour watches until they gained confidence, then watches lengthened, sometimes to 6 hours or more. The experienced couple with less than 4-hour watches made most of their passages in the cold weather of higher latitudes.

Comments from three of the experienced couples provide additional insights on how they handled watchkeeping.

Mark Scott, Liz Hammick, and their daughter, Chloe, aboard *Lone Rival*, a Rival 38, crossed the Atlantic twice and circumnavigated Africa (Chloe was preschool age at the time). Mark said, "Our watchkeeping on a passage was fairly loose. There was always someone designated 'on watch' both day and night, although that person might change during the daytime more frequently than at night. [If one of us was reading to Chloe] out in the cockpit, that person was on watch; if she was busy down below, I might work on the engine and Liz would be on watch. If Liz was preparing a meal I would be on watch.

"After dinner our watchkeeping became more regular, with one person taking a watch until midnight, the next until 4 or 5 in the morning. Seldom did a night watch last less than 4 hours, but if the person on watch was awake or in the middle of writing a letter, that watch might go on for another hour. . . . It takes a couple of days for Liz to get her sea legs and that would influence our watchkeeping schedule. . . . Overall, I would say we are fairly relaxed in the duration of a watch, although we are fairly conscientious about always having a watch."

Liza and Jim Troutman aboard *Imagine*, a Shannon 38, circumnavigated the Atlantic. Jim told me, "Liza and I developed a watch system after many years of trial and error. We started with 2-hour [watches] because it helped build our confidence. We then went to 3 [hours], which allowed us more rest. Finally we evolved to 4-hour [watches], which allowed us more sleep when we needed it. However, it is not 4 hours on, 4 hours off. . . . When one person is ready to rest they are in their bunk for 4 hours. We try to keep this uninterrupted. If there is a need to call that person the time up [on deck] is not counted in the watch. This happens rarely as we do most of the 'group' work between watches. . . . During the periods of darkness we try not to have too much time between when one person comes on watch and the other gets to rest. Say I awaken at 1700 and come off rest. I go on watch and Liza starts dinner prep. We eat at 1800 and talk and socialize until 1900. Liza then goes off watch and I am on until 2300—4 hours of rest for Liza. . . . This means that we did not have the same hours each day and we came to prefer that. . . . We never had trouble getting 6 to 8 hours of sleep a day with this scheme and we always had someone on watch."

Scott and Kitty Kuhner have circumnavigated twice, the second time with sons Alex and Spencer aboard *Tamure*, a Valiant 40. Kitty described their watchkeeping arrangements. "When the kids were too young to keep a watch, Scott took the after-dinner watch as long as he could stand it, generally 1900 to 2300 or so. Then I came on until dawn. It was a good arrangement for us as I easily fall asleep right after dinner and am a pretty good morning person, even if a minute after midnight is a little earlier than I'd like!

"About a year into the trip, we felt Alex and Spencer (about 12 and 10) were old enough to take the evening watch together, but for a shorter time—say 1900 to 2200. They were not allowed off the companionway steps and checked the horizon after each song they listened to on their Walkmans, about every 3 to 5 minutes. Any question at all was a mandatory 'Wake Mom or Dad.' . . . They easily understood the red, green, white light system and judging distances. Both learned early how to use the radar and became very good at determining if we were on a collision course. In fact, Alex was on watch coming into the Bab el Mandeb Straits at the lower end of the Red Sea—you can imagine how busy it was! I came up on deck early and flipped out over the number of boats around us. It was about midnight and the horizon was strewn with lights. Alex couldn't stand it that I was so nervous and sent me back down below with an admonishment not to come on deck again without having had a cup of coffee and woken up fully!"

Watch Systems for Doublehanded Crews

As the survey shows, flexibility becomes the "watchword" for most experienced crews. But it also shows that inexperienced crews tend to start with a formal watchkeeping schedule while they learn to manage on less sleep and figure out their natural rhythms. Table 21-2 shows four different doublehanded watch schedules in use on many offshore boats.

All these watch schedules provide at least 4 full hours off twice a day. The basic watch schedule lets each watch team develop a set pattern of sleeping and waking for the entire passage. However, many people prefer to vary the watch schedule because they find one watch particularly difficult—usually the midnight to 4 a.m. "graveyard" shift. For this reason, the Royal Navy and Merchant Marine use "dog watches" in the late afternoon to stagger the schedule from day to day. If the weather is cold or stormy, or if the crew is forced to hand steer due to a mechanical failure, the 12 hours from 2000 to 0800 can be broken up into four 3-hour or six 2-hour watches. The modified Navy schedule moves the dog watches to between midnight and 4 a.m., thereby splitting the graveyard shift into two short watches.

Most people find it easier to stay alert during daylight hours. Some crews therefore divide the daylight hours into two long watches of 6 hours each. When children are old enough to assist in the watchkeeping, they can be given a short daylight watch until they gain confidence and competence.

The schedules shown in Table 21-2 work equally well for four-person crews with two watches of two people. A single additional crewmember greatly eases the burden of watchkeeping. With three aboard, the night hours can be divided into three watches of 4 hours each, giving each crewmember 8 hours of sleep each night.

TABLE 21-2. ALTERNATIVE WATCH SCHEDULES FOR DOUBLEHANDED CREWS												
	0000–0200	**0200–0400**	**0400–0600**	**0600–0800**	**0800–1000**	**1000–1200**	**1200–1400**	**1400–1600**	**1600–1800**	**1800–2000**	**2000–2200**	**2200–2400**
Basic (4 on/4 off)	A	A	B	B	A	A	B	B	A	A	B	B
Royal Navy, Day 1	A	A	B	B	A	A	B	B	A	B	A	A
Royal Navy, Day 2	B	B	A	A	B	B	A	A	B	A	B	B
Modified Navy, Day 1	A	B	A	A	B	B	A	A	B	B	A	A
Modified Navy, Day 2	B	A	B	B	A	A	B	B	A	A	B	B
Long watch, Day 1	A	A	B	B	A	A	A	B	B	B	A	A
Long watch, Day 2	B	B	A	A	B	B	B	A	A	A	B	B

Finally, the three-two-one system (Table 21-3) provides a good way for doublehanded crews to break in to watchkeeping by keeping the watches relatively short.

In practice, when crews get comfortable with each other and with being at sea, the daylight hours often become less formal, and a watch schedule is maintained only at night. This works well for many crews, and most people come to enjoy the freedom of the days in contrast to the structure of the nights. But make sure the burden of the daylight watchkeeping does not fall on the more diligent crewmember.

As you gain experience, you will modify these watch systems to reflect your individual needs and preferences. You will develop different approaches for shorter (often coastal) passages where a formal watch schedule may be too inflexible for the time frame or the traffic conditions. The watch routines we have developed over a decade of offshore voyaging help illustrate the range of situations you will need to consider and the flexibility common among more experienced crews.

Our watch routine for long passages respects our individual sleep patterns and tends to vary the least from passage to passage. Evans needs more sleep than I do, a total of 9 or 10 hours in 24, which can be taken in a series of short naps. I can make do on 5 or 6 hours of sleep a night for several weeks, but if that's all I'm getting, I need it all at one time to keep functioning. I'm a morning person, whereas Evans prefers evenings. Sunrise is my favorite time of the day, so once the sky begins to lighten, I have no problem staying awake for another few hours. Our watch schedule has evolved over time to reflect these realities.

During the day, we have an informal schedule. Whoever is on deck is in charge. When I'm cooking or cleaning up, Evans takes the watch. When he's navigating or getting weather, I take it. He often naps in the afternoon, and I stay on watch during that period. I usually go to bed between 1800 and 2000 depending upon how tired I am. Evans takes the first watch until midnight. I take over then and stay on watch until Evans wakes up, which is usually just after sunrise and varies between 0600 and 0800. We eat breakfast together, catch up on the happenings of the night, and then I go back to bed and sleep as long as I want, usually until 1200. Evans will usually take a 2- or 3-hour nap in the afternoon, and then we'll have dinner together before starting all over again. While a 4-hour night watch initially seemed interminable, like many experienced couples we found that we enjoyed longer watches after we had been out for a year or so.

TABLE 21-3. THREE-TWO-ONE WATCH SYSTEM											
0000–0300	**0300–0500**	**0500–0600**	**0600–0700**	**0700–0900**	**0900–1200**	**1200–1500**	**1500–1700**	**1700–1800**	**1800–1900**	**1900–2100**	**2100–2400**
A	B	A	B	A	B	A	B	A	B	A	B

We tend to be fairly rigid about maintaining this rotation, though we're flexible on the exact hours. If I can't sleep early in the evening, I stay up later and may have to get Evans up a bit earlier the next morning. If I have to get Evans up for several sail changes during the night, I will let him sleep later in the morning as long as I'm not exhausted. Evans always lets me sleep as late as I want after I go to bed in the morning.

Establishing a watch system for passages of two to five days is more difficult. It takes us about a week to really get into passage rhythm, after which it doesn't matter how long we are out (to a point—we did find our limit somewhere around the forty-fifth day of a sixty-day passage). For shorter passages, we tried different watch schedules, such as those outlined above, but we soon learned to work with our own rhythms rather than forcing ourselves into an artificial schedule. We structure our watches around what works for us on long passages, but we're not rigid about the schedule. If one of us can't sleep, we'll switch places and see if the other can get some rest.

For an overnight hop from one island to another, we often don't bother with a formal watch schedule. For one night we can do whatever needs to be done and catch up on our sleep the next day. We do try to make sure that one of us is getting some sleep or at least resting throughout the night, but we don't follow any set schedule and just allow our bodies to dictate who goes down below when.

We also have found that the boat influences our watchkeeping. We were less vigilant on *Silk* than we have been on *Hawk*. We sailed *Silk* in the trade winds where the weather did not change that rapidly. She was more forgiving, so if we got caught dozing when a squall came, she'd dump us on the cockpit sole, and we'd know it was time to reef. If we were several hundred miles from land or from shipping channels, had not seen other vessels for several days, and were both feeling fatigued after a period of squally weather and little sleep, we would get less formal in our night watchkeeping. The person on watch would doze in a bunk, set an alarm for every 20 minutes, and go on deck to make sure that nothing was visible. While a freighter could conceivably have come over the horizon and collided with us during that period, we felt that the risk was acceptably small.

Hawk is much less forgiving, and we need to get sail off her quickly if the wind comes up. We've sailed her primarily in the temperate and high latitudes where the weather changes quickly with little warning. We have kept almost perfect 24-hour watches on *Hawk* on passages where we have gone over a month without sighting another vessel.

We occasionally use the radar when making landfall or entering crowded shipping channels in poor visibility. But we do not rely on it to ease watchkeeping offshore. Setting a contact alarm at 6 to 8 miles should warn us if anything comes within that radius. But the alarm often goes off for a rainsquall while occasionally missing freighters, and the radar consumes a large amount of electricity. We view it as a last resort when well offshore and will use it only if we are both exhausted and know we're not keeping a very good watch.

Lessons Learned: Watchkeeping

Most people find it very difficult to get enough rest on their first few passages. Yet rest is critical to safety, and staying rested has to be a priority for every member of the crew. The eight experienced crews interviewed in the survey above offered the following tips for sleeping well at sea:

1. **Avoid stimulants.** Fueling up on caffeine can get you through a quick overnight sail or even a two- or three-day passage. But for most people, if caffeine keeps them awake on watch, it will prevent them from going to sleep off watch. The same can be said for amphetamines like NoDoz. Most of the experienced voyaging couples we know avoid stimulants on passage altogether, though some reserve them for landfall or boisterous weather where frequent sail changes or extra attentiveness may be necessary.
2. **Don't neglect bedtime routines.** Even if you have only a few hours before your next watch, normal bedtime routines will help convince your body to go to sleep. Change out of your watch clothes. Wash your face and brush your teeth. These little rituals help your body relax into its sleep cycle. Falling straight into bed with your watch clothes on will make you restless for the first hour and leave you feeling grubby and uncomfortable when you wake up for your next watch.
3. **Make it easy to connect to the on-watch person.** We both startle awake on passage, jolted from deep sleep by a change in the sound of the wind or the rhythm of the waves. If we can't get back to sleep within a few minutes, we're likely not to get back to sleep at all. Immediate reassurance from the on-watch person allows us to fall back to sleep without ever really waking up. On *Hawk*, the sea berths are right by the companionway. The off-watch person can hear the on-watch person call for assistance and can make verbal contact instantly upon waking.
4. **Maintain blood sugar.** As you come on watch, getting your blood sugar back up will help get you through the low-energy cycle that most people experience in the small hours of the morning.

Outside the tropics, I like a hot drink without caffeine—herbal tea with honey, Cup-a-Soup, or hot chocolate. On hot tropical nights, I prefer juice. An hour or so later, when you're awake enough to consider "breakfast," snack on something with complex carbohydrates rather than straight sugar. Sugar tends to create an immediate high followed by a blood sugar crash that will either leave you drowsy or have you back to the candy box for another round. Whole-grain crackers, rice or corn cakes, trail mix, or dried fruit all make good snacks that will replenish your sugar level and ward off drowsiness.

5. **Don't waste sleep time.** It often takes some time and a serious effort to get to sleep, especially early in a passage when we're not yet adjusted to all the sounds and motions. If someone can't sleep, let that person keep watch. Aboard *Hawk*, the on-watch person can extend the watch if he or she is wakeful, and the off-watch person is sleeping peacefully. If the off-watch person insists on being on deck, the on-watch person is free to go below and try to sleep. One of us can almost always get some useful rest, even if not real sleep.
6. **Respect the conditions.** Most crews shorten watches in adverse conditions—in cold or heavy weather, when hand steering, or on squally nights with frequent sail changes. In these conditions, the physical demands wear out the watchkeeper even if they make it easier to stay awake. Off watch, sleeping becomes more difficult, but rest becomes more important. In these conditions, 2- or 3-hour watches tend to be the norm.
7. **Rest whenever you can.** Sleep at sea is a feast-or-famine business. No matter what watch schedule you end up with and what tools you use to help you keep it, if there are only two people aboard there will be nights when neither of you gets any sleep. In squally conditions or in heavy weather, you'll learn to live with the fatigue and replenish your energy from short naps. When the weather settles and you can sleep for all your off-watch hours, you will catch up.

The watch schedule you come to may not resemble anything that I have described in this section, but it should reflect your sleep patterns and preferences and your assessment of the risks. You need to agree on the level of watchkeeping you will maintain in various situations, so set the ground rules before you head off to sea.

Duties of the Watchkeeper

Keeping a proper watch means more than drowsing on deck. It means regularly scanning the entire horizon for other vessels, taking bearings if another vessel is crossing your course, strolling the deck to look for chafe and wear, maintaining sail trim and course steered, and watching the weather. Proper watchkeeping also means knowing when the off-watch is needed on deck and calling him or her in time to reduce sail before the squall hits.

Although ships' lights will help you pick out other vessels more easily at night, vision won't help much with sailing the boat in the dark unless you keep your eyes adapted to low light. Eyes need a half hour or more to adjust to the dark, and a single flash from a cabin light can destroy your light adaptation. Down below, red lights in the galley, head, and nav station will protect your night vision. On deck, we prefer using no light at all most of the time. On a dark night, the sound and feel of the boat tell us how well she is sailing and whether anything has changed. When we absolutely must use a light, we prefer a headlamp with a red filter, as this leaves our hands free and puts the light right where we need it.

The single most important duty of the watchkeeper is to prevent a collision. Preventing a collision starts with being visible at sea, and ways to increase visibility were discussed in the Preventing Collisions section in Chapter 7. While visibility increases safety, it does not guarantee it. Chances are you will have a close encounter at some point, most likely in a shipping lane or near a harbor entrance. The Close Encounters with Ships section in Chapter 15 recounts two close calls we have had with vessels and what we learned from them.

In dealing with collision situations, the first rule is to know the rules. Get the COLREGS (International Regulations for Prevention of Collisions at Sea) and become familiar with them. They are included in most nautical almanacs or can be downloaded from a number of different websites (see the resources for this chapter in Appendix 1). Learn what different light patterns mean and have a reference aboard to use if you are confused. The second rule is that everything out there is bigger than you are, so the rules don't really matter. When it comes to collision avoidance, assume that it's up to you. In a collision situation, try to make contact on the radio if at all possible. Otherwise, signal your intentions early, make easy-to-see course corrections consistent with COLREGS, and give other vessels as wide a berth as possible.

Practically speaking, when watching a vessel in the distance, the best way to tell if its position is changing relative to yours—if they are not going to hit you—is to watch them over a fixed point on the boat. Pick a stanchion or a winch with the vessel behind it, take a bearing to the vessel over it, and then see if the ship's position changes relative to it. If not, you are on a collision course, and you need to take some evasive action immediately.

Beyond watching for other vessels, the on-watch crew is responsible for the following:

- **Change of watch.** At the change of the watch, the new on-watch crew should come on deck about 5 minutes before the changeover. Before coming up, the new crew should take a look at the chart to determine the current position and review the log to see what has happened during the last watch. The retiring crew should explain the current situation including position, course, wind speed and direction, recent sail changes, weather observations, and any trends that might be useful for the next watch. Telling the oncoming watch that the wind has been veering 15 degrees and increasing to 25 knots whenever a squall comes along will help him or her adapt more quickly. Everyone should agree on who is responsible for waking the next watch. Will the current watch wake the off-watch crew, or will the off-watch set alarms and come on deck without assistance?
- **Sail trim and sail changes.** Some doublehanded crews have a rule that both crewmembers must be on deck for any major sail changes. When the boat starts to feel undercanvased or overcanvased, the on-watch crew is responsible for getting the other crewmember up and managing the sail change. We do not follow this rule on *Hawk*. We designed the boat so that one of us can do almost all sail handling alone. If we have to do something that can't be done alone, like set or douse a chute, we try to delay the sail change until the change of the watch. If we can't wait and we have to get the other person up, we both prefer to be told what to do when we're half asleep, not asked for advice. If the situation demands deliberation, then we confer once the off-watch person is awake enough to do so.
- **Staying on course.** Being on watch does not mean being at the helm. If it did, we could never manage 6-hour watches. Staying on course generally means tweaking the wind vane or adjusting the electric pilot. If you find yourself constantly playing with the steering controls on the vane when the wind seems consistent, make sure your sails are well balanced for the conditions.
- **Navigation.** With GPS, navigation means pushing a button and writing down a position. But navigation also includes keeping the ship's log and plotting your position on the chart. The log serves many functions, from recording how the boat does under various sail combinations to tracking motoring hours for calculating diesel usage. But most important, it would give an off-watch some idea of when someone went overboard if he or she woke to find a crewmember missing. The ship's log should include the date, time, course, speed, wind speed, wind direction, barometric reading, pressure change, position, and any comments on sail combinations, cloud cover, or swell. We update the log every 4 hours during the day and less frequently at night to preserve our night vision. We plot an X on the chart to mark our position at noon every day.
- **Preventive maintenance.** Twice a day on passage one of us works our way from bow to stern trying to find anything that isn't exactly as it should be. We correct problems as soon as we find them, and we keep a log of any additional repairs that may need to be made in port after the passage.
- **Weather watching.** The on-watch person is responsible for downloading any weather information that comes during their watch (Figure 21-1). On *Hawk*, Evans also downloads GRIB files every few days (see the Downloadable Weather Files section in Chapter 19). In addition, we keep track of the weather outside the boat to see how it matches up to the forecasts. Every time we step on deck, we note any changes in wind speed, wind direction, swell size, swell direction, cloud cover, cloud movements, and temperature. We note the barometric pressure in the log and its rate of change. If enough signs point to deteriorating weather, the on-watch is responsible for beginning storm preparations.
- **Respecting the off-watch.** The on-watch crew must respect the off-watch crew's need to get as much sleep as possible. That means keeping the boat sailing well (neither wallowing nor pounding), not making sail changes just to stay awake, and eliminating unnecessary noises. Take a stroll below oc-

Figure 21-1.
Evans downloading weather information in the Southern Ocean.

casionally and stuff a sock between the clinking bottles or reorganize the can drawer.
- **Calling the off-watch to assist.** The watchkeeper needs to call for assistance immediately when it is required. That may be for a sail change, a sudden equipment failure, a potential collision situation, or to confirm the watch's judgment. Part of learning to trust your partner(s) is believing that they will call you if the situation warrants it; part of learning to trust yourself is distinguishing between a crisis of confidence and a crisis in reality.
- **Preparing to hand over the watch.** The on-watch crew should have hot water available and replenish the snacks 10 minutes or so before the off-watch crew gets out of bed. Some crews make a habit of handing the new watchkeeper a cup of something hot when they come on deck.

On a doublehanded boat crewed by a couple, the changeover is not usually very formal, but the activities remain the same. As the passage takes on its own rhythm and develops its own pattern, much can be done to limit the number of disturbances experienced each night.

Many settled passages follow a daily cycle of wind increases and decreases based on humidity and local sea and air temperatures. We became most fatigued on the passages characterized by frequent and unpredictable squalls. Squall formation occurs most often in the late afternoon and evening, with the worst squalls coming late at night. Even without squall activity, the wind tends to increase by 5 to 10 knots at night in the tropics. On the other hand, on coastal passages and passages in or near the doldrums, the wind often goes light as dusk approaches and does not fill in again until the next morning. By adjusting the sails at dusk to anticipate these wind speed changes, you'll end up with fewer sail changes and more sleep.

During those times when sleep seems an impossible luxury, remember that fatigue leads to low morale and to errors. Whether you are reducing a sight, plotting a position, setting up a spinnaker pole, or end-for-ending a chafed line, double-check everything. Ask your partner to look at what you've done before you put away the tools or raise the halyard. Two heads are better than one, especially when both are operating at less than 100 percent.

TAKING CARE OF THE CREW

At sea, the boat comes first. Her rhythms determine yours, her needs dictate your priorities. But once the boat is rolling along happily in the trade wind swell, your time is your own until the boat demands your attention again. You can eat, sleep, wash, exercise, and relax.

People respond differently to unstructured time at sea. The lack of routine aboard and the need to be ready to respond to the boat's demands day or night creates a sense of limbo in which normal standards and activities seem inconsequential. Time as we know it ashore, marked by a steady progression of meals and activities and sleep, can become irrelevant in the flow of sail changes and watches. When that happens, a certain kind of discipline can seem irrelevant as well. When day flows into day, little things like brushing your teeth, washing, or taking medications can get lost in the confusion. This may be why the world's navies have always maintained an iron discipline.

Aboard your own boat at sea, the discipline need not be enforced with the cat-o'-nine-tails. However, for many voyagers some sort of structure does need to be superimposed on the rhythm of nature to keep a sense of order and civilization. A routine that sensibly includes food, sleep, and hygiene within the context of the boat's demands keeps crew morale and energy up. You will understand what I mean when you realize it has been five days since your last shower, and nobody has noticed. It may take you a few passages to find a sense of order that suits your sea style.

Cooking

We had been in the grip of a strong high with winds over 30 knots in the southern Indian Ocean for seven days straight. The combination of the normal trade wind swell over our stern and a large swell out of the Southern Ocean on our beam made being below like living in a front-loading washing machine. I was trying to make bread, and the yeast went flying off the top of the gyrating gimballed stove three times. I was so tired of it—of the noise and the motion, but mostly of the planning required to execute even the simplest maneuver. I yelled, "I want 5 minutes of calm! Just 5 minutes when I can set something down without it going into orbit! Five minutes of peace!"

Usually cooking at sea will not threaten your sanity. However, most experienced captains readily admit that the cook has the hardest job on the boat. Avoiding injuries and preventing seasickness requires some planning when the galley is regularly moving 3 or 4 feet in different dimensions. A sea-safe galley starts with galley design as discussed in the Seaworthy Interior section in Chapter 3 and the Modify Your Boat's Interior section in Chapter 4. No matter how simple or luxurious your galley is, finding usable work surfaces when the boat is in a constant state of flux between flat and heeling will prove challenging. You need at least two surfaces for kneading bread, cutting up vegetables, or mixing cakes.

On most boats, the gimballed stovetop offers the only useful surface in a rolling sea. This will often be the only surface on which you can leave things unattended for short periods of time. From the belted-in position in front of the stove, the cook should be able to reach the most frequently used lockers. Deep sinks offer one of the few spillproof spots to put things while mixing ingredients or balancing hot pans. Sinks can be a great place to set a bowl, add ingredients, and then mix everything up. Keep a few towels or rags within easy reach to wedge into the sink to keep things from sliding back and forth.

The two most difficult conditions for coping with cooking at sea are heavy weather and heavy rolling. In heavy weather, minimize cooking with simple one-pot main courses. On most passages you will have to deal with these conditions for only a couple meals if at all. Trade wind sailing will often involve managing a galley rolling through 30 or 40 degrees. The techniques that follow help make cooking at sea easier all the time but are particularly useful in rolly, trade wind conditions. You will want to master this skill as quickly as possible.

- **Gather necessary ingredients.** Most offshore cruisers keep small quantities of baking and cooking ingredients in containers in the galley. Extra quantities are stowed in less accessible areas. Refill any containers that are low before you get started. Gather any additional ingredients, bowls, measuring cups, or pans not stowed in the galley. Put everything on the gimballed stove or wedge them into the sink.
- **Determine your work area.** Depending on what you are making, the best work area might be your cutting board, a large bowl or pot wedged into one of the sinks, or a large pot on top of the gimballed stove. Make sure your container will stay put even if you have to let go of it from time to time.
- **Prepare fresh food in a seated position.** If the recipe calls for peeling, slicing, and dicing fresh fruits and vegetables, your most secure position has your bottom in contact with a solid surface. I like to take the necessary produce and a large pot out into the cockpit on a nice day. Once you have finished with the fresh food, put it in your pot or pan and set it on the gimballed stove or wedge it into the sink with some spare towels so it doesn't slide around.
- **Work with one ingredient at a time.** For items that are stowed in the galley, get out one ingredient at a time, do what you need to do with it, and then put it away. This minimizes the amount of space you need and the number of things that get away from you. If using measuring spoons, cups, or small utensils, rinse them off with a bit of fresh water, wipe them down, and put them back. This conserves water by minimizing the dishes to be done later and keeps the work area and sinks from getting cluttered.

When the meal is ready, you are faced with the most hazardous part of the entire proceeding: getting the food onto a plate without injuring yourself. This is one area where "one hand for the ship and one hand for yourself" simply does not work. Following are a few suggestions for making sure the food ends up where you want it:

- **Pasta.** When cooking pasta or anything else in a large amount of boiling water, use a slotted spoon to transfer the cooked food to a bowl instead of trying to pour the boiling water into the sink in a moving galley. I often let the water cool while we eat, then use it instead of salt water to wash our dishes.
- **Hot liquids.** Strap yourself in when pouring hot liquids, then use two hands: one for the kettle, and one for the mug. You cannot pour accurately from one container to the other if you are not holding both. Never try to pour hot liquids into a container set on the gimballed stove. The slight delay in response of the stove means that you are always trying to hit a moving target not synchronized with your own motions.
- **Baked goods.** The balance of most gimballed stoves changes when the door is open, and you run the risk of having the hot food rendezvous with the galley sole or with your body unless you are quick on the draw. If you can retrieve whatever is in the oven using one hand, use the other hand to control the motion of the stove and use footholds to brace yourself in place. If you need two hands, lock the oven in place, brace yourself securely, and then time the opening of the door to correspond with the boat's roll.

While these ideas will help prevent injuries and keep the cook from getting seasick, they cannot be guaranteed to keep the cook sane. Cooking in a seaway teaches you patience and maturity—you learn to think about where you are putting things, plan before you act, and not pout when things don't stay put through a 30-degree roll. Still, there are times when the only thing that helps is to stomp around and yell at things.

Sleeping

Passages are all sound and motion. The motion on a small boat at sea translates into a variety of sounds that work their way deep into the subconscious. As I try to go to sleep in my bunk, my mind sorts through the litany of sounds surrounding me: the creak of wood on wood over the quarter berth, the waves gurgling by the hull next to my ear, the fresh water sloshing around in the water tank, the wind rattling a halyard against the mast, the snap of a sail as it fills. Gradually, my mind accepts each noise, and I am lulled to sleep by this strange chorus. But let even one of these sounds change, and I will wake immediately.

This constant awareness means that on a double-handed boat, you rarely fall into a sound sleep. A sleep deficit—of which you may be unaware—can result. This gradual fatigue and dulling of the senses saps energy and lowers morale. To avoid it, crewmembers need to get enough rest—even if they are not falling into a deep sleep. But the excitement of departure or of landfall can make sleep difficult. Inexperienced watchkeepers will often be on deck for both watches, too excited to get into their bunks. On fully crewed boats, the skipper needs to insist that "off watch" means "off the deck" to ensure that no one crashes a few days out and throws off the whole watch schedule.

To sleep well in a bouncing, rolling bed, you'll need a comfortable, well-ventilated sea berth fit with a good lee cloth or board as discussed in the Seaworthy Interior section in Chapter 3 and the Modify Your Boat's Interior section in Chapter 4. When you're motoring, the noise of the engine can make sleep difficult, especially if the sea berths are located in an aft cabin next to the engine compartment. Earplugs can help the off-watch sleep when the engine is on. The earplugs made for use by industrial workers provide the most protection and are the most comfortable to wear.

Finally, when you are tossing and turning and trying to figure out what position will stop you from rolling around with the boat, try lying on your side and drawing your top knee up toward your chest while stretching out your bottom leg (Figure 21-2). Almost everyone comes to this position after a few rolly passages.

Hygiene

In wet conditions, water and salt will travel below on you and your clothes. Salt is insidious: constant moisture from salt can lead to open sores and rashes; salt in clothes and bedding absorbs moisture from the air to make fabrics clammy and leave you chilled; and salt from bedding can be absorbed into cushions, which renders them perpetually damp. Airing out the offending clothes and bedding will help for only as long as they are in the sun and wind. Back below, they will become damp again within a few hours. Once a passage gets off to a wet and salty start, it will be uncomfortable until everything can be rinsed out thoroughly in port.

But don't despair. After a few damp, uncomfortable passages, we developed four simple rules to improve life aboard. Managing clothes and foul-weather gear in a limited space is always awkward. But dry, comfortable quarters below make the effort worthwhile.

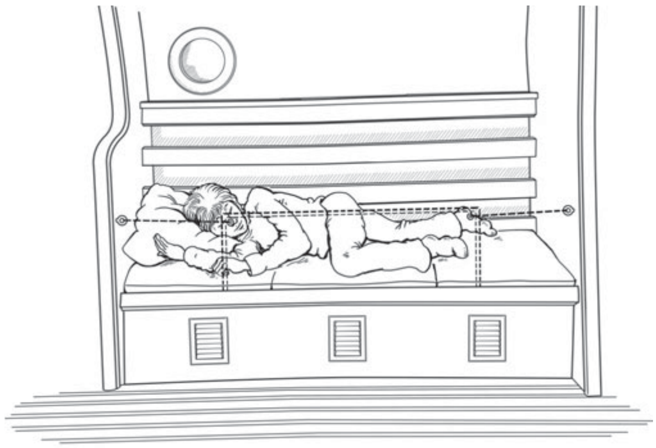


Figure 21-2.
Sailor's rest—a position that everyone trying to sleep on a rolly boat seems to come to eventually. (Fritz Seegers illustration)

1. **Protect the companionway.** A good dodger will go a long way toward preventing water from coming below. However, when the weather starts to turn nasty, only well-constructed hatchboards can really keep water out. After several unpleasant experiences, we made a rule that the hatchboards went in and the hatch was closed the minute the first wave left visible splash marks in the cockpit. That rule has saved us many times when conditions seemed benign.
2. **Minimize clothes or make yourself splashproof.** On our first long, wet passage, we made the mistake of repeatedly changing into dry clothes, and we went through half a dozen changes of clothes in two days. Salty clothes are difficult to stow and impossible to clean on passage, so minimizing them will go a long way toward keeping the boat livable down below, even in bad weather. In the tropics, it is often warm enough to be on deck naked in wet weather. In slightly cooler temperatures, a windbreaker and quick-dry lightweight shorts or pants keep us from getting chilled. In cooler climates, we wear as many layers as are necessary to stay warm and then splashproof ourselves whenever we go on deck. That means pulling on a layer of waterproof clothing over the top of everything else right before climbing the companionway steps in wet weather.
3. **Strip off salty clothes at the foot of the companionway.** Coming below from a wet and salty deck, our outer layer is often soaked. If we're wearing splashproof gear, we shed the outer layer at the base of the companionway and hang it in the head until we next go on deck. If we're wearing quick-dry clothing or nothing at all, we get rid

of the clothing and wipe ourselves down with a freshwater washcloth at the bottom of the companionway. Then we towel off with a dry towel. (Simply toweling off leaves salt on our skin, which causes chapping and chafing.) After wiping ourselves down, we put on dry "below-deck" clothes that we shed before going back on deck. Failing to strip salty clothes or wipe ourselves down if we get wet means that salt accumulates in the cushions where we sit most frequently, leaving them damp after a few days at sea.

4. **Keep salty clothes in a designated area.** Salty clothes are not allowed anywhere in the boat except by the companionway. When we come below and strip, we hang our wet clothes on hangers in the wet locker in the head on *Hawk*. On *Silk*, we hung them from the handrail in the galley or dropped them over the oven safety bar. When we go back out, we pull on splashproof gear over our below-deck clothing or get back into our wet clothes. They warm up quickly enough once we got moving, as long as they aren't cotton.

A head at the bottom of the companionway steps equipped with a hanging locker helps you adhere to these rules and maintain privacy. A curtain at the foot of the companionway also provides privacy and helps isolate on-watch activity from below. If these arrangements are not feasible on your boat, the choice comes down to modesty or a salt-free home. The choice was easy for us, but we never took on extra crew.

No matter how careful you are, salt will find its way into your bedding over the course of a long passage. Bedding takes a great deal of fresh water to get clean. Large washing machines are the only way to remove salt from bulky blankets and sleeping bags. To make laundering as painless as possible, stick to cotton sheets and light blankets in the tropics. We use light bedding for about two weeks at sea before it becomes uninhabitable. In colder weather when you need heavy blankets or sleeping bags, put several light or midweight layers between your body and the heavier bedding. This minimizes the chance of salt getting into hard-to-clean items. Using this strategy, we only need to launder our heavy bedding once a year.

In the very worst weather, some of these rules may have to go out the window. If the off-watch crew has to be able to get on deck at a moment's notice in cold, stormy weather, the only solution is to climb into a bunk with foul-weather gear and boots on. We have been in this position a handful of times in our decade of offshore sailing. It helps to remove absorbent bedding such as sleeping bags and wool blankets and leave only easily cleanable bedding such as fleece blankets and cotton sheets.

Diversions

Once you have taken care of the boat and your most basic needs, you will have time to enjoy a few diversions. Special activities and celebrations can help you memorialize the major milestones of a passage, especially if you have children aboard.

Nature provides the greatest diversions free of charge. A pod of dolphins may stay with you for several hours, giving you more entertainment than a blockbuster movie. Seabirds will try to land on your rigging and will generally not succeed, accompanying their efforts with much squawking and flying feathers. Sunsets may be breathtaking and fill the whole sky, or they may be sublime and end in a green flash. Even gales and squalls have their own beauty, and rainbows at sea seem bigger and more vibrant than those on land.

When nature is being less than entertaining, the range of activities is necessarily limited by the boat's constant motion. The following diversions work well on passage and constitute most of what occupies us while at sea:

- **SSB or world-band receiver.** The ubiquitous cruising nets and chat shows provide great entertainment while on passage. Most of our friends spend an hour or more a day conversing on the high-seas radio. When not in use transmitting to friends or receiving weather forecasts, our radio is usually tuned to the BBC, the primary source of news, information, and entertainment for offshore sailors. There can come a point where you wonder if the whole world has stopped while you've been at sea, and the BBC offers proof that life goes on. Like the soap operas, the news changes remarkably little when listened to from a distant enough perspective. Even that is reassuring at sea.
- **Reading.** Books offer prime entertainment at sea. Evans often reads a book a day on passage. We have to make sure to stock up sufficiently before a long voyage. Book lights sold in major bookstores for reading in bed can also be used in the cockpit. The new LED lights can go 100 hours or more on one set of batteries.
- **Writing.** A book light with one of the pillow lap desks from bookstores or specialty stores will allow you to write letters or keep a journal even out in the cockpit on watch.
- **Games.** Some card games work well at sea, including cribbage and rummy. Travel games designed for cars work too, as long as the pieces are not so

MANAGING GARBAGE AT SEA

Like so many other things, managing garbage at sea requires balancing what is possible against what is desirable. We would prefer not to throw anything overboard. But in the real world, two problems exist. First, sequestering several weeks' worth of potato peels will start a compost heap in your forepeak. That might be useful for growing sprouts aboard, but the odor (especially in the tropics) will drive you from the boat. Second, and more distressing, when you arrive at many islands and dutifully drop your garbage in the rubbish bin, it is often dumped on the beach to be removed by the tide. On the most remote and pristine of islands, the islanders have always disposed of their waste on the beach. When that consisted of coconut shells and human excrement, it was not much of a problem. Now that it is Coke bottles and plastic bags, it is a tragedy.

Environmentally conscientious voyagers are faced with the dilemma of disposing of some waste at sea or waiting and disposing of it ashore with no assurance that it will be properly handled. We opt for a compromise that we feel minimizes the adverse effects on the environment. The process starts when we remove all cardboard and as much plastic packaging as possible from our provisions before we stow them. Because we do major provisioning in more-developed countries or large ports in the islands, we are reasonably comfortable that what we are leaving behind will be properly managed. Once we set off on passage, we handle each type of garbage differently, as described below:

- **Cooking scraps.** We throw organic waste—from carrot peelings to spoiled leftovers—overboard without much thought once we are a half day from land. Often, such scraps are greeted with delight by fish and seabirds in the vicinity.
- **Paper.** We don't have much paper aboard, since we discard paper packaging when we provision. We rarely use paper towels at sea; tea towels are more practical and can be laundered. Still, we have to dispose of the odd piece of paper from writing or making calculations. We usually shred these before dropping them overboard. We use biodegradable toilet paper and discharge it overboard with the waste from the head offshore.
- **Glass.** We prefer heavy plastic containers and reusable jars and do not carry much glass. When we do have to dispose of glass, we fill empty bottles with salt water and drop them overboard.
- **Cans.** Aluminum soda and beer cans can be compressed and carried until reaching a port where they can be recycled. We do not carry soda in cans, but we do provision canned foods. Food comes in steel cans that are not easily compressed, are likely to cut you if you try, and rust if stowed. We fill the cans with salt water so they sink to the bottom. Cans are probably our most common form of garbage after kitchen scraps, and I always regret leaving a trail of cans behind us on the ocean floor. But it is worse to envision the cans dumped just offshore or left on a beach for the tide to take, so unless we are headed for a more-developed country we bury them at sea where they can do the least harm.
- **Plastic.** Plastic, or anything with plastic in it, never goes over the side. We stow all our UHT containers, plastic bags, bottles, tabs, rings, and fasteners in the forepeak until we make landfall in a large port with good facilities for disposing of garbage. Plastic is deadly to marine life: it can be eaten or can get caught in blowholes or lungs. We never throw plastic away in small villages for fear it will end up on a beach. On a few occasions, we have carried it for an entire ocean, but we can normally dispose of it in major ports where we have to clear customs.

tiny that they are likely to end up in the bilge or down a scupper.

- **Music, books on tape, and videos.** An iPod or Walkman allows you to enjoy music or books on tape without disturbing others. It makes a wonderful watch companion. You may want to bring more than one, especially if you have children aboard. Video offers kids the ultimate entertainment, but most of our friends prefer diversions using paper, pencils, wood, crayons, and anything else that comes to hand.

- **Keeping a video or audio record of the voyage.** A VCR, mini-disc recorder, or old-fashioned cassette tape recorder will allow you to send home a verbal or video record of your voyage. The cassette tapes I made on our first trip did more than anything else to help my family feel like "they were there."
- **Physical activity.** As discussed in the Exercise section in Chapter 16, physical activity is difficult on passage but worth trying to keep up. Free weights, stretching, and exercise bands provide workable exercise solutions at sea. Several turns around the deck every few hours will keep your muscles from stiffening up.
- **Social time.** Surprising as it sounds, the boat can so dominate your life at sea that you lose track of those around you. When keeping strict watches, you will see little of the off-watch crew. To make sure that everyone remains in touch, many crews have a daily "cocktail hour," usually in the late afternoon. Whether it involves alcohol or not, the cocktail hour provides interaction and sharing. It gives the skipper the opportunity to assess crew morale and address any problems developing between crewmembers.

If you are becalmed, you may want to go for a swim. A surprising number of people are agoraphobic or acrophobic with respect to all that open space between them and the ocean floor thousands of feet below. We swam once when we were becalmed. The gentle swell felt like a tidal wave from the surface of the water. I was more aware than I had ever been of how my life at sea depended on *Silk*. Everyone should experience this sensation of flying far above solid ground, suspended over nothing. If you do so, make sure to take all sails down, trail a long line from the stern, and leave someone on deck. Don't swim where there is an ocean current. The marine life may find you of interest!

Plan some surprises, especially if you have kids aboard. No matter what your age, when land is several hundred miles away you will appreciate a new toy or game, some candy, or a book you have wanted to read. If everyone aboard brings one surprise for everyone else, you will be sure to have a few special events along the way that will bolster crew morale and keep everyone working as a team.

Morale and Safety

With self-steering, good sail combinations, and GPS, keeping the boat moving in the right direction in good conditions doesn't take that much effort. For many cruisers, the most difficult part of passagemaking can be the psychological effects from the lack of privacy, lack of exercise, lack of sleep, boredom, and underlying stress. Each crewmember needs to find a way to deal constructively with these issues.

I find it too easy to do nothing all day on a long, light-air passage unless I create some structure for myself. I exercise and bake early in the morning when it is cool, read and rest during the hottest part of the day, and write and listen to the BBC in the late afternoon. Evans, on the other hand, goes into a sort of hibernation, conserving his energy until events on the boat require his attention. A couple of times a day he will take a tour of inspection from bow to stern. If anything needs fixing, we immediately get to work.

The difference in our respective approaches causes conflict from time to time. Sometimes I get lonely on passage and want some serious conversation or lighthearted interaction. This is not uncommon. Throughout our travels, skippers commiserate on the loneliness of command, while the first mates commiserate on the loneliness of being commanded. Skippers need to make an effort to include their crews, and crewmembers need to tell their skippers if they are uncomfortable with any aspect of passagemaking. To keep up morale, everyone needs to respect the attitudes and approaches of the others.

When the urge strikes to be truly alone, you can't go for a walk. Given the lack of physical space, especially on smaller boats, psychological space becomes very important. On *Silk*, I had a favorite place on the foredeck I retreated to whenever I needed to be alone. Evans used the quarter berth as his private place. We respected each other's privacy in these do-not-disturb areas. *Hawk* is large enough that we can almost always find a place to be alone if we feel the need.

Be sensitive to your moods and try to be aware if your morale or your partner's is low. Little things can boost morale a great deal. A shower can change your whole outlook. A surprise celebration with a meal and some new toys lifts the spirits. Noticing the beauty of wind and water can renew your sense of wonder. For the most part, morale is attitude—and you can choose to change your attitude.

All crewmembers must agree on how they are going to manage safety on a passage and faithfully follow the agreed-upon rules. Actual practices on offshore boats run the gamut from strict adherence to a carefully developed set of rules to a free-for-all. In the beginning, the exact approach will depend on the relative experience of the crewmembers. In the end, the crew's attitude toward safety and their assessment of the relative risks will determine how they manage safety issues at sea.

The following questions will help you and your crew to focus your discussion on safety:

- When and under what circumstances will harnesses be required? When will you wear life jackets? Survival suits?
- Under what circumstances can people leave the cockpit when they are on deck alone? During the daytime only? Good weather only? At night if wearing harnesses?
- Will two people always be required on deck for sail changes? If not, under what conditions will two people be required?
- In what situations should the off-watch or skipper be called on deck? During sail changes? Crossing another vessel? At waypoints when a course change is required? Anytime anything unusual is sighted?

We fall under the spell of the sea after the first few days of a passage. We celebrate the simple pleasures of nature and the satisfaction of a good day's mileage. Shoreside cares and concerns are left behind. We feel clean and tranquil, and life has a clear and simple meaning. Most people come to love these aspects of passagemaking while still respecting the demands of being alone with the sea.

CHAPTER 22
Heavy Weather

ANYONE WHO HEADS offshore will spend a significant amount of time in light air. Learning to keep the boat moving in less than 10 knots of apparent wind must be considered a key passagemaking skill, one you will have many opportunities to master. But over the course of a tropical circumnavigation, many crews never encounter serious heavy weather. While you may spend a good deal of time running downwind in strong trades with true winds up to gale force, these will be fast, exhilarating days that require little more than some extra attention to the helm. With prudent voyage planning and a bit of luck, the chances are you will never encounter a serious storm. In 90,000 nautical miles of offshore sailing, including more than 12,000 nautical miles in the Southern Ocean, we have experienced sustained storm-force winds (48 knots and over) and survival conditions in just two storms for less than 36 hours in total.

But you can't entirely discount the possibility of getting into heavy weather. Weather forecasting is an inexact science, and even with perfect information, most cruising boats are not fast enough to position themselves against a low-pressure system moving 500 to 700 miles in a day. If you do encounter heavy weather, the chances are it will be gale force, with a few gusts to 45 knots or so. Any well-found boat managed with a bit of knowledge will be able to handle this. The crew may come off less well, and have to deal with seasickness, dehydration, and minor injuries.

If you ever get into a survival storm, it will be a life-changing event. The rarity of these storms and the infrequency with which cruisers encounter them make it difficult to generalize about storm tactics. There are at most a handful of sailors alive today who have been in these conditions often enough on enough different boats to be able to say anything authoritative. Different designs need to be handled differently in gales and storms (see the *Hawk* vs. *Silk*: An Example of How Boat Design Impacts Tactics sidebar below), so it is quite possible they will also need to be handled differently in survival storm conditions. To prepare, you can't go out and practice as you can in a gale. Instead, you need to understand the alternatives and how they relate to your boat, carry the necessary equipment, and try out the techniques in winds as strong as you can manage. Then, if the time comes, you will need to act with confidence and decisiveness though you may have little knowledge and less experience.

Those we have met who have weathered survival storms have done so in all types of well-found boats with all levels of equipment. The "hardware" factors many people concern themselves with when discussing heavy weather—boat type, rig, keel configuration, size, equipment—seem to have little to do with survival. Psychological factors matter far more: crew teamwork, trust in the vessel, and spirited leadership. These survival skills are considered in the Surviving an Emergency section at the end of Chapter 23.

Every experience you have with heavy weather will prove invaluable. You will figure out how to handle yourself and your boat. You will learn that gales can be managed, and slowly your definition of what constitutes heavy weather will change. Most important, you will gain confidence and skills that will make your next experience with heavy weather safer and less frightening.

HEAVY-WEATHER BASICS

As discussed in the Offshore Sailing Conditions section in Chapter 5, gales and storms occur with pleasing infrequency along trade wind routes, and survival storms are almost (but not quite) unheard of. But you can still expect to experience some heavy weather over the course of several years of voyaging, and you must be prepared to deal with it when the time comes. The critical factor for determining the severity of heavy weather is not absolute wind speed; rather, it is wave heights and characteristics. This fact not only dictates storm tactics, it also leads to several Golden Rules that will help ensure the safety of a vessel in severe weather. Finally, one of the most critical elements in managing heavy weather occurs before the wind begins to blow hard. Preparing the crew and the vessel well will forestall many of the most common problems that occur during storms.

Figure 22-1.
Running in a gale off Uruguay after sustained winds of 35 knots for 8 hours. The waves are regular and not steep or breaking, and the horizon is still readily visible.

(In)frequency and Severity

As discussed in Chapter 5, sustained gale- and storm-force winds (over 34 knots) have accounted for only 1.8 percent of our 520 days at sea, for a total of 230 hours or nine and a half days. That includes a predominantly high-latitude voyage on *Hawk* and close to 100 days on passage in the Southern Ocean. We have been in survival storm conditions with breaking waves only twice, once on our first voyage aboard *Silk* and once on *Hawk*. Among our sailing friends, those who sail the high latitudes are far more likely than tropical sailors to have experienced storm conditions (over 48 knots). Still, most tropical voyagers who have been out more than three years have successfully managed gales at sea, though we know a few who completed circumnavigations without ever employing any heavy-weather tactics.

Storm severity can be very difficult to judge from the deck of a small boat at sea. Wind speed is not a meaningful measure of severity. Sustained winds of 40 knots for 24 hours will create more dangerous conditions than several hours of 60 or even 70 knots (assuming you get the sails down in time). That's because the waves have no chance to build up in short-lived frontal systems. Sustained wave heights and wave characteristics offer a much better measure of the severity of a gale or storm. As we have gained experience, we have come to divide the heavy weather we encounter into three categories:

1. **Gale.** In 20, 25, or even 30 knots of wind, the sea is a series of individual waves, many with whitecaps, each easily surmountable on any point of sail by any well-found vessel. But between 30 and 40 knots, the sea starts to change. The wind drives the surface of the sea into furrows and then into spume. The waves become interlinked, the largest often coming in groups of two or three. Swell or current interacts with the wind-driven waves to create cross seas or sudden, unpredictable eruptions of water. To be comfortable—if not safe—a vessel needs to be oriented with the bow or stern into the waves rather than taking them beam-on.

   On deck in these conditions, you can still see the horizon (Figure 22-1). Your glasses won't get coated in salt unless you take a direct hit by a wave. You won't hesitate to bring a splashproof camera on deck, and you might even consider bringing a regular camera out during a moderate period. These conditions can be frightening the first time you experience them, but any well-found boat with sufficient sea room handled with a bit of sea sense should shrug off gale-force winds and the accompanying seas.
2. **Storm.** If the wind has been blowing at over 40 knots sustained for over 8 hours, the sea becomes much more violent. The largest waves will now be two to three times the height of the normal wave train. If running, most boats will be surfing down the wave faces, making steering difficult and the boat less stable. If oriented with the bow into the waves, waves will occasionally slam into the hull, sending whitewater washing over the decks. There will be so much spray in the air that when you are on top of a large wave the horizon will be blurred. Your glasses will get coated with salt after 15 or 20 minutes on deck even if you are sheltering beneath a dodger. You might bring a splashproof camera on deck for a couple of minutes, but

you wouldn't consider getting out the regular camera.

A well-found boat will be able to handle this weather with a well-rested, well-prepared crew that understands what storm tactics to employ. Luck, however, begins to play a larger role in the equation. If a block breaks, a sail blows out, or a rogue wave catches the boat wrong, the results will be far more serious than if the same things were to happen in a gale. If the frontal system passes over and the wind shifts suddenly through 60 or 90 degrees and then continues blowing, the confusion of the two wave trains can result in dangerous seas. That can turn a long-lived storm into a survival storm.

3. **Survival storm.** Somewhere between 50 and 60 knots of wind, the surface of the sea appears to be smoking. We have seen this on only two occasions, both in the vicinity of Cape Horn. At that point, visibility is reduced so much that it's difficult to see beyond the next wave approaching. Glasses get so coated with salt that you can't read the instruments. If these conditions persist for more than 8 hours, the seas will start tumbling, becoming moving avalanches of water. Luck begins to play a larger role in keeping the boat upright. In these conditions, boats can and will get rolled, pitchpoled, or dismasted.

The 1994 Queen's Birthday Storm helps illustrate how much more dangerous ultimate storm conditions can be than "normal" storms. Boats fared very differently depending upon where they were in relation to the storm track, as shown in Table 22-1. As discussed in the Two Weather Phenomena to Watch For sidebar in Chapter 19, the most dangerous part of this storm was within 180 miles south and west of the storm track where the meteorological bomb squeezed up against a high-pressure system over New Zealand to create the ultimate squash zone. Seven boats were southwest of the storm track, within the area estimated to have 50 knots of sustained winds by the New Zealand meteorological service. Reports from search craft and personnel on vessels that made rescues in this region describe 50-foot, breaking seas; rogue waves up to 100 feet high; and wind gusts to 90 knots.

Crews in the worst part of the storm used multiple storm tactics to try to control their boats, including running free and with drogues, lying ahull, and lying to sea anchors. Despite that, only one stayed upright, a catamaran that was later abandoned because its crew believed it would capsize or the main saloon windows would give way, flooding it. Five of the boats were rolled or pitchpoled. The crew on *Quartermaster* reported multiple 90-degree knockdowns before disappearing from the radio. The boat and her crew of three were lost. Boats to the north of the storm track and those outside the area the meteorological service reported as having 50 knots of sustained winds fared much better. Once again, a wide range of storm tactics were employed, as is discussed in more detail later in this chapter.

Within the squash zone, none of the seven boats came through unscathed, yet the sea only destroyed one. A catamaran was scuttled by the rescue vessel, one boat was scuttled by her departing crew, and another boat sank after being taken in tow. The other three were all dismasted, but they (plus the one abandoned with bad steering gear to the north of the storm track) were all re-

TABLE 22-1. OUTCOMES RELATIVE TO STORM TRACK IN THE QUEEN'S BIRTHDAY STORM

Location	Number of Boats	Stayed Upright	Knocked Down > 90 Degrees[1]	Rolled/ Pitchpoled[1]	Abandoned	Lost
Within area of 50-knot sustained winds[2] southwest of storm track	7	1[3]	1[4]	5	6	1
Within area of 50-knot sustained winds[2] northeast of storm track	7	6	1	0	1[5]	0
Outside of area of 50-knot sustained winds but within ~200 nautical miles of storm track[2]	6	4	1	1[6]	0	0

[1]Most of the boats that were rolled were also knocked down, often multiple times. These have not been included in the number of boats knocked down.
[2]As reported by New Zealand meteorological service.
[3]This was a catamaran that was later abandoned because the crew believed it would capsize or be flooded through the saloon windows; it was scuttled by the rescue vessel.
[4]This boat was eventually lost at sea; the skipper reported multiple knockdowns before going off the air.
[5]Catamaran abandoned due to broken steering gear.
[6]The only boat to lie ahull through most of the storm.
Source: *The 1994 Pacific Storm Survey* by Kim Taylor and the *Drag Device Data Base*.

covered later, some after many months. This illustrates an important point that was also true for two other well-documented survival storms, the 1979 Fastnet and the 1998 Sydney-to-Hobart Race: The vast majority of boats *do* survive these storms, and staying with the boat is almost always the safest tactic.

Breaking Waves and Rogue Waves

The most important factor that turns an ordinary storm into a survival storm is not wind speed but the transition from regular, well-spaced—though often very large—seas to breaking waves. For it is waves, not wind, that do most of the damage to boats during storms at sea. Whitecaps or cresting foam and whitewater do not constitute a danger to a well-found boat. Left to their own devices, many cruising boats will happily ride up and down on well-spaced, whitecapped, nonbreaking waves, even ones that are 30 or more feet high. But breaking waves change the situation completely.

Breaking waves normally develop only when something opposes the movement of wind-driven waves, causing them to rise up like combers running onto a beach. As they get higher and steeper, the crest of the wave becomes unstable and begins to collapse down its face, just as happens with a surfing wave. Breaking waves are unmistakable when experienced and cannot easily be confused with large, regular, cresting seas. The wave faces become massive, moving waterfalls that can best be described as rolling, tumbling avalanches of water.

To get some idea of the magnitude of the forces in a breaking wave, consider that every cubic yard of water weighs more than 1 ton. A breaking wave may contain several hundred tons of water moving at speeds up to 30 knots. In the collapsing front of the wave, those forces will be twisting and falling. The twisting motion and weight in the top of a breaking wave can bend stanchions and pulpits, stave in coach roofs, break portlights, and crash through weatherboards. As the waves move from large and well behaved to steep and breaking, you have successively fewer options for ensuring your vessel's safety. Breaking waves have been involved in almost all documented cases where moderate- to heavy-displacement boats have been pitchpoled or rolled.

In order to determine which design factors contribute to stability in breaking waves in the aftermath of the 1979 Fastnet disaster, the Wolfson Unit for Marine Technology and Industrial Aerodynamics at Southampton University in England (see the Heavy-Weather References section in the resources for this chapter in Appendix 1) conducted tank tests on scale models of many different monohulls. They thought they would arrive at design parameters for increasing stability having to do with such things as ballast ratios and hull shapes, but their three most definitive conclusions were also their most alarming:

1. All designs were knocked down past 130 degrees when breaking waves of a height equal to 35 percent of the boat's LOA (length overall) struck the vessel on the beam.
2. Many modern boat designs were rolled or capsized by breaking waves with a height equal to or greater than 40 percent of a boat's LOA taken beam-on.
3. All designs capsized when hit beam-on by breaking waves with a height 55 percent of LOA.

A 40-foot monohull, then, can be knocked down past 130 degrees by a breaking wave just 14 feet high if taken on the beam. It may be capsized (though if well designed it should come back upright again) if hit by an 18-foot-high breaking wave on the beam. It *will* be capsized if hit by a 22-foot breaking wave on the beam. Given that the dynamics of wave formation result in a statistical distribution of wave heights, waves higher than 20 feet will exist even when average wave heights are in the 12- to 15-foot range. But there is some good news—most designs will not be rolled as long as they do not lie beam-on to breaking waves.

The Wolfson tests are disturbing enough without factoring in the random nature of waves in a storm at sea. Tank tests generate a series of waves coming from a single direction at a constant period. But at sea after a wind shift or in an area of currents or shoal water, the waves are not nearly so well mannered. The crews caught in the squash zone of the Queen's Birthday Storm described huge rogue waves approaching at a 60-degree angle to the other waves, hollow waves collapsing when over the boat, and "stacked" waves in which two or three waves combined into monstrous walls of tumbling water.

Fortunately for all of us who spend time in small boats at sea, breaking waves are rare. The Dashews report that during their more than 200,000 miles at sea they have spent less than 72 hours in "severe weather." We have been in breaking waves only twice in our 90,000 nautical miles. Experienced ocean voyagers and the ocean pilot charts agree that wind speeds greater than Force 8 occur about 1 percent of the time in the tropics during the winter and 3 percent of the time in the higher latitudes during the summer, but Force 8 alone will not usually produce breaking waves. One of three concurrent factors is also necessary:

1. **Wind against current.** When strong winds blow against a strong current such as the Gulf Stream or the Agulhas Current, wind-driven waves rise up over the top of the current, increasing wave height and steepening the waves until they begin to break. According to the Scripps Institute

of Oceanography, a contrary current of only 2 knots can double wave heights.

2. **Shoaling water.** When large waves fetch up against the continental shelf or shallow mid-ocean banks—for example, the shallow area extending south of Madagascar or the Georges Banks east of Cape Cod—the waves rise up like combers rolling in to a beach or a tsunami coming ashore.
3. **Sudden wind shift.** Near the center of a very deep low-pressure cell, the winds tend to shift violently from one direction to another. The new wind-driven waves will run in opposition to the underlying wave train laid down by the previous wind. In winds between Force 8 and Force 10, this creates confused seas with random breaking waves. In winds of Force 10 and higher, breaking waves coming from a variety of directions will develop over the sea's surface. This most often happens at the center of a cyclone or in a meteorological bomb, and was a factor in both the Queen's Birthday Storm and the 1998 Sydney-to-Hobart Race.

These conditions can create a large number of breaking waves, turning the whole sea into a moving maelstrom of tumbling mountains. But a single breaking wave can also be incredibly destructive, and these occur more frequently than mathematical models predict. They are often called extreme storm waves (ESWs), and their incidence has been increasing—or maybe our ability to detect them has improved. According to Robin Knox-Johnston, writing in the November 2003 issue of *Yachting World*, oil platforms in the North Sea have recorded a large number of these "freak" or "rogue" waves: "On one [platform], 24 non-linear waves [waves that exceed the height predicted by a linear model of wave formation] were measured in a four-year period and some exceeded 25 meters in height. One was measured at 27 meters when the average wave height was 7 meters."

They have now found, according to Knox-Johnston, that "In open oceans, when large waves are being generated, an instability may occur in a group and one wave, perhaps drawing energy from its neighbours, will build up to a height of 26 meters or more. Large cross seas can combine to produce a tower of water such as might be found near a tropical revolving storm or where waves are moving in a different direction from the swell. . . . Another cause may be a succession of large waves of different frequencies overlapping, as we expect in the Southern Ocean."

A few of our sailing friends have described seeing such waves. Noel Barrott, 2002 winner of the Cruising Club of America's prestigious Blue Water Medal, saw a great deal of heavy weather over the course of several years when he almost completely circumnavigated the Southern Ocean and visited many of the sub-Antarctic islands aboard his 38-foot engineless wooden cutter, *Masina*. "I believe, ultimately, one can always have the phenomenon, particularly when two or more wave trains are running, of two waves coming together and literally co-joining and collapsing in a huge welter of breaking water. I think there is not much hope in this situation. One sees these waves occasionally."

These waves normally occur only in the temperate and high-latitude winter, though they can also occur over seamounts. Tropical sailors are highly unlikely ever to see a freak or rogue wave. They may encounter a storm with breaking waves in a very few, fairly well-defined places: in the Gulf Stream or Agulhas Current, on the way to or from New Zealand, or rounding South Africa. But 98 percent of you reading this book will probably never see a storm with breaking waves or a rogue wave. So use the Golden Rules in the next section to make sure you are always prepared, but don't let the small risk of encountering such waves at sea put you off. Remember that most of the crews who have run into such things have survived to tell about it, and their stories are cruising legends from which we have all learned.

The Golden Rules

The unarguable fact that relatively small breaking waves taken on the beam can overwhelm even the most stable monohull design suggests two imperatives. First, minimize your exposure to potential breaking wave conditions by exercising prudent routing and sailing efficiently to minimize time at sea. Second, if caught in breaking waves, minimize the chance of being caught by one beam-on.

Two less obvious but equally important imperatives also follow. First, it is critical to keep a shorthanded crew functioning so they can position the boat relative to the waves throughout the storm; that means preventing fatigue. Second, prepare the boat well in case that single wave with your name on it comes calling. Many of our friends who have made long passages in the Southern Ocean have been knocked down. All of them have survived, though in some cases the mast didn't. If you get knocked down, the amount of damage will depend in large part upon your preparations.

Avoiding Breaking Waves

Avoiding breaking waves altogether is the obvious objective. The easiest way to do that is to avoid heavy weather. The best way to do this is not to employ expensive weather routers but rather, as discussed in Chapter 18, to plan your voyage to avoid heavy weather in the first place. By staying on the tropical routes, picking your weather windows carefully when leaving the tropics, and making sure you are well out of the tropics during storm season, you can reduce the risk of encountering a storm at sea to less than 1 percent.

Major ocean currents can be a boon to the small-boat sailor, but don't get caught in them when the weather deteriorates. To minimize the risk of encountering heavy weather, study the weather patterns carefully, pick the best weather window you can find, and make a fast passage. The less time you are on passage, the less the likelihood you will be hammered by an unexpected low. For most cruising boats, maneuvering to avoid heavy weather is not a realistic option. If heavy weather is on the way, the best tactic we have found is—when possible—to slow the boat down and allow the weather to pass in front of us.

Avoiding tropical storms is a clear objective, but it is getting more difficult as cyclone season stretches into the winter months. But tropical storm weather forecasting is improving all the time. It is good enough that you shouldn't meet one on passage, though you may have to sit one out in the tropics.

Keep the Bow or Stern Oriented Toward the Seas

The Wolfson data cited above make it clear that lying beam-to the seas in a storm leaves a boat vulnerable to being rolled even in moderate breaking waves. Boats are much less vulnerable when they meet waves with their bow or stern. Given the slight possibility of a freak or extreme storm wave in any storm at sea, it makes sense to limit the time spent beam-to the seas even when the waves are not breaking. Whatever tactics you employ, whenever the waves get over about 10 feet keep the bow or stern oriented into them.

That leads to three hard and fast rules in heavy weather:

1. **Don't beam reach when wave heights equal or exceed the beam of the boat.**
2. **Don't lie beam-to the seas in breaking waves.**
3. **Do balance the boat for the wind angle you want to maintain.**

The third rule is the one that got many crews into trouble in the 1998 Sydney-to-Hobart and the Queen's Birthday storms. If the boat is not balanced, eventually a wave will cause her to slew off and expose her beam to the wind. If going to windward on only one sail, use a trysail rather than a storm jib, as this will help keep the bow up into the waves. If running off with one sail, use a storm jib, as this will pull the boat straight downwind. In addition, warps trailing off the stern will act as "tail feathers" to help keep the stern into the wind. Using a storm jib and warps will produce a balanced helm on most boats. Definitely *don't* run off with an unbalanced sail plan or helm. This will eventually lead to a broach, which may end in a roll.

Be Ready to Implement a Variety of Tactics

Despite the near religious zeal some sailors have for one tactic or another, our experience suggests there is no single "silver bullet" solution that works for all boats in all storms. Boats differ in seakeeping ability; skippers differ in heavy-weather experience; storms differ in their wind and wave characteristics. How a skipper handles a particular vessel in a particular gale may be quite different from how that skipper handles the next gale in the same boat.

To prepare for heavy weather, learn about as many experiences of as many boats as you can. The Heavy-Weather References section in the resources for this chapter in Appendix 1 will give you a place to start. Talk to skippers who have weathered storm conditions and try to understand their techniques. Read as many detailed accounts of storms at sea as you can get your hands on and try to absorb the range of possible solutions. Take your boat out in gale conditions and try as many heavy-weather techniques as possible. Heave-to and see how your boat lies and how much leeway she makes under various sail combinations in various wind speeds. Run before the wind and see how little sail you can carry and still keep moving comfortably.

Managing heavy weather is like anchoring: successful skippers keep trying solutions until the boat feels safe, stable, and comfortable. In the Queen's Birthday Storm, the crews on 12 of the 20 boats in Table 22-1 used two storm tactics during the storm; 6 used three or more. Some changed tactics as the wind increased; others did so when the boat got knocked down or equipment got damaged. Having as many options as possible will increase the odds you'll find a satisfactory alternative.

Avoid Fatigue

Boats can and do survive breaking waves without getting rolled, but the chances of doing so are greatly increased if every sea is taken on the bow or on the stern. In severe breaking waves, the impact of the wave and the force on its crest will tend to spin the boat, exposing its beam to the seas. Even before things get that severe, self-steering systems on many boats will not be able to keep up with the forces and react quickly enough to keep the boat oriented properly to each wave.

That's why many experienced sailors argue that, in the most extreme conditions, hand steering is the only option for keeping the boat safe. There's a good deal of anecdotal evidence to reinforce this conclusion. Comparing the single-handed Around Alone (formerly BOC) and Vendée Globe boats with the fully crewed Volvo (formerly Whitbread) boats makes a compelling argument. These races use very similar boats to race through the same challenging waters. Yet while no fully crewed (Whitbread or Volvo) boat has ever been rolled or capsized in the Southern Ocean (except one that lost its keel), in a few races up to half of the single-handed racing boats (Vendée Globe, Around Alone, or BOC) have been rolled or capsized, and it's a rare race in which at least one boat does not end up dismasted after being rolled. The main difference between the two races is that the single-handed sailors rely on autopilots, while the fully crewed boats are hand steered all the time.

Assuming that no one is incapacitated or injured, hand steering through a 24- or 48-hour blow is reasonable with a crew of four, feasible with a crew of three, and possible with a crew of two. To have any chance at all of managing it, however, every member of the crew must be functioning at nearly full capacity. The crew cannot go into the critical period already fatigued, injured, or seasick.

Even if the crew does not have to hand steer, staying rested is critical to the safety of the boat. Most mishaps occur due to a string of fatigue-induced poor judgments and/or lack of energy to take immediate necessary actions. For that reason, our primary rule during heavy weather is to stay rested. Our storm tactics are all geared toward ensuring that the boat can take care of herself for as long as possible, allowing us to continue our normal watch routine, with one of us always getting some rest. This limits fatigue-induced errors and ensures that we can function at a high level for up to 48 hours if hand steering becomes necessary.

Four elements of preparation are a tremendous help in keeping fatigue levels manageable:

1. **Bulletproof self-steering systems.** Hand steering is an enormous drain on a small crew and should be avoided until there is no alternative.
2. **Trusted crewmember.** If the captain is to get enough rest to make good decisions, at least one crewmember must be available to take charge of the boat. The captain must trust this person enough to relax and go to sleep.
3. **Readily available food and water.** Zero-preparation, high-energy food will keep the crew energized. Make sure it is easily available and that each crewmember keeps eating and drinking throughout the storm.
4. **Early use of storm tactics.** On a shorthanded boat, storm preparations and storm tactics need to be implemented early. The crew will be more rested and confident if everything is done before conditions get dire. When a storm is due, our rule is to take action the very first time it crosses our mind to do something. What we lose in miles we more than make up for in additional rest, reduced tension, and an increased safety margin.

We have never done it, but there is an argument to be made for carrying a strong stimulant in the medical kit for these situations. It may prove valuable as a last resort to stay alert in a situation that requires immediate attention and decision making.

Prepare the Boat and Crew for Heavy Weather

If you are receiving accurate weather forecasts, you may be aware a storm is approaching several days beforehand. But even if the forecast gets it wrong, deck-level forecasting (see the Deck-Level Forecasting in Temperate and High Latitudes section in Chapter 19) should give you several hours' warning that heavy weather is on the way. What should you do in the 4 to 6 hours before the storm arrives?

1. **Take seasickness medications, if necessary.** Those prone to seasickness should take the medication while they are still feeling fine. A full range of seasickness medications, from pills to suppositories, should be stowed in an accessible location (see the Seasickness section in Chapter 16), and each crewmember should know where to find them.
2. **Top up your batteries.** You may not be able to charge your batteries during the next 24 to 48 hours. Your solar panels are unlikely to see any sun, and your wind generator should have the brake firmly set throughout the gale. You will not want to run the engine in large waves, because the prop might freewheel. Run the engine as long as necessary to fully top up the batteries. If you have refrigeration or a watermaker, run these at the same time.
3. **Restow everything.** Go through the boat and stow everything securely. Put away extra clothing, books, notebooks, cooking utensils, and so on. Check all drawers and lockers to make sure they are securely latched and will not come open if the contents shift. Make sure floorboards are locked in place. Secure the covers to the icebox.
4. **Lash down everything on deck.** Remove anything that does not need to be on deck and stow it below. That includes spare sails, solar panels, boathooks, plastic jugs, cockpit cushions, and odds and ends stowed in the coamings. If you have roller furling, wrap the sheets around the sail three or four times, cleat off the furling line, and secure the drum so the sail cannot come unwrapped. Remove anything lashed to the lifelines and stow it below. Add lashings to anything that cannot be stowed below, including dinghies, life rafts, and spinnaker poles. Make sure extra sail ties are accessible. Three

times the normal number of sail ties can be required to secure a sail in gale-force winds. Put some spare line in a handy place for lashing the helm or tying down anything that comes loose.

5. **Prepare storm devices; hank on storm sails.** Put warps, tires, chain, drogues, sea anchors, chafe gear, or other devices for storm tactics in the top of the cockpit locker or on the cabin sole in a place where they can easily be reached. If your storm trysail and storm jib are not bagged and ready to fly, now is the time to hank them on and get them in order.
6. **Make the boat watertight.** Secure all hatches and ports. Orient dorades so that they are pointing aft. Locate the dorade plates, put them in a convenient place, and make sure everyone knows where they are. Put in the hatchboards, and consider sealing them in place with a layer of silicone adhesive. Check the main bilge pump and emergency pumps. Pump the bilge dry. Finally, if conditions really look dire, remember to cover any other air vents, like the louvered vents used for air-conditioning systems or for ventilating an engine room. Seventy or 80 knots of wind for a few hours will force enough blowing spray through vents like these to do major damage to mechanical equipment below.
7. **Arrange necessary equipment.** Put one dry change of clothes near each bunk. Set up harnesses, tethers, foul-weather gear, flashlights, and towels near the companionway. Be sure that harnesses and tethers show no signs of chafe and lubricate clips on tethers if necessary. Check that the jacklines are properly set and secured and show no signs of chafe.
8. **Check the chart for nearby dangers.** You want to be sure of your sea room well before the storm actually starts. Take a close look at the chart and highlight any dangers you could conceivably get within range of over the next several days. Check that you have sufficient sea room to run off, to drift to leeward, or to forereach to windward. If there are any dangers in the area, consider what tactics will allow you to avoid them in different wind directions.
9. **Fortify the crew.** Make a hot meal to eat immediately, and make sure everyone eats. Get out a few cans of hearty stews or soups and put them and a small saucepan in a secure but accessible place in the galley for a one-pot meal during the gale. Boil water and stow it in a thermos for making tea, cocoa, or hot soup. Set up an accessible stock of high-energy foods, including dried fruits, energy bars, nuts, crackers, chocolate, and hard candy.
10. **Prepare the galley.** Put away all dishes, pots, pans, and so on. Leave nothing on the gimballed stove. Make sure all knives are in an enclosed drawer. Leave the stove gimballed, but if it can swing far enough to hit the safety bar in front of it, wrap the bar with a towel to protect the glass in the oven door.

By now you should have a good idea of exactly where the gale is and how severe it is likely to be based on deck-level and outside forecasting. Sit down and discuss exactly what your plan of action will be and what alternatives you might need to employ. To minimize confusion, everyone needs to know what role they will play in each procedure. At the same time, the crew needs to understand that the captain will not know the exact course of action until the time comes to make the decision. Crew morale hinges on knowing the skipper is prepared for any eventuality.

If you can complete all these steps before the gale hits, your vessel and crew will be well prepared. Waiting for weather can be worse than getting through it once it starts. A crew that is kept busy helping with preparations before the gale arrives will be in a more confident and upbeat mood when the storm actually hits. That bit of extra energy is often all it takes to keep things from looking dire.

GALE AND STORM TACTICS

This section focuses on the type of heavy weather most prudent cruisers will experience only a couple of times over the course of several years of voyaging—sustained gale-force winds with moderately large, regular, nonbreaking seas. The chances you'll ever see worse conditions are very slight. The tactics discussed here will work in up to 45 or 50 knots of true wind on most boats. They can be practiced in the strong winds you can find around your home waters on days when you wouldn't normally choose to take your boat out for a sail.

When it comes to heavy-weather tactics, there are two main theories. One school of thought says that you want to keep the boat moving forward, since the loss of momentum means a loss of stability and a greater chance of being rolled. Another school of thought argues that stopping the boat is almost always the best solution, since the greatest danger comes when the boat starts to surf down wave fronts.

Not too surprisingly, these two theories have evolved from racing and cruising, respectively. They reflect the different priorities, crew sizes, and boat designs of the two groups. Cruisers tend to sail shorthanded, so they can't hand steer all the time, as may be necessary to keep the boat moving in heavy weather. They value safety above speed and view stopping as a viable option when things get uncomfortable. Traditional cruising designs with their full keels reflect this philosophy, and most full-keel cruising boats stop quite happily in all but ultimate storm conditions. Racers want to keep racing if possible and there are usually enough people aboard to steer 24 hours a day. Modern racing underbodies with their fin keels are designed to be driven forward in storm conditions, and most modern racing boats seem to want to keep going just as much as the crews who race them. Fully crewed race boats have a competent watch ready to assist in the event of an emergency and a shore crew with a container of spares ready to make repairs when the boat pulls into port. Voyagers have to maintain their own reserves to deal with the unexpected and use their own resources to fix any damage.

Both theories have been proven. Hundreds of voyagers have hove-to or forereached through storms, and many Around Alone, Vendée Globe, and Volvo racers have kept moving successfully through rugged Southern Ocean conditions. Much can be learned from both camps. As elements of yesterday's racing designs have become incorporated into more and more of today's cruising boats, racing tactics have become more relevant. Experiment with as many of these tactics as possible and see what works on your boat.

Heaving-To and Forereaching

As a gale begins to build and the wind increases and shifts, the waves become bigger and more confused. A boat going to windward will start to pound, or her bow will be thrown off course by the waves, which exposes her beam to the seas. At what wind speed and sea state this happens will depend on the displacement, length, and underbody design of the boat. When the pounding starts, most voyagers want to make the boat more comfortable but not lose miles toward their destination. The easiest way to do that is to slow down or stop the boat and wait for better weather. Three alternatives exist for slowing the boat down or stopping it in the gale and storm conditions we're considering here: heaving-to, forereaching, or lying ahull.

Heaving-to on a monohull can be likened to pulling on a hand brake in a car. It slows everything down and allows crews to enjoy a lovely picnic lunch on a summer afternoon a few miles from shore, make a repair to a sail on passage, or take a time-out to talk over a boat-handling decision. Forereaching can be considered a variation on the theme for boats with modern underbodies or multihulls. Both tactics have the advantage of simplicity: the vessel jogs comfortably along without the deployment of any equipment and is free to respond to changes in wind or waves.

Throughout this chapter, the term "heaving-to" is used to mean heaving-to *free;* that is, doing so without some sort of drag device to hold the bow up into the waves. Some experienced sailors advocate heaving-to against a parachute in survival storm conditions, and this has been a proven tactic for some boats in some storms. I consider this option in the section on Lying To a Sea Anchor below.

Another tactic for stopping the boat, lying ahull, involves lying beam-to the seas, and as such it violates one of the Golden Rules. This is the only storm tactic we do not recommend for monohulls, though we know people who have successfully used it in the most extreme conditions imaginable (see the Lying Ahull sidebar below).

Heaving-to means setting up the sails and the rudder so that they oppose one another, and the boat stops making headway (Figure 22-2). In the textbook case, the boat will lie with her bow 40 to 60 degrees off the wind and waves and slide slowly to leeward, creating a slick to windward that causes waves to break before they reach the boat. In reality, the boat is not really stationary. It will jog up to windward until the main luffs, fall off until the main fills, and then jog up again, making little headway and a fair amount of leeway.

Exactly how much time the boat spends making headway versus leeway depends upon its hull configuration, rig, and center of effort, and the size and shape of the waves, among other factors. A traditional full-keel boat will normally make 1 knot of leeway and almost no headway; modified fin-keel boats with skeg-hung rudders may make up to 2 knots of leeway. Most fin-keel boats will continue to make headway, and are thus not technically hove-to. Instead, they will *forereach*, jogging slowly to windward while making 1 or 2 knots of headway and less than 1 knot of leeway (Figure 22-3).

Most boats forereach quite comfortably under just a mainsail, so it's easiest to start with this tactic when experimenting with your own boat. Generally speaking, you can forereach on one less reef than you would use for sailing in the given conditions. To forereach, the main should be sheeted to the centerline and the helm locked in position to hold the boat close-hauled. Start by locking the helm amidships and see what happens. If the boat falls off to a broad angle and keeps sailing, you need to turn the helm more to windward. If it gets in irons or tacks through, you need to turn the helm a bit to leeward.

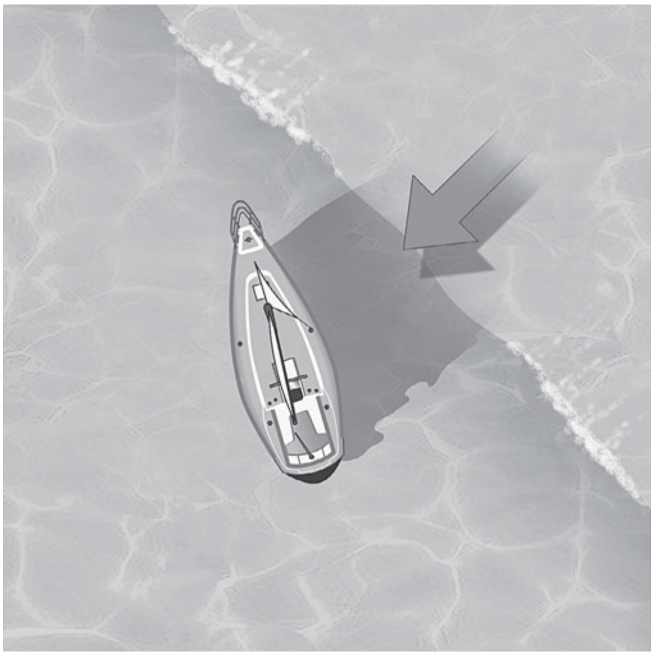


Figure 22-2.
Hove-to. When hove-to, a sailboat makes no forward progress but drifts more or less dead downwind. (Joseph Comeau illustration)

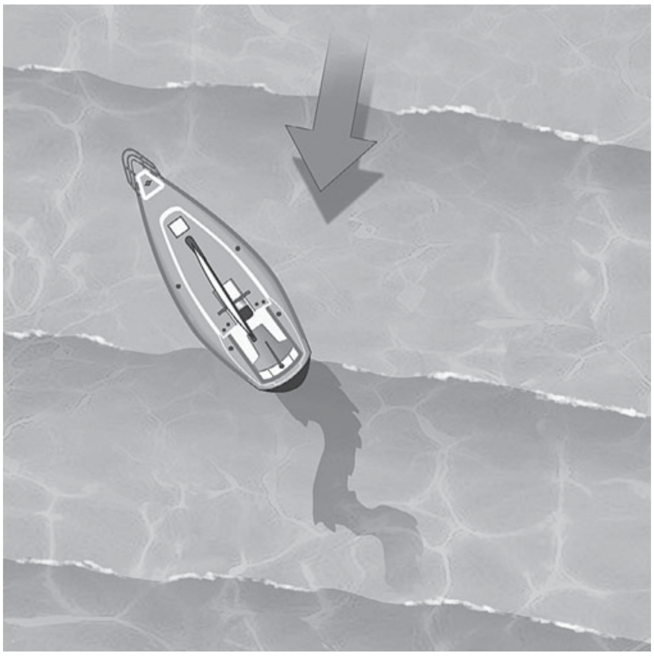


Figure 22-3.
Forereaching. When forereaching, as here under a reefed mainsail, a boat weaves its way gently to windward. (Joseph Comeau illustration)

You're forereaching when the boat jogs up to windward until the sail starts to stall, falls off to leeward, and starts sailing again.

In addition to slowing things down, forereaching is a perfectly acceptable storm tactic as long as the waves are not breaking. We have forereached under a deeply reefed main on *Hawk* into very large but well-spaced, nonbreaking seas for 36 hours in winds gusting over 50 knots in the Southern Ocean. Most boats will forereach comfortably into gale-force winds under a double-reefed mainsail. In stronger winds, sail will need to be reduced. A triple-reefed mainsail or trysail will keep the boat pointed into the wind and moving forward on sloops; a staysail may work better on a cutter.

Different boats require different sail combinations and rudder angles to achieve and maintain a hove-to position, and the same boat will require different amounts of sail and rudder angle to heave-to in different wind speeds and wave conditions. In gale-force winds, many heavy-displacement cutters and sloops with traditional underbodies will heave-to under a single- or double-reefed main sheeted to the centerline, a backed headsail sized to between two-thirds and three-quarters of the foretriangle, and the helm lashed within a quarter turn of the centerline. In storm-force winds, many full-keel boats will heave-to under just a storm trysail with no headsail at all.

Silk had a centerboard in a modified fin keel and a skeg-hung rudder. Like most ketches with full-sized mizzens and traditional underbodies, she hove-to on the mizzen alone without a backed headsail. We used the full mizzen in gale-force winds and put in a reef at around 40 knots. We had a second reef position in the mizzen for heaving-to in higher wind speeds, but we never had to use it. With the helm locked on the centerline, we would adjust the mizzen sheet so the boat sat 45 to 50 degrees off the wind. We then fixed the mizzen boom in position with a block and tackle from the end of the boom to a stanchion base. *Silk* would drift at about 1½ knots dead downwind. Yawls and ketches with small mizzens lack the sail area aft to keep them up into the wind in all but the most extreme conditions. They heave-to best if treated like cutters or sloops.

To experiment with heaving-to on your own boat, go out on a breezy day with at least 25 knots of wind. Reef the main so the boat is comfortable in the conditions, then size the jib to between 80 and 100 percent of the foretriangle. Turn the boat through the wind, but do not release the jibsheet. Lock the rudder in a position that holds the boat's head 40 to 60 degrees off the apparent wind. Adjust the size of the sails if necessary: too little sail overall will prevent you from getting the boat's head up even with the helm hard to windward; too much headsail will cause the boat to fall off beam-to the wind in any lulls; too much mainsail will keep the boat too close to the wind and cause it to tack through in any gusts.

When the boat has bled off speed, use a GPS to determine the actual direction of drift, and check the boat's wake to see if you are making any headway or just leeway. Adjust the sails and rudder again, and see if you can stop all forward motion and make only leeway. If you can do that, you will be properly hove-to, and if the wind is strong enough you should be able to see the slick of calm water to windward. Many experienced open-ocean sailors believe the slick protects the boat from large breaking waves or cross seas by forcing the seas to break before they reach the boat.

If your headsail sheets outside your stays, or if you have a staysail stay, the headsail or sheet will likely be chafing on something. To heave-to at sea for any length of time, you will need to eliminate this chafe. The easiest solution is to use a staysail or storm jib sized to sheet inside the lifelines and shrouds. Alternatively, try rigging a short sheet that runs inboard of any rigging or a snatch block to hold the sheet off the lifeline or shrouds. Because most boats will forereach under just a reefed mainsail without a headsail, chafe is not normally a problem with this tactic.

With either technique, you must be able to secure the rudder so that a rogue wave or sudden motion as the boat falls into a trough does not send it hard against the stops. The wheel locks found on most boats are nowhere near strong enough and also lack that little bit of elasticity that will let the rudder give when struck by a large wave. Lashing a tiller with stretchy line works well. On wheel boats, the problem takes a bit more effort to resolve. On *Hawk*, we use two small block and tackles with somewhat stretchy Dacron line that clip to the eyes that hold the binnacle in place (refer back to Figure 7-11). This holds the rudder still most of the time but gives just enough to prevent damage to the rudder or the steering system when the boat gets hit by a large wave.

Perfect your technique for heaving-to before heading to sea. Try it in all wind and sea states and learn what your boat likes and what she doesn't. Again, boats differ significantly. The longer the keel, the better it will "grip" the water and the less leeway the boat will make. A traditional full-keel boat will normally make ½ to 1 knot of leeway, while fin keels may make over 3 knots.

In fact, it may be impossible to get a fin-keel boat to do anything other than forereach. Full-keel, heavy-displacement boats stall out 40 degrees to the wind, giving them an 80-degree window within which they'll make no headway. But *Hawk*, with her fin keel and spade rudder, will still have some forward momentum as close as 20 degrees to the apparent wind, so the window within which we can heave-to is much smaller. A slight change in wind angle or a wave that knocks her bow off will have *Hawk* sailing again. Friends of ours on racier cruising boats have had the same experience. If they manage to get the boat to stop, the situation is not stable and has to be monitored constantly.

The leeway a boat makes while hove-to means that you do need sea room—a couple hundred feet if you're just stopping for a few minutes to take stock, a couple of miles if you're enjoying lunch with a few bottles of wine. Offshore in gale conditions you need a lot more room—most boats will drift between 20 and 50 miles to leeward every 24 hours.

You don't need to worry nearly as much about leeway when forereaching as when heaving-to. Forereaching allows you to continue to make slow miles toward your destination without beating up the boat or yourself. Heave-to if you're in extreme conditions, trying to stop the boat completely, or need a stable platform to fix something on deck; if you're just trying to slow down the boat and can't afford to make leeway, forereaching makes more sense.

Heaving-to and forereaching both become dangerous if large waves begin to push the bow off so far that the side of the boat is exposed to the full fury of the sea. If the boat is becalmed in the trough, it will fall off the wind before the next wave arrives and could get hit beam-on. In a dangerously confused sea, a wave may strike the opposite bow and force the boat to tack through. She will also tack if the wind speed increases enough that the smallest sail area the boat can carry overpowers the rudder and brings her head through the wind. In any of these cases, the boat is at risk of being rolled or tumbled.

From down below, you can tell that you are reaching the limits of heaving-to or forereaching as a storm tactic if the boat tacks or if waves are knocking the bow off repeatedly and interrupting the regular pattern of jogging up to windward and falling off to leeward. If you cannot reduce sail further, heaving-to or forereaching is no longer a safe tactic. It is time to consider other alternatives.

Running Off Free or with a Speed-Limiting Drogue

If your destination is downwind and the waves are not steep or breaking, you should be able to comfortably continue along your course for the duration of a gale or storm. Boats can run off free or trailing something to slow them down. We have run downwind with just the staysail up in winds over 50 knots in large—but not steep or breaking—seas. This is the favored tactic when the trade winds reach gale force or higher.

Running Free

When running downwind, you steer the boat to put the wind and the waves on one stern quarter or dead over the stern. You may carry a small amount of sail to stabilize the boat or set her to run under bare poles with no sail at all. In true storm conditions, the resistance of the mast, hull, and rigging will drive most boats at 4 to 5 knots; a staysail sheeted flat amidships can help keep the boat tracking downwind.

LYING AHULL

Lying ahull means taking all sail down, lying beam-to the wind, and skidding slowly sideways before the wind and the waves. On most boats, the helm must be lashed so the rudder keeps the boat's head up into the wind. Most full-keel boats will assume a position 90 degrees to the wind with the seas broad on the beam. In theory, the slick created to windward by the boat's motion through the water will cause the seas to slide past without breaking.

Lying ahull in a monohull has three disadvantages. First, when lying beam-on the rolling can be terrible, and crew injury, seasickness, or gear damage is more likely than with other storm tactics. Second, if conditions intensify and the seas reach the height of the boat's beam, damage to the vessel becomes likely—including bent pulpits, ripped-off dodgers, stove-in coach roofs, and so on. Third, when wave height gets to be 35 percent of the boat's LOA, the vessel faces a serious risk of being knocked down or rolled if it encounters a breaking wave.

Some experienced multihull sailors view lying ahull as their primary storm tactic, and it does seem effective for catamarans of sufficient size and weight. Heavy catamarans over 40 feet or so have so much stability that they are very difficult to capsize. Two catamarans around that size in the Queen's Birthday Storm withstood significant breaking seas without capsizing, though both lay ahull, one for most of the storm after a steering failure. Lying ahull was the preferred storm tactic for friends of ours on a 50-foot, heavy-displacement catamaran that sailed more than 50,000 miles, including around Cape Horn.

Although lying ahull may be a safe tactic for multihulls, experience has conclusively demonstrated that this is the most dangerous possible tactic for a monohull, as vessels roll most easily in this orientation to the waves. The two monohulls lying ahull in the Queen's Birthday Storm were both capsized, and the only boat to be rolled 360 degrees when Hurricane Mitch crossed the Caribbean 1500 fleet in 1998 was lying ahull. The more than half-dozen crews we know whose vessels were rolled through 360 degrees were all lying ahull when it happened. While lying ahull with no sail can be an effective tactic in a short-lived tropical squall, follow the Golden Rule when it comes to a serious blow and keep the vessel facing into or away from the waves—never beam-to them.

There are several advantages to running off: the reduction in apparent wind speed eases the strain on the boat's equipment; steerageway is maintained so the helmsman can avoid a particularly vicious wave; if crewmembers are exhausted or seasick, the boat is likely to manage on her own when running off in gale conditions; and a wind vane or autopilot will be able to handle the steering chore in waves that are well spaced and not breaking.

To run off, you must have adequate sea room. Most depressions are fast moving, and they usually wind down after 24 to 48 hours. An average speed of 4 knots means that you will need a minimum of 100 nautical miles of sea room.

Most traditional, full-keel boats can run off safely under bare poles in gale or storm conditions as long as the waves are not breaking, but boats with moderate displacements and more modern underbodies will begin to surf at some point (see the *Hawk* vs. *Silk* sidebar below for a comparison of running off in two different boat designs). Although the boat may be perfectly under control if hand steered, keeping the crew rested is critical to the safety of a shorthanded boat. If the autopilot or wind vane can no longer manage the boat safely, or if the boat's stern starts slewing around in the wave crests, you'll need to use another tactic.

On both of our boats, if we took the helm in this situation we could feel the change in the boat's motion in the wave crests—a slip-slidey feeling, just short of a skid, that reminds me of driving on ice. On most boats, slowing down will keep the boat's stern oriented to the waves and allow the self-steering to maintain control. This is where a speed-limiting drogue makes sense.

Running with a Speed-Limiting Drogue

A *drogue* is anything towed from the stern of the boat to slow it down without stopping it completely, including long warps alone or with tires, chain, sails, and even anchors attached. Today cruisers can purchase a variety of commercially manufactured drogues including the Delta drogue, Galerider, and Jordan Series drogue; these have the advantage of being designed to exert a consistent amount of resistance while moving through the water smoothly, without inverting, spinning, or slewing off in one direction or another.

Drogues fall into two categories: low-pull or speed-limiting drogues, which check the boat's speed and keep it from surfing while maintaining momentum and steerage-way; and medium-pull drogues designed to slow the boat to 1 or 2 knots and hold the stern steadily into the wind and waves. The Galerider, Delta drogue, and Australian-made Seabrake are examples of speed-limiting drogues, and the Jordan Series drogue and various small parachute-type drogues (as opposed to parachute sea anchors, which are meant to be deployed off the bow and stop the boat completely) are considered medium-pull drogues. For more information on specific drogues, see the Contact Information for Drag Devices section in the resources for this chapter in Appendix 1.

When running toward your destination in heavy weather with large, nonbreaking seas, you want to keep up as much speed as is safe. If you cannot run free because the boat has started to move too quickly for the autopilot or wind vane to prevent a broach, then you should slow the boat down only as much as necessary to let the self-steering stay in control. That means using warps or a speed-limiting drogue.

We know it is time to deploy the drogue when *Hawk* begins consistently surfing at over 10 knots. At this speed the autopilot won't correct in time if the balance between wind and waves suddenly shifts, and it's time to slow the boat down. On *Hawk*, this tends to happen at around 40 knots of wind in 10- to 15-foot seas. We have found that she will remain well under control in these conditions if we can stop her from surfing while keeping her speed somewhere between 5 and 7 knots.

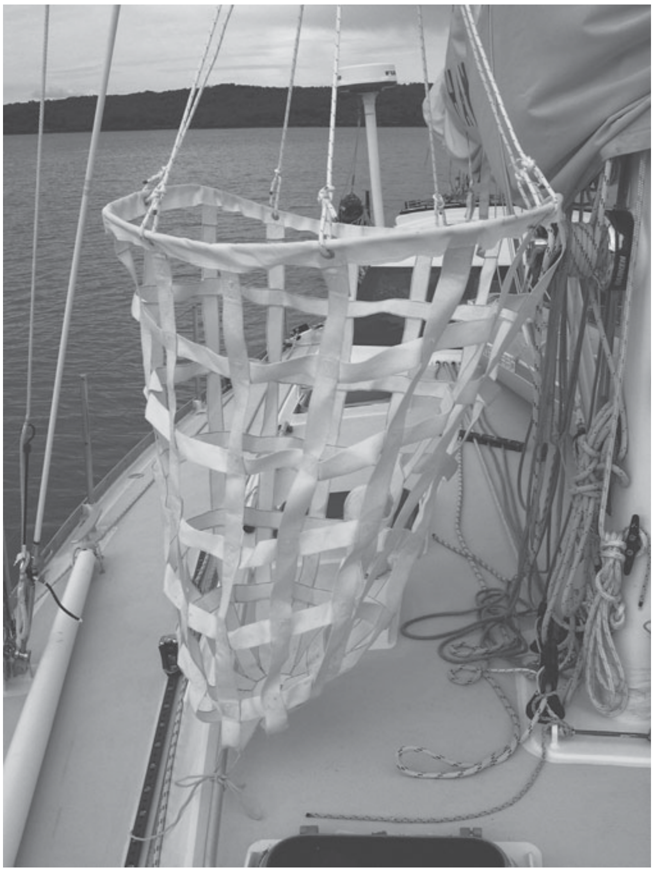


Figure 22-4.
The Galerider, a speed-limiting drogue.

Trailing warps will not achieve this in these winds. A 300-foot line towed from *Hawk*'s stern quarter will stabilize her and help her track downwind, but it will not decrease her speed by more than 1 knot or so. A well-designed speed-limiting drogue works much better. We use the drogue in conjunction with a storm jib to keep the boat stabilized and running dead downwind.

A drogue needs to be correctly sized for a given boat. If the drogue creates too little friction, it will pull out of the water completely, suddenly releasing the tension on the rode and allowing the boat to accelerate unchecked down a wave face. If the drogue is too large and generates too much resistance, then it will slow the boat too much, making it wallow and dragging down the stern, exposing the cockpit and companionway to the full force of the waves and causing the boat to be pooped repeatedly. The drogue must create enough friction to prevent the boat from surfing while allowing the stern to lift easily to approaching waves.

While we have a variety of drag devices aboard, the one we have used the most and feel the most comfortable with is the Galerider (Figure 22-4). This consists of a webbed bowl attached to a circular wire rim with a diameter of 42 inches, designed for a boat with a displacement of 30,000 to 55,000 pounds (*Hawk* displaces about 37,000 pounds with a cruising payload). The Galerider is designed to allow water to flow through it, which lets the boat keep moving at a moderate speed while, in theory, creating sufficient resistance to keep her from surfing. A bridle of strong nylon lines connects with the rode via an oversized galvanized swivel. The whole thing stows neatly into a flat bag half the diameter of the rim and fits wedged behind our cabin heater in the main saloon, easily accessible even if we're seasick (refer back to Figure 20-7).

If the drogue is to work correctly, the right amount of rode needs to be deployed. In theory, speed-limiting drogues like the Galerider should be deployed two waves back and in the opposite part of the wave to the boat. That is, when the boat is on a wave face, the drogue should be in the back of the second wave behind the boat. This keeps the drogue from being jerked out of the face of the wave as the boat accelerates toward the trough. Too little rode, and there will not be enough resistance to slow the boat; too much, and slack will develop between the boat and the drogue, which means the boat will accelerate only to jerk up against the drogue when the slack comes out of the line.

That's the theory. In reality, we've never been in a storm where the waves were that consistent. Whenever we've used our Galerider, there have been periods of several minutes out of every hour or so where a series of waves were more than twice as high as the average (Figures 22-5A and 22-5B). The first time we used it, we followed the manufacturer's recommendation and deployed the drogue on 300 feet of nylon double-braid rode, but in the intervals of the largest waves (and in one storm these were breaking), the drogue ended up in the wave directly behind us, and several times our boat pulled it right out of the wave face (see Figure 22-7). When this happened, the "freefall" that followed would end when the drogue bit and the boat fetched up against it hard enough to swing the stern one direction or the other. The nylon rode had enough stretch in it to soften the impact, so this didn't damage anything, but the only way to keep the boat headed in the right direction whenever these larger waves came along was to hand steer, which defeated the purpose of using the drogue in the first place.

In this situation, we would have liked to add more rode, but as was the case for others we have interviewed, we found we couldn't easily add a second line with the rode under load. Especially when using a bridle, the rode length deployed initially tends to be the rode length carried throughout the storm.

In large seas with spume flying everywhere, it's also incredibly difficult to tell exactly where the drogue is if it is more than one wave behind you. At night it's impossible. So we have found these detailed discussions about rode length to be less than useful in practice. After pulling the drogue out of some wave faces, we decided we were better off with more rode than less. We have since doubled the rode length to 600 feet, and that has worked well in Southern Ocean storms. We create a 600-foot rode by connecting two of our 300-foot double-braid nylon lines with an anchor bend and whipping the tails to the line to prevent the knot from slipping.

Opinions differ on whether to set the drogue off the quarter or to use a bridle to hold the rode dead off the stern. When we have set it from the quarter, the pull on the quarter sometimes confused or even countered the autopilot, with the result that we "wiped out" and the stern got spun by a breaking wave crest. We now use a bridle and much prefer it. It holds the stern square to the waves, and the boat steers much better and with much less effort. The one time we deployed a drogue on *Silk*, however, she was more comfortable taking the waves on her quarter instead of square on her stern. You will need to experiment with your boat. Boats with modern underbodies that surf easily seem to do better with a bridle, while more traditional boats may prefer lying quarter to the seas.

Again, opinions differ on how long the bridle should be. If the bridle is too short, the forces on the knot will be much higher. Some commentators suggest that the bridle and rode lines should come together at a 30-degree angle, but we prefer an angle of less than 15 degrees. To achieve that, we use a bridle that is roughly half again the length of the boat or six times the width of our transom—about 70 feet in our case. We attach a 75-foot Dacron spare jibsheet about 75 feet from one end of the 600-foot rode using an icicle hitch. Again, we whip the ends of the knot to the rode to prevent the knot from slipping.

To deploy the drogue, we bring the line bags and the Galerider up on deck. We engage the autopilot and pull out the bitter end of both the rode and the bridle line. We each take one of the lines and run it through the snatch

Figures 22-5A and 22-5B.
These two photos were taken within 15 minutes of one another in a gale in the Southern Ocean when the wind had been averaging 40 knots with higher gusts for more than 12 hours.

block at one stern quarter and to the primary winch on that side, pull through about 10 feet of line, and then secure it with a tugboat hitch or by cleating it next to the winch.

Next we flake the rode down on the helmsman's seat in a big figure eight, ending at the thimble spliced into the drogue end of the rode. We shackle this to the swivel on the Galerider bridle, mouse the shackle with a wire tie, and double-check that everything is secure. One of us shakes out the Galerider and holds it open against the wind, then tosses it into the water. The line snakes out fast. *Hawk* checks for a second when the drogue bites, then bounces forward again before settling down to a relaxed 6 or 7 knots. We then adjust the rode and bridle lines until the icicle hitch is centered behind the boat. Once the drogue is deployed, *Hawk* no longer surfs. With the drogue holding her stern straight into the seas, the autopilot stops hunting around trying to keep up with her erratic motions. It's as if she's suddenly held in place by a spring that stretches when a wave grabs her but stops her before she can start surfing. Our boat speed generally holds between 6 and 7 knots, with the occasional bounce up to 8 or 9.

We have retrieved our Galerider using our primary winches when winds have dropped to gale force, and found we couldn't turn the winch using low speed and all our strength when the drogue was fully loaded. That means in gale (not storm) conditions, our Galerider generates steady-state forces of about 3,500 pounds (10 percent of displacement); forces in storm conditions when a wave slams us against the drogue must be at least double that. To manage those forces requires very strong attachment points with chafe-free leads. Here we have taken a lesson from our time in the Chilean channels, where we sat out many a storm with several stern lines tied to trees ashore. We ran these lines directly to our primary winches through oversized snatch blocks shackled to the toe rail at *Hawk*'s stern quarters (Figure 22-6). The only contact the lines have with the boat is at the winch and at the snatch block sheave. Using this method, we have never had any chafe on the rode when trailing a drogue.

On *Hawk*, we have run with the Galerider and an ORC-sized storm jib in true winds of up to 50 knots. If the wind speed or the wave shape means that we start surfing for short periods even towing the Galerider, then we drop the storm jib and run under bare poles. The motion is a bit less comfortable, but the boat remains stable and does not need to be hand steered as long as the waves remain orderly without breaking.

Retrieving the drogue is the hardest part of the whole operation. We like to retrieve it and get underway again as soon as the wind drops below gale force. Using our primary winch and working in shifts of 20 to 30 minutes each, it has taken us over 2 hours to winch in a 300-foot rode. The loads are so high that we can generally only winch when the slack comes off the rode. When we went to a 600-foot rode, we used snatch blocks to lead the drogue to the windlass.

We have pulled the Galerider out of wave faces even with the 600-foot rode, and we believe this could be a danger in breaking waves. We have created a two-element drogue by putting our Delta drogue in series with

HAWK VS. *SILK*: AN EXAMPLE OF HOW BOAT DESIGN IMPACTS TACTICS

As discussed in the Two Boats, Two Voyages sidebar in Chapter 3, *Hawk* and *Silk* represent two distinct types of cruising boats. The differences in how these two boats handle heavy weather arise in part from the difference in their overall length and displacement and in part from the differences in their designs. The boats react differently to strong winds and big waves, and the tactics we employ need to reflect these differences.

- **Close-hauled.** If we are trying to make progress to windward, we can keep going much longer on *Hawk*, in part due to her size but also due to her ability to point higher and drive more efficiently into large waves. With *Silk*, by the time the wind went over 25 knots apparent and the seas reached 6 or 8 feet, we had to keep her overcanvased to push her at 4 or 5 knots through the waves; otherwise she would hobbyhorse her way to a standstill. That meant she was heeled over at more than 30 degrees and often pounding, making for an unstable platform and a choppy, uncomfortable ride. Even then we would be making good only 45 degrees or so to the apparent wind (about 60 degrees to the true wind), so our progress toward an upwind destination was minimal.

  On the other hand, with her ketch rig, *Silk* hove-to easily on the mizzen sail alone, and once hove-to she rode very quietly with her head about 45 degrees off the wind, sliding to leeward at 1 knot or so. Given the comfort of being hove-to versus the punishment of making almost no progress, we rarely tried to keep sailing to windward when the true wind went over 20 to 25 knots.

On *Hawk*, the situation is almost reversed. With her fin keel, spade rudder, and fractional rig, *Hawk* sails efficiently to weather and resists slowing down or stopping. Without pressing too hard, we can make good 6 knots over the bottom, sailing her 30 degrees off the apparent wind into 30 knots of true wind and 8- to 10-foot seas. Though *Hawk* could certainly sail into stronger winds and bigger seas, we tend to slow her down when the true wind goes over 30 knots by dropping the staysail and forereaching under the reefed main alone. Under this reduced sail area, she'll make good 3 knots or so less than 30 degrees off the wind, which means we're still making miles toward our destination. Her motion is considerably less violent, though not nearly as calm and quiet as heaving-to in the same conditions on *Silk* would have been.

In a moderate gale with moderate wave conditions, forereaching has proven to be an entirely satisfactory tactic without the complexity of streaming something in the water. Only once in more than 50,000 miles aboard *Hawk* have we been in storm conditions where forereaching could have been unsafe. But when we're tired and want a break for some sleep or a meal, or if we need a time-out to consider our options, we both miss the ease with which *Silk* hove-to.

- **Beam-reaching.** Given the vulnerability of boats to breaking seas on their beam, we make every effort to keep the bow or stern into the seas. But we reach the point where we become concerned enough to change course much later aboard *Hawk* than we used to on *Silk*, a function of *Hawk*'s greater displacement, wider beam, and higher ballast ratio.
- **Running.** The ease with which *Hawk* breaks loose and surfs when running before gale-force winds and waves translates into greater speed and higher forces than was the case aboard *Silk*. That in turn means more active management on our part to control *Hawk* off the wind. When the self-steering can no longer react quickly enough to keep *Hawk* from broaching, we deploy a speed-limiting drogue as described in the Running with a Speed-Limiting Drogue section above. The drogue slows *Hawk* down to 6 knots or so, which is fast enough that overtaking seas rarely board us.

  Running before 35 or 40 knots of apparent wind under the staysail alone, *Silk* rarely exceeded 5 knots of boat speed, which meant the autopilot or wind vane had little difficulty in controlling her, making a drogue unnecessary. *Silk* rarely surfed in these conditions, though at times it felt as if the wind and waves were trying to rush her off her "feet" while she plodded along at her own predetermined pace. As the waves built, they boarded us and partially filled the cockpit on occasion, but never so often the cockpit drains couldn't deal with the situation.

All this translates into much more active management in gale and storm conditions on *Hawk* than was necessary on *Silk*. Not only must we be constantly evaluating the sea state and the boat's reactions to it, but we must also be aware of how tired we are getting and whether or not we need to reduce speed so one of us can get some rest. On the other hand, *Hawk*'s ability to keep going longer in heavy weather and begin sailing again sooner means we spend less time in strong winds and big waves. She can sail out of almost anything if we're willing to take a beating. With the wind well forward of the beam, *Silk* could not, literally, so we waited it out. On a trade wind circumnavigation, that meant occasionally heaving-to for 12 hours until the wind shifted. *Hawk* is better suited to the high-latitude voyaging we have done aboard her, where 40 percent of the time we have had the apparent wind forward of 70 degrees.

Like most traditional designs, *Silk* was extremely forgiving, and in all but the most severe conditions she could take care of herself if we needed to take care of ourselves. *Hawk* offers more comfortable, faster passages almost all the time but demands more attention in the conditions when, as a shorthanded crew, we are least able to provide it.

Figure 22-6.
To eliminate chafe, the rode for the drogue runs from the winch directly to a block shackled to the stern quarter.

the Galerider. The chances that both could get pulled out of a wave at the same time seem minimal. We have not yet tried this drogue in storm conditions but believe it will be an improvement over the Galerider alone.

SURVIVAL STORM TACTICS

Visualize what it would be like to wrestle with a jib in the bed of a pickup truck driving 60 mph over a rough road in a deluge of rain, and you begin to have some idea of what it is like to manage a boat in a survival storm. Lack of confidence in the vessel and limited experience with heavy weather are the primary causes of four of the most common mistakes:

1. **Stopping sailing too soon or using too little sail area.** The longer you sail, the farther you can get from the storm center, and the longer you have steerageway to avoid the biggest breakers. Carrying too little sail early on in a storm will cause the vessel to be sluggish and unresponsive to steering and allow her to end up beam-to the seas. Most boats will not heave-to satisfactorily without enough sail to keep the bow into the wind, and will not run off safely without sufficient sail to keep the boat responding more to the wind than to the waves.
2. **Not implementing storm tactics early enough.** Stopping sailing too early leaves the boat vulnerable to big seas. But once conditions really deteriorate it will be close to impossible to deploy a parachute and difficult to deploy any sort of a drogue. Picking the right time to move to ultimate storm tactics takes the most judgment and is the most difficult thing to figure out before the fact. If the rhythm of the boat changes and she seems to be struggling to keep her feet in successive waves, take action.
3. **Not getting underway early enough when conditions moderate.** Most knockdowns and capsizes happen near the end of a blow, after the wind has shifted, which causes the waves to become confused. Getting some sail back up at the end of a storm after the wind has shifted and the barometer has begun to rise is the best way to keep the boat stabilized and able to deal with the dangerous sea state. Yet, as discussed in the What the Barometer *Really* Tells You sidebar in Chapter 19, there is often a lull in the eye of a low or in the area between the warm and cold fronts where the wind will die and the barometer will level off but not start to rise. Putting too much sail up may mean getting knocked down when the weather deteriorates again. In this situation, motoring with a trysail or a staysail to stabilize the boat until the wind shifts and the barometer begins to rise is the best tactic.
4. **Abandoning ship too early.** It has been well documented in highly publicized sailing disasters such as the 1979 Fastnet, the 1998 Sydney-to-Hobart Race, and the 1994 Queen's Birthday Storm that you should not abandon a vessel until it is literally sinking beneath your feet, and you have to step up off the deck to your raft. In case after case, crews have been injured or killed in life rafts, while their abandoned vessels have been found months later floating happily on their own. The boat is the safest place to be almost all the time, and staying with it greatly increases your chances of survival.

To stay aboard when the boat is taking on water or after a dismasting, you need a strong yacht that you trust implicitly. Only then will you have the confidence and peace of mind to stick with the vessel through thick and thin. Olin Stephens, one of the great offshore designers, said, "When I think of the boat in which I should be happiest in meeting heavy weather, I visualize one that is moderate in every way, but simply as strong as possible."

Considerable disagreement exists among experienced yachtsmen as to the effectiveness of the various alternatives discussed in this section. The only two objective tests we are aware of (the U.S. Coast Guard and Southampton University tank tests—see the Heavy-Weather References section in the resources for this chapter in Appendix 1), both favored series drogues, but it is unclear whether these tests reflect real "at sea" conditions or whether they apply to all boat designs. As the Southern Ocean Storm Tactics sidebar below demonstrates, in Southern Ocean survival storms crews on different boats have used different solutions.

We have been in survival storms only twice: the first for 48 hours, and the second for only about 8 hours. We cannot write about each of the tactics that follow from firsthand experience, and we certainly do not know what storm tactic will work best for your boat in a survival situation. But in the seven years we have been cruising aboard *Hawk*, we have interviewed dozens of crews who have been through survival storms, and we have also read and analyzed the *Drag Device Data Base (DDDB)* and reports and analyses of the 1979 Fastnet, the 1994 Queen's Birthday Storm, and the 1998 Sydney-to-Hobart race (see the 1998 Sydney-to-Hobart Race: A Postmortem sidebar below).

The vast majority of boats and crews survive these storms, which has to be considered a successful outcome. However, boats often lose their masts or steering and suffer damage to topsides, coach roofs, and portlights. Crew can be lost overboard or injured severely in knockdowns or rolls, with broken bones being the most common injury. The question, therefore, is not how to survive such a storm, but how to do so with the boat intact and the crew uninjured. That means keeping the boat upright when the sea would have it otherwise.

Although we have not come to definitive conclusions on how to do that, we have developed six hypotheses (that we continue to refine), as follows:

1. **Never lie ahull in a monohull.** As discussed in the Lying Ahull sidebar above, this tactic is most likely to result in knockdowns, rolls, and dismastings. Of the three boats that lay ahull for any length of time during the Queen's Birthday Storm, only one—a catamaran—remained upright. The other two were both rolled and dismasted, one well to the north of the New Zealand meteorological service's reported area of 50-knot winds. That crew chose lying ahull as a tactic; the other two found themselves lying ahull after gear failures.
2. **Running free is likely to result in a knockdown.** We have interviewed crews from a dozen boats that were knocked down after broaching while running free in survival conditions. When we got into our first survival storm, we were so inexperienced we did not know how to heave-to. We ended up running free for about 12 hours at the beginning of the storm in conditions we would later have hove-to in. By the end of that 12 hours, *Silk* was almost broaching as she surfed the crests of some waves, and cross seas running perpendicular to the major wave train were crashing into us beam-on. We deployed warps off the stern, and I have little doubt that if we had not done so *Silk* would have been knocked down.

   In the Queen's Birthday Storm, three boats ran free. One was rolled and dismasted, one was knocked down past 90 degrees and dismasted, and the crew deployed a drogue on the third when they decided the boat was going too fast. As already described, we deploy a speed-limiting drogue on *Hawk* when she begins to surf regularly, and on at least one occasion we would likely have broached and been knocked down if we had continued to run free.

   There are two caveats to this point. First, we have interviewed a few people who have kept their boats upright in survival storms while running free, including Max Fletcher, who is quoted in the Southern Ocean Storm Tactics sidebar below. They were all on heavy-displacement boats with full keels or centerboards that were all but impossible to get surfing, and in most cases their crews hand steered them through the worst of the storm. If you are running free in a survival storm and your boat starts surfing regularly, or if you are hand steering and do not want to continue, we would recommend switching storm tactics. Second, in a few long-lasting storms (more than 72 hours) in the Southern Ocean, some very experienced sailors have found that the boat did better when they got rid of the drogues they were towing and ran free. The Running Off with a Medium-Pull Drogue section below considers why this may be the case.
3. **Heaving-to free does not seem like a successful strategy in survival seas.** In that first survival storm aboard *Silk*, if we had hove-to we probably would have been fine for the first 12 hours. But after that point, the waves crashing into our side would sooner or later have knocked us down or left *Silk* beam-on to the major wave train, which would

almost certainly have meant getting rolled. It is telling that of the seven boats in the most dangerous part of the Queen's Birthday Storm (see Table 22-1), none of them hove-to. All of them chose running with a drogue as their primary tactic. Having seen severe breaking seas, I can understand why these crews did not consider heaving-to a viable alternative.

Granted, all the monohulls that ran with drogues in this part of the storm ended up getting rolled, and none of them tried heaving-to. But of the five boats that hove-to outside the most dangerous part of the storm, three were knocked down to 90 degrees or more. Fore-reaching, motoring into it, running free, running with a drogue, and lying to a sea anchor were all more successful tactics than heaving-to outside of the most dangerous part of the storm. Lying ahull was the only tactic that could be considered less successful. We have interviewed a few crews who have hove-to dozens of times in gale and storm conditions but switched tactics in survival storms when the waves would no longer allow the boat to keep her bow into the wind. We have also interviewed two crews who did not switch tactics and were knocked down past 120 degrees.

4. **Some sort of drag device can help keep boats upright in survival storms.** All but one of the experienced Southern Ocean sailors quoted in the Southern Ocean Storm Tactics sidebar below used a drag device to slow the boat down and orient the bow or stern into the seas in survival storms. It makes sense that having something "anchoring" the bow or stern into the wind will keep the boat from getting oriented beam-to the seas in breaking waves and reduce the chances of getting knocked down or rolled.
5. **Even this may not prevent a knockdown, so be prepared.** Although we have come to believe that drag devices can help keep a boat upright, we do not believe they are foolproof. Keeping the bow or stern oriented into the main wave train still leaves the boat vulnerable to getting struck beam-on by a freak wave or having two waves pyramid under it and then collapse as described by Noel Barrott in the Breaking Waves and Rogue Waves section above. The vast majority of experienced Southern Ocean crews we interviewed have been knocked down past the horizontal at least once. They viewed this as a difficulty, not a disaster. They prepared their boats so that a knockdown would do a minimum of damage and accepted the risk that it might happen. The likelihood of such an event has to be considered minimal for any crew on a tropical circumnavigation that plans their voyage prudently. But it costs almost nothing to be sure the boat is organized and set up to prevent damage during a knockdown, and it just may save your life someday.
6. **There is no "silver bullet."** We firmly believe that the size, hull type, and displacement of a boat along with wave shape and sea conditions all affect the optimal tactics for a particular storm. In our opinion, Adlard Coles's original *Heavy Weather Sailing* (see the Heavy-Weather References section in the resources for this chapter in Appendix 1) said it best: keep trying different things until the boat feels "right"; that is, under control, bow- or stern-to the prevailing seas, and not being subjected to the force of breaking waves.

   It may take several different storm tactics to get the boat feeling "right." In the Queen's Birthday Storm and among those we have interviewed, sailors in survival storms switch between tactics when what they are doing does not seem to be working or when something breaks (the rode to a sea anchor chafes through, for instance). That means that if you ever find yourself facing hurricane-force winds and breaking seas, you will want to have as many options at your disposal as possible.

This is what we think we know. What we don't know is which drag device works best for different boats. Speed-limiting drogues have been used successfully in survival storm conditions; however, they did not stop the boats in the most dangerous area of the Queen's Birthday Storm from getting rolled. Although the conditions in that area of the storm have to be considered extraordinary, the evidence suggests that speed-limiting drogues may have their limit. The following sections explore the other alternatives available to hold a boat bow- or stern-to the wind in survival storm conditions and lay out what we know about the pros and cons of their use.

Running Off with a Medium-Pull Drogue

Ten boats in the Queen's Birthday Storm ran with drogues for all or part of the storm. The drogues these boats used ranged from warps made from long lines to speed-limiting drogues like the Galerider to small parachutes meant to be set off the stern. Several boats did better when additional drag was put out in the form of chain or anchors streamed from warps. This resonates with our

SOUTHERN OCEAN STORM TACTICS

Noel Barrott, winner of the 2002 Blue Water Medal, who sailed the Southern Ocean aboard *Masina,* a 39-foot engineless, traditional wooden cutter, said:

> "Our ultimate defense during these passages was (and still is I think) given sea room, to run square off, towing 60 fathoms of 1½-inch warp in a bight through fully encapsulated 'Panama' fairleads back aft out near the quarters. On a large snatch block running in the bight we towed a large-fluked, stainless steel flying boat anchor (Northill), a folding version, opened up of course. [With] the storm staysail sheeted hard and flat amidships and helm lashed she would look after herself with the head blown off downwind, slewing off before any breaking seas coming in on the quarters caused by different wave trains due to the rapid passage of the frontal systems and the veering or backing of the wind."

Maxwell Fletcher, who sailed the Westsail 32 *Christopher Robin* nonstop from New Zealand to the Falkland Islands, said:

> "The smallest of the storm jibs was 36 square feet (half the size of a sailboard sail) . . . and in one gale we had to take it in because it was overpowering the boat. That was the heaviest weather of the trip, as we were heading southeast across the 50th parallel, a storm that lasted 60 hours. We were doing 130 miles a day running under bare poles, surfing occasionally at 8 or 9 knots. We estimated the wind Force 10, occasionally 11, seas 35 to 45 feet. We had to steer by hand because we didn't dare let the boat get caught by a breaking sea. A few times a wave broke over the transom, but for the most part the 5 to 6 knots we were averaging was perfect. We were afraid if we dragged warps we might have slowed down too much and gotten pooped more often (plus lose steerageway), but if we had gotten too tired we would have done that."

Susanne Huber-Curphey, who, with her partner Tony Curphey sailed the Rhodes 41 *So Long* from the Beagle Channel to South Africa, said:

> "I heard this one wave approaching like a steam train. [It] threw the boat over and [I] felt the shocking sensation of huge amounts of water over me; at the same time the noise of breaking glass and all kinds of stuff flying on top of me. . . . The wave threw *So Long* sideways onto the water; the masttop was below the surface (toplight was ripped off) and maybe 2,000 liters of seawater entered through the partly closed companionway. . . . After the knockdown on Friday morning we steered downwind bare-poled, without any sails, and the Aries self-steering kept the boat on course at about 5 to 6 knots. By noon Friday the still increasing wind made the situation critical with building seas and huge breaking waves. It was not safe anymore to keep the boat unsupported at this speed. For the first time we deployed our new [drogue] over the stern, a system of 120 little parachutes attached to 200 meters of rope [Jordan Series drogue]. The boat then settled at about 2 knots of speed and took the breaking seas in a very safe angle over the stern. We could feel the gentle pull of the drogue to keep the boat at a secure angle to the sea. . . . Between Thursday evening and Friday noon the barometer had dropped 18 millibars to 992 millibars, wind north Force 9 to 10. For the next 41 hours, all day Saturday, until Sunday morning we were drifting with the [drogue] with the wind at storm force and shifting from north to southwest."

Alun Hubbard, who, with a crew of climber-adventurers sailed the 50-foot steel ketch *Gambo* from New Zealand to the Beagle Channel nonstop, said:

> "We didn't have a particularly fast crossing—39 days from Lyttelton, New Zealand, to Puerto Williams (via Cape Horn) but as I was new to these latitudes, I took it pretty prudently to start with and sailed way too far north (about 45°S). . . . However, I slowly built confidence and had a very fast last two weeks averaging close to 1,000 nautical miles a week between 50° and 55° south. This is including a week-long westerly storm with sustained winds over 50 knots (gusting to 75+) and big waves (50+ feet), one of which knocked us down (to about 140 degrees) about 1,200 nautical miles west of Cape Horn. Boat and crew survived this fine—though I then tended to [lie] to a 24-foot para-anchor off the bow when seas got big subsequently. We spent 30 hours like this just west of the Cape Horn continental shelf to allow a system to go through before making a run for it, which we did in perfect weather and managed a skinny-dip about a mile off Isla de Hornos in bright sunshine."

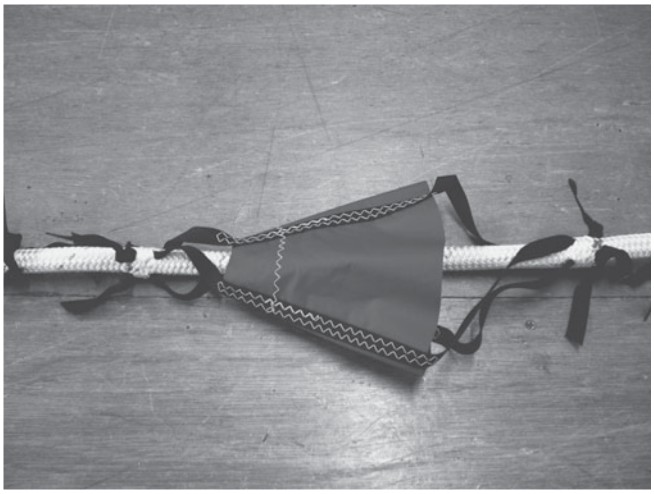
Figure 22-7.
Evans hand steering off Uruguay. The line running from our stern to the Galerider in the wave behind us (just visible under his left elbow) is 300 feet long. The wave is just starting to break, and Evans has turned to look over his shoulder to position the boat's quarter to the wave face.

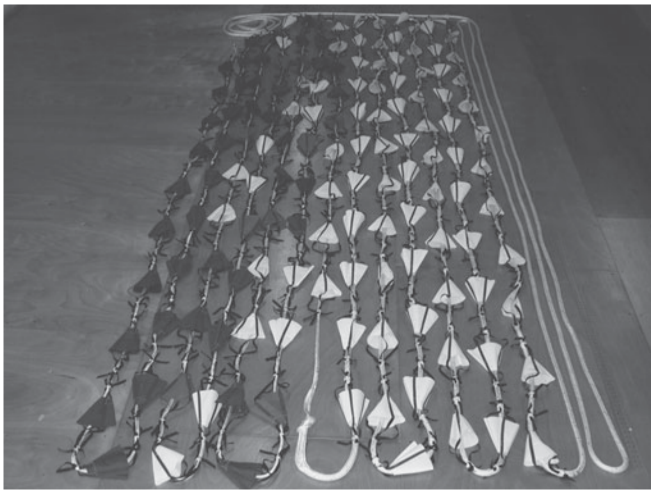
experience aboard *Silk* in a survival storm in the Gulf Stream. We first took two 60-foot docklines, cleated each to one of our stern cleats, and tied the bitter ends together to form a large bight. Streamed off the stern, this had almost no effect on *Silk*'s speed or stability. We then streamed 30 feet of chain on the end of a 150-foot anchor rode off one quarter. The change was immediate. *Silk*'s freight-train run in the crests of the waves came to an abrupt end, and she plodded along like a docile plow horse as the waves rushed past her.

Only four of the crews who used drogues in the Queen's Birthday Storm hand steered; the rest relied on self-steering or lashing the helm. After deploying warps in the Gulf Stream storm aboard *Silk* and setting the Galerider on *Hawk* in breaking waves (Figure 22-7), neither of us felt we could leave the boat to her own devices, and we hand steered until the seas were no longer breaking. Experience from the 1998 Sydney-to-Hobart Race suggests that crews that hand steered through the worst conditions had better outcomes than those that did not (see the 1998 Sydney-to-Hobart Race: A Postmortem sidebar below).

This brings us to two conclusions. First, in a survival storm the boat needs significantly more drag to remain in control than in gale or ordinary storm conditions. That means that speed-limiting drogues may not be up to the task. Second, in large, breaking waves, hand steering may help keep you out of trouble, but there are limits to how long a crew of two can steer effectively.

Medium-pull drogues provide significantly more drag than speed-limiting drogues and may be better suited to these conditions for some vessels. The best known medium-pull drogue is the Jordan Series drogue designed by Donald Jordan. It consists of hundreds of small cones of sail material strung together on a long line that is streamed from the stern (Figures 22-8A and 22-8B).





Figures 22-8A and 22-8B.
A Jordan Series drogue consists of hundreds of small cones made from parachute material sewn to a long warp. (Courtesy Ace Sailmakers)

They are designed to create enough drag to slow the boat to 1 to 2 knots. Spreading the resistance over many small cones prevents the drogue from being pulled out of wave faces and creates a great deal of holding power. The line provides elasticity so the vessel can "give" to a large wave but will be pulled up gradually if a wave tries to carry it away. Both U.S. Coast Guard and Wolfson Unit tank tests have found that the Jordan Series drogue does the best job of stabilizing a boat. More to the point, the handful of people we know who have used them have all avoided being knocked down or capsized in extreme conditions (see the Southern Ocean Storm Tactics sidebar above).

Jordan calculates that the loads on the series drogue may reach two-thirds of the boat's displacement, so attachment points need to be structural. Even through-bolted cleats and winches may not be strong enough to withstand the peak load. He recommends installing dedicated chainplates on the stern quarters as attachment points. The few people we know who have used the

Jordan Series drogues have attached them to stern cleats, but you should ensure that your own hardware can withstand such large forces before following their lead.

The three crews we have interviewed at length about their experiences with the Jordan Series drogue cite three disadvantages. First, a Jordan Series drogue holds the vessel almost stationary stern-to the breaking seas, which means that the boat may occasionally be swept by waves. The companionway, hatchboards, and cockpit locker lids need to be very strong and watertight to withstand the forces involved. Second, the drogue can be extremely difficult to retrieve. Putting it on a winch may damage some of the cones, though some people have retrieved them that way successfully. There is so much drag that even using a winch the drogue can't be retrieved before winds have dropped to about 20 knots. One crew spent eleven days trying unsuccessfully to retrieve their drogue after a Southern Ocean storm and ended up cutting it away. Finally, the drogue is time-consuming to make, expensive to buy, and difficult to stow unless high-tech line (such as Spectra) is used to reduce the weight and the bulk of the finished drogue.

The Jordan Series drogue has not been around long (the Coast Guard report summarizing tests of a prototype cited in the Heavy-Weather References section in the resources for this chapter in Appendix 1 was written in 1987), so firsthand experience is hard to come by. None of the boats in the Queen's Birthday Storm carried Jordan Series drogues. But what evidence there is supports the U.S. Coast Guard findings that it reduces the chances of being rolled in breaking seas. We now carry a Jordan Series drogue aboard and hope to have the opportunity to test it against our speed-limiting drogues in storm conditions.

Some very experienced sailors have advocated running free in survival conditions. Vito Dumas, the first person to circumnavigate the Southern Ocean in a small boat, did so aboard a 31-foot ketch in 1942. He advocated surfing in the wave crests rather than weighing the stern down. Adventurer and single-hander Bernard Moitessier made the decision to follow Dumas's example when *Joshua* was being pooped repeatedly in the worst storm he encountered in the Southern Ocean. He cut away his warps, and the boat rose up on the waves and surfed along safely, though he did have to hand steer to keep her out of trouble. Nancy and Bob Griffiths, who circumnavigated the Southern Ocean in their 53-foot steel cutter *Awahnee* in the early 1970s, also cut warps away in an extreme storm and felt the boat was better off.

Studies of wave formation over the last decade or so suggest a way to reconcile these experiences with our conclusion that drag devices help stabilize a boat in survival conditions. These studies have found that waves tend to be steep and breaking early in a storm. This is because the underlying water is not yet moving at speed with the wind. During that period, drogues or warps stabilize the boat. After the winds have been blowing at storm force for 48 hours or more, the waves become less steep but their velocity increases dramatically. Warps may then slow the boat too much in front of the rapidly moving waves. Cutting drag devices away may allow the boat to rise up and surf over the waves, but only if the boat is hand steered to avoid breaking seas. This is a situation that, in theory, would occur only in the Southern Ocean, which is where the three crews cited above were sailing. But it again highlights the need to keep trying things until the boat feels right, and to change tactics if the situation changes and the boat becomes pressed.

If the vessel has been hove-to and conditions have deteriorated to the point where running off with a drogue is necessary, you will have to turn your boat so her quarter is positioned to the waves. This will bring you beam-on to the seas for a brief period. When you are getting ready to turn and run off, watch the waves and wait for four or five smaller waves that are not breaking. In the storm conditions we have experienced, we have always been able to find a short break in the waves, but it might take 15 to 20 minutes.

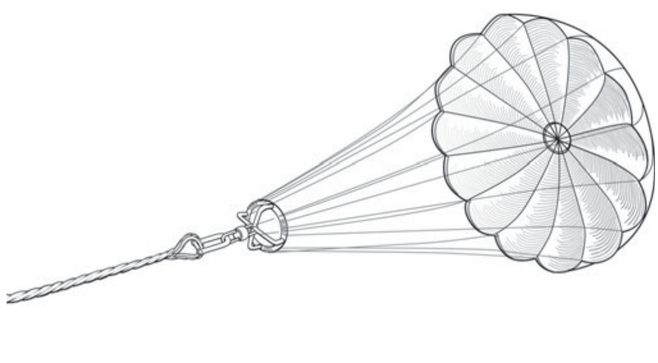
Lying To a Sea Anchor

A sea anchor is streamed from the bow to hold the bow facing the wind and seas. It anchors the boat to the water. Most sea anchors look like parachutes, and in fact, some people buy army surplus parachutes to use as sea anchors. They are streamed straight off the bow or at an angle to it on nylon line, which helps absorb the shock loads as waves hit the bow (Figure 22-9). Some parachute sea anchors come equipped with a tripping line, which is used to retrieve the parachute or to control the rate of drift by partially collapsing the device.

The merit of sea anchors continues to be one of the most hotly contested points in heavy-weather discus-

Figure 22-9.

Most sea anchors consist of large parachutes that are streamed from the bow on a long nylon line. (Fritz Seegers illustration)



sions. Many people believe this is the only tactic that makes sense in ultimate conditions, and there are some truly astonishing testimonials. On the other hand, even a brief glance through the *DDDB* will reveal a number of difficulties in using these devices in the real world. Everyone seems to agree on two points: small sea anchors don't create enough drag and are completely ineffective in storms; and for drag devices to be effective, tension must be kept on the rode at all times. Beyond that, there isn't much agreement.

There are three schools of thought on the proper sizing and deployment of a parachute sea anchor. Some manufacturers recommend a minimum diameter a bit bigger than the boat's beam (with bigger being better) and a deployment directly over the bow like a regular anchor on a rode at least 300 feet long. This large size provides sufficient drag to hold the bow through a breaking wave, and the over-the-bow deployment is simpler and less prone to chafe than the alternatives. However, such large sea anchors are extremely difficult to deploy and to recover, impose enormous loads on the deck hardware and rode, and make for an uncomfortable and potentially even dangerous motion aboard with the bow pitching, snatching, and tacking. Picture your boat anchored in a gale in a reasonable anchorage, then double the wind speed and add huge waves. There can be little doubt that the tension on the rode would vary as boat and parachute respond differently to different waves. It should also be obvious that this would not be a comfortable way to spend hours, let alone days, at sea.

The second school of thought, which is advocated by Lin and Larry Pardey in their *Storm Tactics Handbook*, recommends using a sea anchor with a diameter somewhat smaller than the boat's beam and deploying it on a rode about 100 feet long with a bridle so it lies about 30 degrees off the bow. This puts the boat in a hove-to orientation to the wind and seas rather than an anchored one. With this solution, the boat will give more as the waves hit it, reducing the strain on the hardware, anchor, and the boat itself. The shorter rode keeps the parachute closer to the boat, which should keep the rode under tension at all times. The motion will be much quieter as the boat will stay in one orientation to the wind. And if the boat is drifting to leeward it will create a slick that may cause the waves to break before they reach it. In this hove-to orientation, however, there is some risk that a large wave will force the bow off and then roll the boat. For boats over about 40 feet, it is difficult to design a bridle sufficiently strong to handle the enormous loads (estimated at up to two-thirds the boat's displacement).

The third school of thought is that both of the above options have such serious limitations that sea anchors really don't have much of a role in storm tactics.

There is currently not enough real-world experience to clearly recommend one theory over the others. We know people who have successfully used sea anchors not just once but several times (see the Southern Ocean Storm Tactics sidebar above), but we know more people who have gotten them wrapped around their keels, lost them to chafe, and cut them away when the motion became too violent. An analysis of the *DDDB* provides insights into the pros and cons of sea anchors and into the issues that need to be addressed to use one successfully.

The fourth edition of the *DDDB* chronicles more than seventy case studies involving sea anchors, about equally divided between monohulls and multihulls. Of those, more than one-quarter would be considered unsuccessful, meaning that the sea anchor could not be deployed, chafed through and was lost, did not hold the bow into the wind, or got fouled and did not have any effect on the boat. It's interesting to note that multihulls had a much higher success rate than monohulls—almost 40 percent of the monohull case studies have to be categorized as unsuccessful, versus less than 20 percent of the multihulls. Multihulls seem to do better with sea anchors in large part because they can set the rode off a bridle from either hull. This spreads the loads and holds the vessel into the wind with much less yawing. It also greatly improves the motion as the boat swings back and forth across the eye of the wind. The crews on monohulls that set a mizzen sail or a riding sail (refer back to Figure 6-5) described a more comfortable motion.

There has long been a discussion about whether or not sea anchors increase the risk of steering damage by shock loading the rudder when a large wave drives the boat backward. The *DDDB* shows only one case where an autopilot was damaged on boats that employed drogues and ran downwind, but more than 10 percent of the boats using sea anchors did sustain damage to their steering systems, with the incidence being twice as high for multihulls as for monohulls. As discussed in the Heaving-To and Forereaching section above, you must have a way to lock the rudder so that it can give slightly but is otherwise secured in position when the parachute is deployed.

The evidence for and against using parachutes on catamarans is ambiguous. Many catamaran sailors tell us that in storm conditions they would deploy a parachute. But catamaran manufacturer Catana specifically recommends against this. A 44-foot Catana was capsized with the loss of four lives in a Force 12 storm in the Mediterranean when it had been lying to a parachute. There is some evidence that the parachute had been incorrectly deployed, but the engineer I spoke with at Catana believed that the cat flipped when the pressure on the parachute suddenly decreased due to a change in the way the boat and the parachute were aligned to different waves.

1998 SYDNEY-TO-HOBART RACE: A POSTMORTEM

Evans Starzinger

Background

This was a well-prepared and experienced fleet of 115 boats. The previous heavy-weather Sydney-to-Hobart Race occurred in 1993, and there have tended to be one or two races each decade with sustained 50-knot winds. Eighty-four percent of the crews had experienced similar conditions before, and 92 percent of the skippers believed (in hindsight) that they had the proper level of experience on board.

Weather

The race started with a 35-knot gale warning. Two hours after the race started, this was increased to a storm warning for sustained winds in excess of 48 knots. Actual conditions measured on a nearby oil platform peaked at 55-knot sustained winds with regular gusts to 65 and significant wave heights of 7 meters with 12-meter maximum wave heights.

Sailors tend to think about heavy-weather winds in terms of the strength of gusts. Seventy-eight percent of the fleet had dedicated navigators on board, 90 percent of whom did not understand the 70-knot gusts and 12- to 15-meter peak waves implied by a 50-knot sustained forecast. They did not appreciate the severity of the forecast until the front of the fleet started reporting 70-knot winds (which were the gust speeds). Twenty-five boats decided to retire upon hearing this report from the front of the fleet.

Boat Design

The race experience supported many of the same conclusions generated by other heavy-weather races regarding boat design. There was no statistical difference in the experiences of different types of boats (e.g., heavy versus light, fin versus full keel, etc.), except that smaller boats tended to get caught in the worst of the weather. The stability index proved to be a good predictor of how fast a boat would come back up after being knocked down, with 115 degrees again judged to be an acceptable minimum. The boats were hard to spot and differentiate by search-and-rescue crews, with their white hulls, white sails, and few distinctive markings. Reflective tape high on masts, large bright numbers on decks and hulls, and colored storm sails would all be useful improvements.

Twenty-seven crewmembers reported broken or cracked ribs, and this was the most common injury. This suggests that padding all edges down below that could be fallen onto might be a useful heavy-weather preparation.

Sailing Tactics

The race experience confirmed that sailing with waves on the beam was the most dangerous orientation, and tactics should be employed that avoid this. It was also clear from postrace debriefings that yachts that continued to "actively sail" generally fared better as long as they had the crew strength to sustain careful steering. Forereaching 60 to 70 degrees off the wind was popular, as it kept the boats on course for the finish.

Eighty-six percent of the fleet deployed storm jibs, and 48 percent used a trysail. Twenty-nine percent of the fleet were under bare poles for a time, averaging 5 to 6 hours. Many of the crews under bare poles felt their vessels became too sluggish to steer well in the troughs and worried about getting knocked beam-to the waves. Forty-two percent of the fleet felt that their storm jibs were too big for the conditions and that consideration should be given to carrying a "hurricane" jib that would be 15 percent of the foretriangle. Various problems were also reported using standard sheets with mechanical clips on the storm jibs; splicing a dedicated set of sheets on the storm jib and trysail should be recommended.

Out of 115 boats, 5 were rolled through 360 degrees, and another 15 were knocked down beyond 90 degrees. The general consensus was that the "luck" of being struck or not by an extreme wave determined the fate of individual yachts.

The fleet did not exercise many of the heavy-weather tactics designed to conserve the vessel and crew. Most either continued to race or retired as rapidly as possible. No vessels deployed drogues or sea anchors or trailed warps, despite the fact that warps and drogues would likely have been useful for stabilizing the yachts running off to shelter. Tactics and gear designed to conserve the vessel and maintain crew strength may well represent a gap in the crew's safety training.

(continued on next page)

Safety Equipment

The various pieces of safety gear got quite a workout:

- **Harnesses and tethers.** The harness/jackline system was essential to keeping people on board during the storm. There was strong feeling that the typical nylon jacklines stretched too much and that Spectra webbing (very expensive) or threading Spectra/Vectran cord inside the nylon webbing would be a big improvement. Harness tethers with three clips (one to the harness and two for tethering to the boat) were strongly praised as they allowed crew to move around the boat without ever being unclipped, and the clip on the harness end allowed crew in boats that had rolled to unclip and avoid being trapped underwater in the cockpit.
- **Life vests.** Type I vests were reported to dangerously restrict mobility; inflatable vests were preferred. Automatic-inflation vests regularly inflated on deck when hit by solid green water, so the manually inflated models were preferred.
- **Life rafts.** The most serious problem with life rafts was a lack of stability and the danger involved in going outside the raft to right them. People had difficulty staying in or with their rafts, highlighting the need to take your harness with you when boarding a raft. Those stowing life rafts below had difficulty getting them on deck, while several rafts stowed on deck were washed away. All the various lines on all the rafts (drogue rodes, grab lines, lacings on opening covers, etc.) were judged to be too small—not strong enough and too difficult to tie and untie with cold, tired fingers.
- **Flares.** Most of the crews did not know that in strong winds you need to fire a flare downwind, and 40 percent of the flares did not ignite. It might be useful to give crews an opportunity to fire flares in windy conditions (from the back of a moving truck?).

Summary

Seven boats were abandoned and six people died in this race. Even so, the fleet did remarkably well considering the conditions they faced. The vessels were very robust and showed improvement versus previous heavy-weather races. Rig-failure rates (10 percent) were only half that in the 1984 Sydney-to-Hobart Race, and hull failures (5 percent) were only a third. The fleet demonstrated prudent seamanship. Sixty-five percent of the fleet elected to retire, and probably would have retired earlier and avoided even more damage had the weather prognosis been communicated in a more timely and complete fashion. This race clearly demonstrated both the power of vicious breaking waves to overwhelm even well-found vessels and the general efficacy of sailing tactics designed to keep either the bow or stern into the waves.

Yet several of the most compelling case studies in the *DDDB* involve catamarans. Some of the sailors we know on smaller, lighter cats regularly lie to sea anchors with excellent results. None of them have been in survival storms, however. The sailors on larger, heavier cats we have interviewed lay ahull or forereached even in quite severe storm conditions. It is significant that the two catamarans (38 and 41 feet long) in the Queen's Birthday Storm that were eventually abandoned did not get capsized or rolled, though at times they were each lying ahull.

It is also significant that the only boat not to get rolled in the most dangerous part of the storm was a catamaran. That boat towed a drogue while the skipper hand steered and used the engines to keep the boat oriented to the waves—until the drogue line got caught in the prop. They then lay ahull until a parachute was deployed. The cat lay to the parachute until the crew was taken off and the rescue vessel purposely scuttled it. The crew abandoned the cat because they believed it was going to capsize or the saloon windows were going to give way, flooding the boat.

If you decide to carry a sea anchor aboard, pay particular attention to setting up a deployment methodology that will work on your boat. Figure out how to eliminate chafe (many of the case studies in the *DDDB* advocated using chain where the rode crossed the deck and bow rollers). Consider whether or not to use a trip line. There are several cases of trip lines fouling the chute in the *DDDB*, and several more where people who have used parachutes more than once have decided not to use trip lines the second time. Make sure to size your rode for the technique you plan to use (over the bow or hove-to) and the conditions. As with drogues, many people wished they had put out more rode to start with because adjusting it once it is set is virtually impossible. Finally, deploy it early. In the Queen's Birthday Storm several of the crews had parachutes aboard, but they did not feel they could safely deploy them once conditions deteriorated.

We carry a sea anchor, but given the issues with deployment, chafe, and rudder damage, we hope we never have to use it. We could envision using it in a situation where we had lost the mast and engine and were on a lee shore and had to have a way to hold our position. Yet it gives us comfort to know it is aboard and that we have one more option if the worst should happen.

Motoring or Sailing into the Weather

When the fishing boats that ply the Bering Sea run into a storm, they motor into it slowly, keeping their bows into the waves. Quite a few of the crews who successfully weathered the storm during the 1998 Sydney-to-Hobart race sailed 60 to 70 degrees off the wind, turning the bow up to meet each wave as it came. In the Queen's Birthday Storm, the 43-foot Westsail ketch *Por Vida* motored into the storm at two-thirds throttle using the autopilot after losing a drogue to chafe. Making headway slowly into the waves under sail or power is an established tactic that gets little mention in discussions of survival storms.

If using the engine, keep the boat as upright as possible. Most engines will experience problems pumping oil through the system if the boat is heeled more than 30 degrees. Check your owner's manual for specifics on your engine.

Whether they were sailing or motoring, those interviewed after the Sydney-to-Hobart race in 1998 described how they steered through the waves. They took most waves at a 40-degree angle, but they met large breaking waves head-on. When climbing to the crest of an unusually large, steep wave, they kept the speed slow by feathering up into the wind. Then they would bear off and slide down the back at a 60- or 70-degree angle to the wave to keep the boat from leaping off the crest and freefalling or from burying its bow in the trough. As the next wave approached, they would turn the boat back up to 40 degrees.

This is one of the tactics we would consider using if we were caught in a survival storm aboard *Hawk*. We would prefer sailing to motoring because we feel the sails are less vulnerable than the engine to being disabled by a storm. Also, we have motored into moderate-sized breaking waves on a few occasions when entering or leaving tidal passes with strong currents. Our propeller sometimes freewheels as the bow drops down over the wave and the stern comes out of the water. This is not good for the engine and could leave us without steerageway for a critical moment. Finally, we carry a limited amount of diesel, and unless we were still receiving reliable weather information, we would have no way of knowing if it was likely to be enough.

This tactic requires that the crew hand steer the boat, which is a major downside for a shorthanded crew. For that reason, we would be inclined to try our two-element drogue or the Jordan Series drogue first and reserve this tactic as a backup in case we lost the drogues to chafe.

The 1998 Sydney-to-Hobart Race: A Postmortem sidebar above nicely summarizes many of the points about survival storms made in this section.

HEAVY-WEATHER STRATEGIES FOR THREE OFFSHORE VOYAGERS

Our old friends *Simplicity*, *Moderation*, and *Highlife* each carry different equipment for managing heavy weather. Their crews would each use tactics in gale, storm, and survival storm situations that reflect the natures of their boats and their own theories about heavy-weather management.

Simplicity is a heavy-displacement, 33-foot boat with a traditional underbody that is unlikely to surf except in the most extreme conditions. She is stable and forgiving, but her smaller size and lighter weight make her more vulnerable to being rolled than *Moderation* or *Highlife*. If her limitations are respected, however, she will keep her crew perfectly safe.

Susan and Simon spoke to a half-dozen people who had sailed sister ships in gales and storms. Based on this advice, they bought a small, 8-foot-diameter parachute from an army-navy supply store and figured out how to set it at a 30-degree angle off the bow from a bridle for use in ultimate storm conditions (Table 22-2). Since they left, they have been in one gale and one storm. The gale lasted 12 hours, and they hove-to on the double-reefed main and backed staysail and waited it out. They got into the storm crossing the Agulhas Current on their way to Durban from Réunion Island in the Southern Indian Ocean. The "southerly buster" brought storm-force winds dead up their course. The seas were large and confused, though not too many were breaking. After the bow got thrown off by waves and the boat got hit beam-on several times, they deployed the parachute on the bridle and lay hove-to against it for 12 hours before the storm abated. The noise and motion were quite terrifying, but the boat came through unscathed.

Moderation is a fairly heavy 40-foot catamaran. Her size and stability allow her to handle more extreme con-

TABLE 22-2. HEAVY-WEATHER STRATEGIES FOR THREE OFFSHORE VOYAGERS

Heavy Weather	When Sailing:	*Simplicity* (33-foot traditional cutter)	*Moderation* (40-foot catamaran)	*Highlife* (52-foot, cutter-rigged ketch)
Gale	Upwind Downwind	Heave-to: double-reefed main, backed storm jib Run under storm jib	Forereach: double-reefed main, blade jib Run under blade jib	Keep sailing under reduced sail or forereach Run under staysail
Storm	Upwind Downwind	Heave-to: triple-reefed main Heave-to: triple-reefed main	Forereach: triple-reefed main Run under storm jib with **speed-limiting drogue** on bridle	Heave-to: reefed mizzen Run under bare poles; **speed-limiting drogue** if necessary
Survival storm	Upwind Downwind	Heave-to against **small parachute**[1] on bridle; triple-reefed main Same or run under bare poles with warps and tires	Lie ahull or lie to **parachute sea anchor** Run with speed-limiting drogue on bridle or lie ahull	**Series drogue** or **parachute sea anchor** Same

[1]New additions in **bold**.

ditions than *Simplicity* without her crew having to employ storm tactics, but she will surf easily off the wind. A speed-limiting drogue will help slow her down so the self-steering can maintain control.

Michael and Molly agonized over their choices of storm equipment, and they are still not sure what they would do in ultimate conditions. While sailing around England and the Med, they found themselves in gale-force winds several times. The boat did very well forereaching or running off, but the waves were not large. They have been confused by the conflicting advice on parachute sea anchors they received. They've decided they would rather have more options than fewer, so they purchased a Galerider and a parachute sea anchor. Michael set up a system in which the parachute is held by rubber bands until deployed, and the rode can be deployed out of the second chain locker.

The only heavy weather they have been in was a downwind gale in the Bay of Biscay. They deployed the Galerider off a bridle from the stern when *Moderation* started surfing at 15 knots, and it slowed her down to 8 knots or so and kept the boat stable.

Highlife is a 52-foot ketch with a fairly modern underbody and moderate displacement. She is large enough that gale conditions will pose no particular problems, though she will surf downwind unless a speed-limiting drogue is deployed.

Hugh and Hilary wanted as many heavy-weather options as possible. They purchased two types of speed-limiting drogues, a parachute sea anchor, and a Jordan Series drogue. They've been in winds up to 40 knots and have so far never needed to deploy any of these. *Highlife* is big enough that she can handle significantly more than Hugh and Hilary care to. If the wind goes over 30 knots true upwind, they tend to forereach. In winds over 35 knots apparent downwind, they switch down to the staysail and run. In survival conditions, the Highlifes believe they would use the parachute as a last resort, preferring to deploy the Series drogue.

None of them can know for sure what they would do in a survival storm, but they have each thought through the available data, equipped their boats with a variety of alternatives, and set those up so that they are easy to deploy. The chances are that none of them will use these survival tactics, but they rest easier when they get a gale warning, knowing they have options if the worst should happen.

CHAPTER 23

Toward Self-Reliance: Managing Emergencies at Sea

WHEN WE ARE on passage, we must be totally self-reliant from the moment we pick up our anchor and leave port to the moment we drop our anchor or tie up to a customs dock. In between, we have to deal with whatever comes along. In a true emergency situation, we might try calling for help, but we would still have to survive until help reached us. In many of the places we have been sailing, that might be a matter of weeks.

Self-reliance starts with keeping the boat going on a long passage. My father was a pilot in the Navy Reserve in the late 1950s. His instructors told him, "We can't tell you what will go wrong. We can only tell you that something will. The better you know your craft, the better your chances of making a repair." The same is true about keeping a boat going: I can't tell you what will go wrong, only that something will. Most of what we do on passage is aimed at finding the things that have gone wrong while the problem is still manageable. We want to keep any little breakages from turning into emergencies.

But when emergency prevention fails, then we must manage whatever emergency develops. And once again, I can't tell you what will go wrong, but the better you know your boat, the better the position you will be in to address the problem. We have been fortunate enough never to have to deal with any of these emergencies ourselves. But we have interviewed others who have, and we have thought through our own emergency procedures. Although the discussion in this chapter has to be theoretical, as with the discussion of survival storms in Chapter 22, the purpose is to get you thinking and give you a few ideas that you will hopefully never have to use.

When it comes to emergencies, proper equipment, experience, and preparation are important, but the will to survive is the most essential factor in determining the outcome. Eric Lee, secretary of the Naval Life Saving Committee (UK), summed up his vast experience: "Men with a minimum of equipment, but with a strong will to live, have survived for long periods, whereas other men with ample equipment have succumbed in less." The last section of this chapter looks at leadership and survivor skills, which will be relevant not just in the situations discussed in this chapter but also in managing a survival storm, a severe grounding, or a medical emergency.

EMERGENCY PREVENTION

I cannot tell you what will go wrong on your boat, but I can tell you how to go about finding it before it becomes serious. At least twice a day on passage, usually first thing in the morning and last thing at night, we do a thorough inspection on deck and below, looking for anything that's not quite right. Refer back to Table 13-1 for a summary of what we look for and what we do about it.

What kind of things do we find over the course of a long passage? Our 9,000-nautical-mile, nonstop, east-about voyage from the Beagle Channel just north of Cape Horn to Fremantle on the southeast corner of Australia helps illustrate the types of repairs we make at sea. After a year of rugged day sailing around the bottom of South America with almost no breakages we thought that *Hawk* was in good shape for heading offshore. However, we were quickly reminded that the stresses and strains of

GOING ALOFT AT SEA

If you have to go up the mast at sea and you don't have the luxury of waiting for calm conditions, wear a padded suit or a life jacket to protect you from the mast. Use a climbing harness (available from climbing stores) instead of a bosun's chair, as you can't fall out of it. If a crewmember is available to assist you, lead the halyard somewhere where it can be operated from a seated position. That will allow both of your assistant's hands to be dedicated to the task, which means you will get up much faster. Leading the halyard to an electric windlass if you have one is best, but a primary winch in the cockpit also works.

When attaching the halyard to the climbing harness, most people recommend using a bowline. However, one time when Evans was up the mast while we were on passage aboard *Silk*, I almost went overboard. If I had, he would have been stuck up there because he couldn't have gotten his weight off the bowline. Since then, he has used a shackle but tied it shut with a bit of Spectra line to make sure it doesn't open accidentally.

If you have extra hands, one crewmember can man a downhaul and a safety line to the person going up the mast. A little pressure on the downhaul will prevent swinging and will help stabilize the person up the mast. If you don't have anyone to help, you'll have to weigh the risk of going up without a safety against the slower speed that will result as the person on deck tries to manage two halyards and keep them running free.

Even if you don't single-hand, you should have a way to get up the mast alone in case a crewmember is sick or injured. The best way to do this is to use climbing ascenders (Figure 23-1). Put on a climbing harness. Attach a spare halyard to a climbing line of the proper diameter. Raise the halyard, clip off the climbing line to something at the base of the mast, and tension the climbing line. Hook two ascenders to the climbing line. One ascender will attach to your harness with webbing or a line, and the other has foot loops attached. Slide the ascender with the foot loops up the halyard so the loops are off the deck and step into the loops. Slide the ascender attached to your harness as far up as you can and then sit down in the harness. Repeat until you reach the top of the mast.

The ascenders are clumsy to operate going down. Instead, you can use a rappelling ring or a GriGri, an ascender with a lever that allows you to slide down the rope like a rappelling ring. To learn to use this equipment, find an REI, an Eastern Mountain Sports, or another sporting goods store with a climbing wall and ask the staff to get you familiar with the techniques. It won't take more than an hour of your time, and it's fun!

Single-handed offshore racers have large webbing loops sewn into the luff of their sails. When they need to go up, they put the boat on a close reach and climb the luff. Loops in the sail would be very useful as handholds for those of us who don't have the stomach to climb free.

Figure 23-1.
Evans up the mast using ascenders.

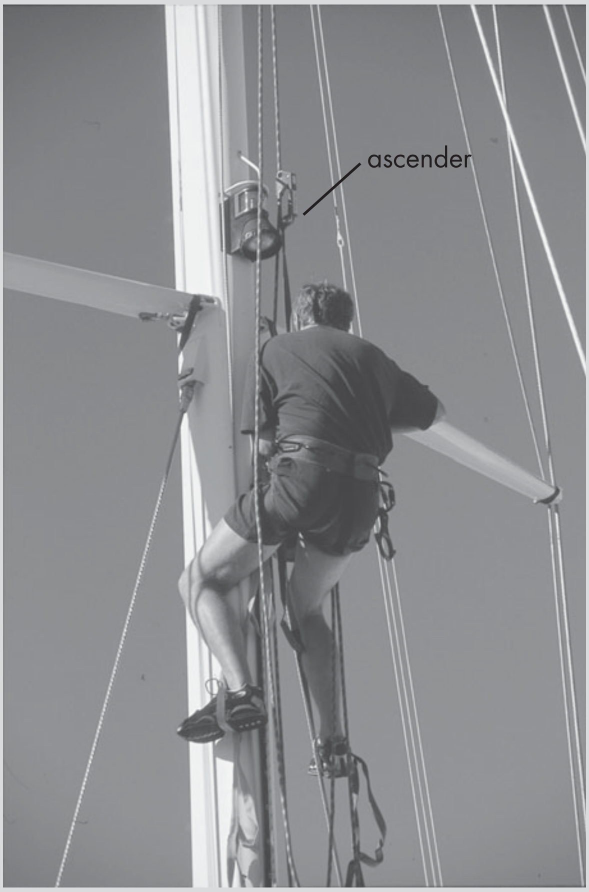


TABLE 23-1. REPAIRS MADE OVER A TWO-MONTH SOUTHERN OCEAN PASSAGE				
Day	**Problem**	**Solution**	**Spares/Materials**	**Tools**
3	Rope clutch for halyard caught in fold of main; ripped off mast when raising the sail	Replace clutch	Rope clutch	Screwdriver
5	Circuit board in masthead wand for B&G bad; wind direction and wind speed erratic	Replace wand	Masthead wand	
7	Spectra loop on pole fitting on end of spinnaker pole chafed through	Replace loop	Spectra line	Phillips-head screwdriver, knife
10	Carbon fiber batten broke during jibe, punched hole through sail	Replace batten, fix sail	Spare batten, sticky-back Spectra sail material, 3M 5200	
11	Crack in boom at vang attachment point	Jury-rig an attachment point farther aft using Spectra line; epoxy fiberglass patch over crack	Spectra line, fiberglass mat, and epoxy	
13	Hatch leaking into sail locker	Recaulk Lexan no longer bonded to aluminum hatch	Silicone caulk	
24	Bolt missing from wind vane, Delrin bearing loose	Machine replacement bolt and build new bearing	Bolt, plastic from a cutting board	Dremel tool, holesaw
48	Tack torn out of jib (had been using an old jib for as long as possible)	Replace with new jib	New jib	
55	Electric autopilot leaking hydraulic fluid	Top up fluid; replace seals after passage	Hydraulic fluid	

coastal cruising mostly in flat water cannot be compared to open ocean sailing in large waves. Evans's log of the repairs from this passage, summarized in Table 23-1, offers a snapshot of some of the tools, spares, and materials required to achieve self-reliance.

EMERGENCY MANAGEMENT

Potential misfortunes voyagers face near land are discussed in Chapter 15. Many of these can occur on passage. But the way of preventing and managing these emergencies depends little on whether you are in port or thousands of miles away from land. On the other hand, there are several emergency situations that are dangerous because you are at sea and far from assistance. These situations have to do with the integrity of your vessel and her ability to get you to your destination. In many of these situations communications may be lost, making it impossible to get help and advice from outside, let alone ask for rescue.

The boat is your lifeline, and her safety is synonymous with yours. Survival rates in life rafts are abysmally low. Being prepared for the worst that can happen does not start with "safety" gear such as life rafts and EPIRBs. It starts with trying to fix the problem yourself with whatever comes to hand.

Every voyager dreads the emergencies described below. We know of a few boats that suffered rigging failures, one that lost its rudder, and one that sank. We know of twice as many boats that were damaged by poor navigation and fire than by all the following situations. The odds predict you will never have to face these crises. Prevention improves the odds even more, and it starts with an offshore-capable boat that is worthy of your trust. But it cannot remove all the risks of voyaging. So if prevention fails, preparation needs to take over. Resolving the situation satisfactorily hinges on your ability to do things one step at a time in a logical fashion.

There is no magic in what follows. With a bit of time to consider the problem, any reasonably intelligent person could come up with these solutions. This section succeeds if it gets you to think about the procedure before the emergency hits—before your response becomes instantaneous, before you realize that the repair would be easy if you had thought to put a certain item aboard. You need to address the realities of boat construction and crew strength in theory before you have to address these issues in fact. If the time comes, you may not have time to reason. You and your crew need to do your thinking beforehand.

Taking On Water

Taking on water does not necessarily mean sinking, and you and your crew must understand the distinction. Too many vessels have been abandoned when their crews believed they were sinking, only to be found floating days or weeks later. When an existing hull opening starts to leak, the crew should be able to do a repair that will get the boat safely to port. Failures of ports or hatches only become a serious threat in severe storm conditions when the boat could be rolled. A life-threatening situation exists if hull damage from a collision allows in more water than can be pumped out in a given period of time. Even so, many boats have been kept afloat long enough for their crews to be rescued.

You must accomplish four steps when facing any breach through the hull:

1. Operate the bilge pumps as often as necessary to stay ahead of the leak. This will likely mean that one crewmember is fully occupied pumping the bilge until the problem is resolved.
2. Quickly locate the leak and make it accessible.
3. Install a temporary "patch" to slow the rate of seawater flowing in.
4. Put in place a more permanent solution that will allow the boat to be sailed to port.

If your hull is compromised, you need time. A bilge pump that moves a large amount of water quickly gives you that time. As discussed in the Belowdeck section in Chapter 4, you should have a high-capacity pump that can remove at least 30 gallons per minute from the bilge. Once you pump out enough water to see what needs to be done, you will need something to repair the damage. Carry spare sailcloth, underwater putty, and marine plywood. A collision mat can be jury-rigged using sailcloth or canvas, grommets, and some line and used to buy the time necessary to repair the breach in the hull.

Failure of Structural Openings

Any place where the structural integrity of the hull is breached to create an opening—such as seacocks, ports, hatches, hatchboards, and even cockpit locker and anchor locker lids—the potential exists for the structure that seals the opening to fail completely. For each of these openings, you need some way to reseal them to maintain the integrity of the hull. The following ideas offer some guidance when you outfit your boat:

- **Seacocks.** As an underwater fitting, a failed seacock poses a serious danger in any sea conditions. Locating the leak can be the most difficult step. Everyone on board should know the location of every seacock and how to access it. A bilge full of salt water that hasn't come from the stuffing box or the deck pipe should start an all-out search. Once you find the culprit, insert a tapered wooden plug of an appropriate diameter into the seacock to stop the flow of water. Keep one of these plugs within reach of every seacock. You can buy them at most marine supply stores or make your own. The pressure of the water coming through an opening the diameter of a seacock will require you to use some force to get the plug inserted and held in place. On older fiberglass boats, the problem may not be the seacock itself but delamination from water intrusion in the fiberglass around the seacock. Diagnosing this problem can be a challenge in a wet bilge, but if you can figure out what's going on, underwater epoxy around the base of the seacock will fix it.
- **Ports.** Ports are unlikely to fail except in extreme storm conditions when a breaking wave slams a boat down on its side or crashes squarely into the port. In that situation, the boat may be vulnerable if the port is a large one and the boat is rolled. To make a patch, stuff a cushion or a life preserver into the port and secure it with duct tape, battens, or some sort of a strut. You can then consider a better remedy. Carry a piece of marine plywood the size of your largest port to use for a more complete repair. You can mount it over the outside of the port with underwater epoxy and screws.
- **Hatches, hatchboards, and locker lids.** A failure in one of these large openings poses a serious danger to the boat, especially since it is only likely in storm conditions. A large sail in its bag (like a spinnaker) stuffed into a cockpit locker after the lid has been lost makes an excellent temporary "patch." Smaller sails, sleeping bags, blankets, duffel bags full of clothes, and life preservers will temporarily seal smaller openings. But you will need a more permanent fix as quickly as possible, because water entering through such a large opening could overwhelm the boat if it were rolled. To find a piece of wood large enough to make a permanent repair, rip apart a bunk, a bulkhead, or the cabin sole. Secure the wood with underwater epoxy and screws or bolts.

Collision

Of all the situations discussed in this section, a collision at sea poses the most immediate and serious threat. After a collision that results in a major breach of the hull, you can do little more than deploy the life raft and get safely off the boat. Many newer yachts are being designed with collision bulkheads that break the boat up into separate watertight compartments. These boats should stay afloat with one or even two flooded compartments. A few older boats are being fitted with positive flotation in the form of carbon dioxide canisters and bags that inflate when in contact with water. Consider these structural systems when selecting and outfitting your yacht.

After a collision, you should first check to see that everyone is still aboard and unharmed. A violent collision can easily throw an untethered crewmember off the boat or cause serious injury to someone moving around below. Once you are sure that no one is missing or injured, go below and pull up the floorboards to determine if you are taking on water. If so, get all the available bilge pumps working. Next, locate the damage to the hull. This might require a crowbar or a hacksaw. The area must be cleared so you can assess and possibly repair the damage. Water will be flowing in under pressure, so none of this will be as easy as it sounds. Once you locate and can reach the area, start stuffing into the hole anything you can get your hands on that might slow the flow of water: sails, clothes, duffels, sleeping bags, blankets, and so on. Use oars, boathooks, battens, and any other rigid objects to hold this gear in place. If the hole is small enough that you have gotten this far, eventually you should be able to lessen the flow.

Once things are controlled enough to consider the situation, two approaches may help, and you should probably try both. First, position a collision mat over the outside of the hull to cover the area. Slide the mat across the hull using lines attached to the corners until the hole is covered and the pressure of the water holds the mat in place. Once you have sealed the hole from the outside, you can attempt a more permanent repair from the inside. As described above for the hatch or locker lid, some combination of wood, screws, underwater epoxy, and ingenuity should create a patch that reduces the inflow of water to a level that can be dealt with by a high-capacity bilge pump.

Once you have stabilized the situation below, make sure to thoroughly inspect the rest of the boat. Rigging damage is common in collisions, and you may well find that you also have to deal with a broken shroud or headstay.

Steering Failures

Steering failures at sea are likely to be more frustrating than life threatening. Even at the height of a gale, you can run off trailing warps that will stabilize your course as long as you have sea room. You usually have the benefit of time with a steering failure, unless the loss of the rudder creates a below-waterline hole through the hull. In that case, the lack of steering will not be your first concern.

Steering failures fall into two categories. A complete loss of the rudder will force you to jury-rig a steering system of some sort. Quite a number of rudders have been lost in the last couple of years in the major rallies, mostly when carbon fiber rudderstocks failed. Alternatively, the rudder can still be attached to the boat but not respond to movements of the helm. This can happen if something fails in the steering mechanism that attaches the tiller or wheel to the rudder—a broken steering cable, for instance—or if a stainless steel or aluminum shaft breaks loose from the fiberglass blade of the rudder due to delamination.

If the rudder is still intact, you will have to rely on your spares locker. Carry complete service manuals for your steering system, an emergency tiller, and spares for most of the major steering components: steering cables, clips, sheaves, and so on. If something in the steering system is broken, the steering system can generally be bypassed using the emergency tiller or repaired with the spares carried aboard. If the rudderstock has become detached from the rudder, lines can be run from winches on either side of the boat through snatch blocks on the stern quarter to holes drilled through the aft end of the rudder and used to move the rudder from side to side. Given time and materials, you will find a way to repair the steering.

If the entire rudder has been lost, most boats can be sailed to windward by sheeting in the sails until the boat gets close to tacking and then dumping them before the boat comes through the wind. To make any other course without any sort of a rudder will be more difficult. Setting a storm sail or jib on the backstay as a riding sail in conjunction with a small headsail may provide some control over the course on a cutter or sloop. Sheeting in the riding sail should bring the boat closer to the wind; easing it should cause the boat to bear off. Long-keel, ketch-rigged boats have the greatest likelihood of being able to stay on course without a rudder over a variety of wind angles. Almost any boat will be difficult to steer downwind without a rudder, which is most likely to be the direction you need to go if the rudder is lost more than halfway through a trade wind passage. To have some control over your course, you will have to fashion some sort of jury rudder.

The standard jury-rudder solution consists of a large board lashed or bolted to the end of a spinnaker pole to make a sweep. The pole is attached to the stern or the backstay in a way that creates a pivot, and the boat is steered using lines led from either side of the board through snatch blocks at the quarters to the primary winches. Compared to a real rudder, such a solution offers very limited steering control. In one detailed account ("For Want of a Rudder," *SAIL*, November 2004), Mike Harker and his crew went through three iterations of this classic solution. The first two lasted for only 80 miles; the second time the spinnaker pole cracked—spinnaker poles are not meant to handle lateral loads of the magnitude experienced when used as a rudder. The third attempt, constructed from a spinnaker pole supplied by another boat that had come to assist, worked for seven days and got them into port.

To reduce lateral loading, their final design twisted the board at the end of the pole instead of sweeping it. It was attached to the stern by lashings in four places. The plywood blade sported a "shark's fin" that came above the water to which the control lines were tied. Using this jury rudder, they were able to make good about 4 knots on a heading that swung through 120 degrees—60 to each side of the desired course.

As this example illustrates, the traditional solution can be made to work with enough materials, engineering aptitude, and patience. But it is difficult to rig, offers very limited control, and tends to break after a few hours or a few days. Other crews who have written about their attempts to construct this type of jury rudder have said that it only saps the crew's energy and wastes valuable resources.

Downwind, some sort of a drogue may steer the boat better. A commercial drogue works best, as it is designed to provide a consistent amount of drag without spinning, distorting, or breaking. If a commercial drogue is not available, a drogue made from an anchor and chain or by lashing together the head, tack, and clew of a storm jib may be of some use. Any drogue solution will work better if you can change its angle relative to the stern. Running bridle lines from the drogue to the primary winches through snatch blocks at the end of a spinnaker pole lashed securely across the stern of the boat increases the range of steering angles you will be able to achieve. You will need to vary the length of the rode to find the point that maximizes the drogue's impact on the boat's direction.

In "Ship Without a Rudder" (*Cruising World*, July 2005), editor Herb McCormick describes a drogue-steering solution used to steer *Serengeti*, a 60-foot, high-tech racing boat that lost her rudder while he was crewing aboard her in the Pineapple Cup. A New Zealand–made drogue shaped like a basket, called a Sea Claw, allowed the crew to sail at about 3 knots under a storm jib sheeted to the centerline. The boat slalomed downwind the 40 miles to Nassau around a heading that wandered through about 30 degrees. Although additional speed would have increased their steering control, when they tried to put up more sail the drogue skipped across the surface of the water uselessly. In the postmortem, designer Bill Tripp said, "We needed [a drogue] that worked at 6 knots . . . a drogue that wasn't so dependent on being full, which isn't a bagful of water." The Galerider (refer back to Figure 22-4) comes closest to the design he described.

These are, at best, makeshift solutions. A far better solution is to either carry a spare rudder or have designed a way to put together a real rudder using materials on the boat. Several offshore races now require participants to demonstrate a workable jury rudder to participate in the race (see the resources for this chapter in Appendix 1 for a website with some interesting alternatives).

In putting together an emergency rudder, keep in mind the basic principles at work. Higher rudder forces will be needed to control the boat in bigger seas, with more sail area, or with less underwater surface area. Bigger rudders will steer the boat better but put much more strain on the attachment points to the hull. Steering forces can be reduced by reducing the amount of canvas up, reducing the size of the rudder, or slowing the boat with drag. Whatever solution you come up with, the rudder should be about half the size of the original. Any smaller, and it won't effectively steer the boat. Any larger, and it will put too much strain on the connection points. Auxiliary rudder wind vanes or wind vanes equipped with a kit to convert them into an auxiliary rudder provide one easy, but costly, solution to this problem. That is what we have chosen to do aboard *Hawk*.

Rigging Failures

Most rigging failures can be prevented by a careful inspection of the rig before passage, by a thorough annual inspection by you or a qualified rigger, and by pulling and inspecting the mast and replacing the rigging after five years or so of hard offshore use. But like the other emergencies discussed in this section, when prevention isn't enough, preparation becomes essential.

Broken Shroud

The dozen boats we know of that suffered a broken piece of standing rigging fell into two categories. In the first, the cause of the failure involved a sudden shock loading and was the result of another problem aboard. In one case, this was a jammed roller furler that prevented a headsail from being reefed in a gale; the strain from the headsail caused a lower shroud to part. In the second category, the failure was due to fatigue, either because of the age of the boat or from constant pressure on one piece of rigging over an extended period of time.

We know of two boats that experienced a major rigging failure when their bobstay broke. As a piece of rigging, the bobstay is often overlooked. But if it breaks when the boat is under sail with a large genoa up, the genoa can pull the bowsprit right out of the deck. Even with a staysail stay supporting the mast, the entire rig can be lost. Bobstays are often shock loaded. They are frequently run into docks or subjected to strains from anchor rodes. They need to be inspected and replaced at least as often as the rest of the rigging.

When a piece of standing rigging breaks, the first priority is to take the strain off the affected portion of the rig to minimize the chances of additional failure. Do not reduce sail immediately, as the sail and halyards may be holding something up. For a broken shroud, tack or jibe (very softly) to move the loads to the side of the boat opposite the failure. For a broken headstay, bear off and head downwind. For a broken backstay, turn upwind. As soon as the strain is off the damaged rigging, set up a halyard for reinforcement. Once things seem to be stabilized, you can reduce sail.

Once the strain is off the rig, the sail has been reduced, and the boat has been slowed or stopped, lash the broken rigging or clear it out of the way. A piece of rigging wire swinging across the deck is bound to injure someone or damage something. Then get out the spare stay and fittings and jury-rig a replacement for the broken rigging. Today's high-tech lines are strong enough to be used in place of wire, and these are easier to stow and to attach to strong points. Eventually you will need to go up the mast to clear the fittings from the old stay and install the new one. Stabilize the mast with spare halyards before you trust yourself to it.

Total Dismasting

The greatest danger from a dismasting comes not from losing the mast itself but from the possibility of a serious breach of the hull. The remains of an aluminum mast pounding against the side of a vessel can easily create a hole large enough to sink the boat. After accounting for all crewmembers and treating any life-threatening injuries, the priority has to be protecting the boat from the mast, even if that means cutting the mast away completely. Until the mast and other wreckage are cleared, do not start the engine. You will almost certainly foul the prop and complicate the situation.

If you have a major breach of the hull after a dismasting, you will have to deal with that once you have accounted for all crewmembers and made sure no one has been seriously injured. One crewmember will need to be on the bilge pump while whoever else is on the boat goes about trying to seal the opening as described above. As soon as you can be sure you are in no immediate danger from flooding, turn your attention to the mast.

Before you even start evaluating the wreckage, turn off all power. Next, size up the situation. If the wreckage is battering the hull, the sea is running, and there is little chance of calm weather in the next few hours, cut the wreckage free and let it go. Don't start thinking about a jury rig when the possibility exists of serious damage to the hull. Use fenders, life preservers, or other padding to minimize the pounding the hull takes while you get rid of the mast.

Without a mast to stabilize it, the boat's motion will be quick and unpredictable, and many of the handholds on deck may be missing or under wreckage. Before starting to work on the mast, don safety harnesses and tethers and set up alternate jackstays so you can move about easily.

If the mast has buckled and broken, there will be a lower section still standing and an upper section hanging by shrouds, mast track, cables, running rigging, and some twisted pieces of metal from the mast itself. Leave any shrouds still attached to the lower section in place to stabilize it. You will have to remove the standing rigging holding the upper section. Wherever possible, remove the clevis pins from the turnbuckles near the deck to free stays and shrouds. Where that is not possible, you will need heavy leather gloves, hydraulic cable cutters (if available), and a hacksaw. You will also want heavy-duty pliers to remove cotter pins and heavy-duty wire cutters or pliers to work smaller pieces of metal back and forth until they fatigue and break. The three crews we know who went through this all said that removing the mast was exhausting.

Once the standing rigging, mast track, mast wiring, and anything else holding the broken section have been severed, it can be lowered to the water using one of the halyards running through the mast. The mainsail will still be attached to the broken section. Try to salvage as much of it as possible, but if this becomes dangerous, the mainsail should also be cut free. The mast section should now be parallel to the boat and held fore and aft by the halyard. Cut both ends of the halyard at the same time.

If the entire mast has come down or has been sheared off at deck level, the process is the same, except that you will need to unpin or cut all the standing rigging. Do everything you can to recover the boom and spinnaker pole, which will be critical for constructing a jury rig.

Once the mast is cleared away, deal with any smaller breaches in the hull. The mast may have taken a section of the coach roof with it; you'll need to find a way to seal that and make it as watertight as possible.

When the wreckage is cleared and no water is coming aboard, you will be faced with "what next?" Even if motoring to port is a possibility, a jury rig will steady the motion of the boat and speed your approach to shore. If you have a portion of the mast left, then you have a firm foundation for a jury rig. If you don't, you will be left trying to create something from the boom, spinnaker poles, and boathooks.

Jury rigs come in all shapes and sizes depending on the materials available for their construction. The standard jury-rig solution uses a spinnaker pole lashed on top of the boom and stayed by at least ten high-tech lines to different points on the mast (see Figure 23-2B).

As Rodrigo Claros found when building a jury rig for his Peterson 34 in the North Atlantic after being dismasted ("When Your Boom Must Become a Mast," *Cruising World*, December 2004), stepping the mast is often the biggest challenge. After securing the heel of the mast, run a line from the top of the jury-rigged mast through a block on the bow and back to the windlass or a cockpit winch. Then figure out some way to raise the line off the deck in front of the mast step by 3 or 4 feet. A vang or pigstick can serve as a gin pole (Figure 23-2A), which will create the necessary leverage. Having a second crewmember lift the top of the mast or, as in Claros's case, resting it on a radar arch, will facilitate getting it up into the air.

Claros's solution, as shown in Figure 23-2B, withstood gale-force winds and allowed him to sail with a mainsail and a jib. Faced with the same dilemma, your solution may not be as elegant, but you will find a way to get the boat sailing once again.

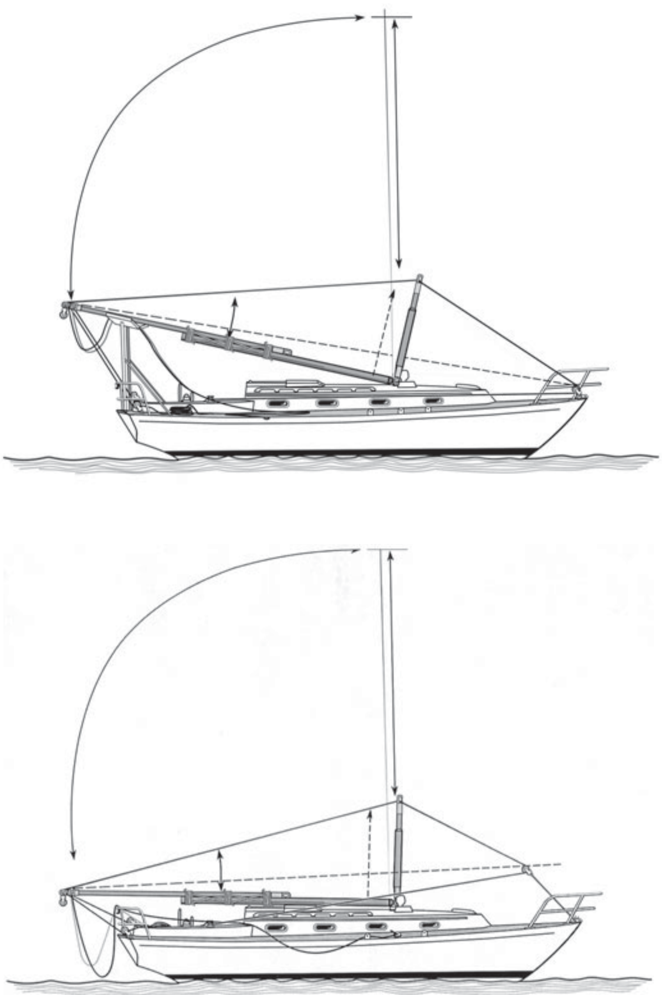


Figure 23-2A.

To raise a jury mast, fix the heel and run a line from the top of the mast, through a gin pole, to a block on the bow, and back to the primary winches or a windlass. (Shown on boat with radar tower [top] and without [bottom].) (Fritz Seegers illustrations)

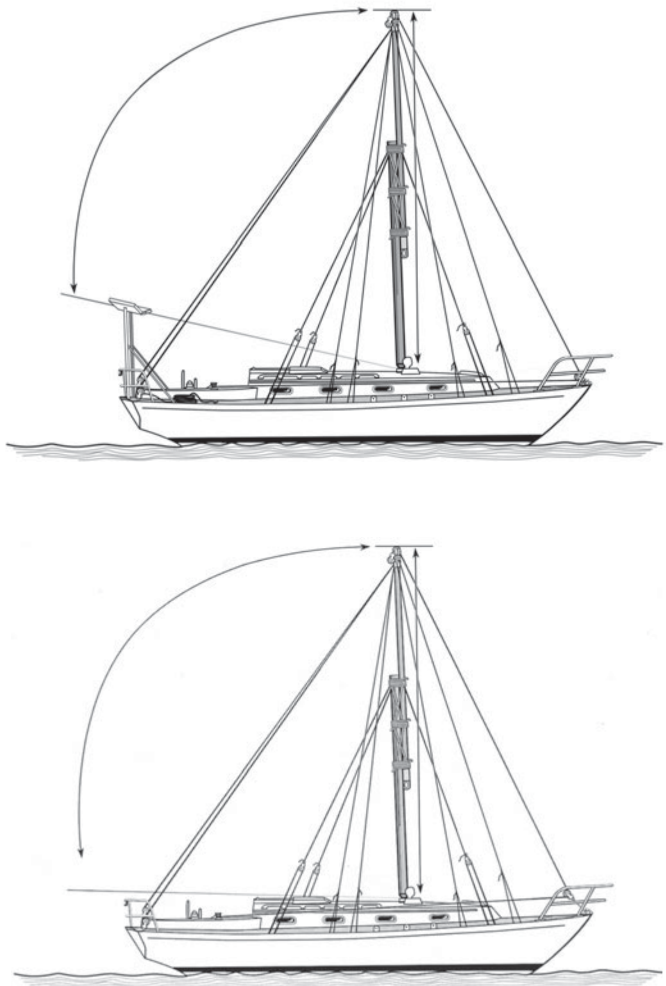


Figure 23-2B.

Once the mast is stepped, secure it with at least ten stays attached to different points on the mast. (Shown on boat with radar tower [top] and without [bottom].) (Fritz Seegers illustrations)

PIRACY

We get asked about piracy so frequently that I have to say a few words about it. *Piracy* is defined as robbery at sea, and as such is distinct from thievery near shore, a much more common problem (see the Theft section in Chapter 26).

Piracy occurs far less frequently than we ever would have believed before going cruising. The places where it occurs are well known and well understood within the cruising community, and those places can be avoided, which is what we have always chosen to do.

There have always been issues with piracy in parts of Indonesia, around the Philippines, and in the South China Sea. The main target is shipping traffic, and large freighters traveling in these areas take many precautions. There have been a few incidents with yachts, most of which occurred inshore as opposed to offshore. Traveling in company and moving only during daylight hours when coastal cruising may help avoid an attack. Avoiding areas where piracy has been recently reported is more certain to keep you safe.

In recent years, piracy has become a serious problem for yachts around Somalia and the Horn of Africa at the entrance to the Red Sea. As of this writing (2006), there have been several documented attacks on yachts and one attack on a cruise ship. The perpetrators travel in high-speed boats armed with AK-47s, and they will shoot without provocation. Many yachts travel in convoy up the Red Sea, but this doesn't offer much protection as the convoy often gets separated due to differences in boat speeds. The area where piracy has occurred is small, but for boats en route to the Med, it cannot be avoided. Only a few attacks on yachts have been reported, but they have been violent and potentially life threatening. Hundreds of other yachts pass through this area and travel up the Red Sea without incident each year.

Any actual incidents of piracy are widely reported in the press, through the cruising grapevine, and in the SSCA bulletins. Several websites also track and report all incidents of piracy worldwide, and they are useful in determining risky areas (see the resources for this chapter in Appendix 1). If you pay attention to those sources, you should know what areas pose a potential risk and what tactics people are using to try to minimize those risks.

SURVIVING AN EMERGENCY

> "It's easy to imagine that wilderness survival would involve equipment, training, and experience. It turns out that, at the moment of truth, those might be good things to have but they aren't decisive. Those of us who go into the wilderness or seek our thrills in contact with nature soon learn, in fact, that experience, training, and modern equipment can betray you. The maddening thing for someone with a Western scientific turn of mind is that it's not what's in your pack that separates the quick from the dead. It's not even what's in your mind. Corny as it sounds, it's what's in your heart." (*Deep Survival: Who Lives, Who Dies, and Why*. Laurence Gonzales, W.W. Norton, 2003. Used with permission.)

Studies of those who have overcome overwhelming odds and survived show that, hard as it may be to accept, survival comes down first and foremost to attitude. The parallels between the experiences of people such as Steven Callahan, who spent seventy-six days in a life raft after his boat sank (see his book *Adrift: Seventy-Six Days Lost at Sea*), and Joe Simpson, who hiked out of the Peruvian Andes after he broke his leg in a fall while climbing and was left for dead (see *Touching the Void: The True Story of One Man's Miraculous Survival*), lead to some quite clear conclusions about what it takes to survive. If you ever find yourself in a survival situation, understanding the attributes and attitudes survivors share can help you increase your own chances.

Laurence Gonzales spent many years interviewing survivors of all sorts of disasters for his book *Deep Survival: Who Lives, Who Dies, and Why*. He found that survivors go through a clear progression that can be likened to the stages of dying. Those who survive face the horror of their situation squarely and objectively, find beauty in the midst of the calamity surrounding them, and then feel certainty that they will survive. As Gonzales says, "In the stages of dying, the last stage is acceptance. In survival, it is total commitment."

We have never been in a survival situation, but on two occasions we have been pushed way beyond our comfort level and felt as if our lives were in danger. In both cases, we came up against our own limitations and had to either push through them or give in to them. In both cases, the worse it got, the harder Evans fought. But the worse it got, the more I wanted to climb into my bunk, close my eyes, and wish it all away. Forcing myself out of the (relative) security and comfort of my bunk, into my foul-weather gear, and into the cockpit remain the hardest things I have ever done. After an experience like that, we don't make landfall and celebrate. It takes weeks and sometimes months to recuperate, to integrate what we have learned about ourselves, both good and bad, into our self-image and our worldview.

We saw the same phenomenon among the crews sailing around Cape Horn or heading down to Antarctica. One experienced sailor seasoned by North Sea gales became terrified, not of anything specific, but of the Drake Channel and the Horn and Antarctica. He crawled into his bunk and couldn't be threatened or cajoled to come out of it again. Such stories are far from uncommon. Two other couples we knew took on crew in Mar del Plata, Argentina, for the trip to the Beagle Channel just north of Cape Horn. Both had to put the additional crew ashore a few hundred miles south at the first good harbor after being hove-to in 50-knot winds for 24 hours. Similar incidents occurred aboard some of the charter boats that went to Antarctica. "Fight" and "flight" are not the only reactions to life-threatening situations. "Freeze" has proven a time-honored survival mechanism for many species, humans included. But while freezing may be helpful when facing a predator, it is not much use in an emergency at sea.

Gonzales puts it this way: "[I]t's easy to demonstrate that many people (estimates run as high as 90 percent), when put under stress, are unable to think clearly or solve simple problems. They panic. They freeze. Muddled thinking is common in outdoor recreation where people get lost or injured or are otherwise threatened with harm." But we have found that we have gotten better at managing our fear and working constructively through a crisis. It is a skill that can be mastered. As Gonzales says, "It is not a lack of fear that separates elite performers from the rest of us. They're afraid, too, but they're not overwhelmed by it. They manage fear. They use it to focus on taking correct action."

As we have become more confident in situations where we are under stress and feel we are at risk, we have unconsciously developed a set of behaviors that closely mirrors the patterns and thought processes Gonzales found to be common to survivors around the globe and over the centuries. Although not an emergency, a situation we faced on a Southern Ocean passage illustrates the steps that help us focus on taking correct action:

1. **Accurately assess the situation.** The second day out on a Southern Ocean passage from Albany on the southwest coast of Australia to Tasmania, the end cap came off a batten car, and all the ball bearings ended up on deck. When we went to reef, the damaged car chewed up the mast track about a third of the way up the mast, making the mainsail unusable for all practical purposes. A few hours before, we had received a forecast for 48 hours of storm-force winds starting in the next 12 to 24 hours. The first thing we did was to determine if there were any immediate options for repairing the track and the car. Although we had a spare car aboard, we did not have a spare section of track, nor did we think it would be prudent to go up the mast in Southern Ocean seas to get the damaged piece of track off. We came to the conclusion that we would not be able to use the mainsail for the duration of the passage.
2. **Stay calm and evaluate alternatives.** After getting the main put away and the boat sailing under alternate sails, we sat down in the cockpit and discussed alternatives. We do carry a trysail that uses a separate track from the mainsail, so we could get some sail area up to assist the headsails and help us point higher if need be. We talked about returning to Albany and fixing the track instead of venturing farther into the Southern Ocean, but to do so would mean sailing dead to windward, and with only the trysail we would be hard pressed to get to Albany before the storm arrived. If the bad weather caught us in the shallow waters off Albany, the seas would be far worse than in the open ocean. We decided we had to head for a downwind port; with the forecast calling for storm-force northwesterly winds, that meant somewhere on Tasmania, our original destination. To reach the closest port on the north coast of Tasmania would mean entering the shallow waters of the Bass Straits, notorious for dangerous seas in heavy weather, at what was likely to be the height of the storm. In the end, we decided that continuing on to Port Davey and weathering the storm in the deep waters to the west of Tasmania well away from the continental shelf was our best option.
3. **Take decisive action.** In this case, we got the boat sailing well under the best possible sail com-

bination and then prepared for the storm we knew was on the way.

Once we make a decision, we stop debating and set about implementing. Having something to do is far better than hashing and rehashing the options without adding anything at all to the discussion. Don't second-guess yourself at this point. In all but the most dangerous situations, most decisions can be undone or modified later.

4. **Celebrate any improvement in the situation.** Whenever we make headway against a problem, we ease up for a moment and bask in the glow of satisfaction. We spent the next 48 hours running downwind in gale- to storm-force winds, with an exhilarating run into the harbor, where we were able to take shelter behind the aptly named Breaksea Island and enter a protected estuary. After we got the anchor down in remote Port Davey we celebrated with a big meal and a long sleep before going back to address the problem.
5. **Try as many times as necessary to get it right.** This is especially true in heavy weather, when you may have to try three or four storm tactics before the boat really feels "right." In this case, to get from Port Davey, a totally isolated harbor in a UNESCO World Heritage site accessible only by boat or float plane, to Hobart, where we could fix the mast track, we would have to sail upwind for 15 to 20 miles into Southern Ocean winds and seas before rounding Tasmania's South East Cape and entering sheltered waters. While we could have motored the 60 miles to Hobart, we decided that we had to fix the mast track if at all possible in order to be in seamanlike condition for the next leg of the voyage.

   I took Evans up the mast, he unscrewed all the bolts from the 10-foot-long section of track, and we lowered it to the deck with the trysail halyard. With a router and a sander, he managed to get the track relatively smooth again. We put it back up, pulled the mainsail off the track, and replaced the damaged batten car. We put it all back together and raised the main at anchor, only to find that it was jamming on one part of the track. We took the track down again and went back to work with the router. It took an entire day to get the track smooth enough to be functional.
6. **Don't give up—have faith that you will succeed.** It often takes several tries and both of us offering odd thoughts and suggestions over a period of several hours before we come up with a solution that eventually solves the problem. If you let negative thoughts get the better of you and you stop trying, then you cannot succeed. As long as you are trying something new or your mind is still working away at the problem, you have a good chance of figuring something out and getting out of the situation. The very worst thing that can happen is for the crew's spirit to be broken—for them to not only stop trying but to stop caring.

The captain's primary responsibility is to sustain the crew's energy and keep up their spirits. Doing so results in a safe and happy ship in all situations, not just in an emergency. Lead by example, intentionally and visibly being a good role model for the crew. Be positive and optimistic. Don't sugarcoat the situation, but keep your darkest thoughts to yourself. Don't let yourself or your crew adopt a passive attitude, huddling down below. Give them confidence that you are in control and in command of the situation.

This kind of leadership requires you to always be thinking and preparing ahead. Constantly consider what you will do if gear fails or conditions get worse. Prepare plans to deal with these possibilities. Take whatever actions you can so these plans can be implemented quickly and easily. This keeps you and the crew active, gives you a sense of confidence and control, and allows you to remain on top of the situation as much as possible.

We know very few people who have had to deal with true survival situations on a sailboat. For an isolated activity carried out far from rescue services, offshore sailing is pretty safe. But that doesn't mean it is without risk. Accurately assessing and managing that risk is part of what it takes not only to cross oceans successfully, but also to enjoy it.

In the end, we are not risk-takers. We have struck a balance between the high-latitude sailing we have chosen to do and the conservative way that we approach it. We are not comfortable leaping into a new adventure without a safety margin, as a few of the sailor-adventurers we know seem to be. We build leeway into every element of the voyage, and that gives us the confidence to step off into the unknown. As Gonzales puts it, "At their best, adventurers are both bold and cautious. That means knowing where the envelope ends, and moreover, knowing yourself well enough to estimate correctly just how far beyond it you can go and still get back."

CHAPTER 24

Toward Seamanship: Efficient Passagemaking

IF YOU MASTER all the skills discussed in the preceding chapters in Part IV, you will make safe, competent passages. But something is still missing. To make efficient, elegant passages you need to take your passagemaking skills to the next level. That means reducing passage times by increasing per day averages. But that also means making sure that you arrive in port rested, with only minor repairs necessary to the boat. For a shorthanded crew, the boat and crew's condition at landfall are far more important than fast passage times.

Our experience and the pilot charts both suggest that you will spend a third of your time or more trying to keep the boat making headway in less than 10 knots of wind and a large ocean swell. It took us almost two years to get to the point where we could keep the boat moving comfortably without resorting to the engine in these conditions. And, almost a decade later, we're still learning, further refining our light-air skills with every passage we make.

Efficient passagemaking also means taking advantage of variations in the location and strength of prevailing winds to improve your passage time to your destination. Chapter 20 described how to put together a passage plan based on average conditions expected along your route for a given month of the year. But the conditions you experience will, by definition, vary from the average. Adapting your passage plan to reflect actual conditions can decrease your passage time. The availability of onboard weather information has made it possible to do this with some accuracy. This is another skill that we are still trying to perfect.

Finally, any landfall that ends with crew and boat intact has to be considered a good one. But a *successful* passage, to us, is one where we arrive rested and ready to explore the place we have worked so hard to reach. It is one during which we have suffered no major breakages and where the boat needs only minor attention to be back in offshore trim. It is one that, as Evans likes to say, is so boring that I have nothing to write about. Taken together, all of this—from passage planning and preparations to a safe landfall, from preventing emergencies to managing heavy weather—defines seamanship. Seamanship is not a one-time event, but an ongoing process, one we are constantly working toward with each new lesson the sea shares with us.

KEEPING THE BOAT MOVING SAFELY AND WELL

Learning to sail a boat comfortably on passage while making good daily averages toward your destination takes practice. Keeping the boat moving safely and well starts by knowing when you have too much sail up and when you don't have enough. It means keeping the boat safe in strong winds, as already discussed at length in Chapter 22. But it also means learning to keep the boat moving the third of the time on passage when you will have less than 10 knots of apparent wind. Motoring is one way to do that, but not the least expensive or the most rewarding.

Even with good light-air skills, the time will come when you won't have enough wind to keep the boat moving. You will then have to decide whether you are going to wait for wind or try to find it. If you decide to go looking, you will also have to decide in which direction to turn your bow when you crank up the "iron genny." These decisions take experience and judgment, but some rules of thumb are helpful.

Learning the Language

Your boat will let you know when you are pushing too hard or not keeping enough way on for the sea conditions. Every boat is different, and you will need to pay careful attention to your boat during your first few passages to understand what she is telling you. But after a few passages, her voice will be as clear to you as your companion's. The following signs will help you get started in learning your boat's language.

When the boat is pounding violently going to windward, you need to reduce sail. In certain conditions the hull form and sea state interact to create pounding. You cannot do anything—the boat would pound if you heave-to. But pounding generally means that the boat is overcanvased and would sail better reefed down. We avoided pounding regardless of the cost in boat speed to prevent damage to *Silk*'s gear and crew. *Hawk*'s hull form is more forgiving than *Silk*'s, so she rarely pounds. On *Hawk* the best way to tell if she is overcanvased is if she has more than a quarter turn of weather helm. We have marked the wheel so that we can tell at a glance if we're carrying too much sail (refer back to Figure 5-26). On both boats, the inclinometer (refer back to Figure 20-5) has been the final arbiter of discussions about whether or not it is time to reef. We reefed on *Silk* when the inclinometer started to hit 30 degrees regularly; on *Hawk* we reef earlier, at about 20 degrees of heel.

Many cruising boats will hobbyhorse when going to windward in waves, especially if they are overloaded in their ends. All the motion seems to be in an up-and-down direction without any headway. If the boat speed drops to 50 percent of your hull speed, the boat is undercanvased and needs more power to drive through the waves, even if that means sailing at a higher angle of heel than normal.

These can be very trying conditions. When we crossed the equator on our way back to the Caribbean from the South Atlantic on *Silk*, we found ourselves close-reaching in 25 to 30 knots of wind and steep, uncomfortable seas. We would normally have been sailing under mizzen and Yankee. Instead, we used full main and Yankee. We sailed with the lee rail well underwater for five days and made good 150 to 170 nautical miles each day. We were not choosing between comfort and speed; being uncomfortable was unavoidable in the sea conditions if we were to make any headway at all.

Hawk sails comfortably undercanvased, but we often prefer to carry a bit more sail and make more miles. To judge if we need to put up more sail area, we again use the marks on her wheel. Even occasional lee helm means we need more sail—she'll sail faster and more comfortably. If the helm is centered most of the time, adding sail will increase our speed but reduce comfort. Whether we add more sail or not will depend on general conditions, what weather we are expecting, and how much rest we have had.

Downwind, the situation is a bit more subtle. When overcanvased, both *Silk* and *Hawk* will start to slalom downwind. They will surge off in one direction, and the self-steering will have a difficult time getting them back on course. When it does, it will often overcorrect, sending them surging off in the other direction. If we look over our stern, we will see that we are scribing big S's with our wake. If we take the helm, we can hold either boat on course by anticipating the waves, but if we misjudge, it takes brute force to bring them back on course. While offshore racers would hand steer to stay on course without reducing speed, most doublehanded crews don't view that as an option. Reefing will almost always settle the boat with the self-steering holding the proper course.

Deciding that the boat is undercanvased going downwind can be less obvious. The boat's roll tends to increase as the wind decreases and the sails stabilize her less against the swell. This often happens when the wind dies after a period of reinforced trades. The marks on *Hawk*'s wheel are a good way to determine if she is undercanvased downwind. If the center mark is staying within 5 degrees of the centerline at all times, we will have a more comfortable ride if she carries more sail.

Making Miles in Light Air

Many sailors prefer the outright fury of a gale to the utter frustration of being becalmed. Without effective light-air sails, you will be forced to choose between motoring and drifting. To be of real use, light-air sail combinations need to be tough enough to stay up in squally conditions. With good light-air sails and good sailing technique, you can continue to make miles toward your destination without depleting your diesel supply. Aboard *Hawk*, we have made progress downwind in 3 knots of apparent wind in 10-foot Southern Ocean swells. Our light-air sails are discussed in detail in the Light-Air Sail Combinations and Sail Handling section in Chapter 5.

Even with the right sail combinations, keeping the boat moving in light air is truly an art. The lighter the wind and the larger the swell, the more difficult it is to make forward progress. Learning to sail your boat well in light air will sharpen your sailing skills in all conditions. It will also minimize your fuel bill and enable you to keep the engine off in the oppressive heat of the tropics.

When the air goes light, take a quick tour around the boat and make sure all the weight is stowed as low and close to the centerline as possible. If the trip has been calm, many things may have found their way out of stowage. If you think you may be facing several days of light air, consider taking another anchor off the bow or moving more chain into the bilge. On many designs, weight in the ends causes the boat to pitch, which slows the boat down when you have the least speed to spare.

Over the course of some 30,000 nautical miles spent in apparent winds of less than 10 knots, we have learned the following lessons:

1. **Manage the apparent wind angle.** First and foremost, we try to optimize our apparent wind angle. We obtain the most efficient wind angle possible by managing our overall passage routing and fine-tuning our course along that route. If the pilot charts show that we might be in light air for much of a passage, we will pick a course that brings the wind as far forward as possible. In very light winds we sail the direct route only when the apparent wind angle is between about 50 and 90 degrees. The rest of the time the course to our destination comes second to managing the apparent wind angle to maximize boat speed.

   With the true wind forward of the beam, we sail by apparent wind angle. When the wind is on the nose, the boat can't be sailed as close in light air as it can in stronger winds, especially in any waves. Sailing at a slightly deeper angle gives the sails a bigger groove and allows them to keep pulling as we sail through lulls. With light winds on the nose and flat water, we sail about 5 degrees deeper than our normal close-hauled apparent wind angle on *Hawk*—about 35 degrees apparent. In a big swell offshore, we will sail up to 10 degrees deeper than this.

   With the apparent wind on the beam or aft, which means the true wind is aft of the beam, we concentrate on the true wind angle. With light apparent winds behind the beam, most boats will get to their destination fastest by sailing a true wind angle of about 140 degrees, which translates to between 90 and 110 degrees apparent on *Hawk* depending on our boat speed. Polar diagrams for your boat will help you determine the most efficient angle to the wind in light airs.
2. **Make the most of currents.** As the wind dies and boat speed drops, current becomes more and more important to overall speed. Seek out any current in your area if it does not take you farther from where the wind might be. Avoid any countercurrents, even if it means sailing 20 to 30 miles off your intended route.
3. **Let the sails breathe, but keep the rig stable.** Virtually all the gear we have ever broken at sea has been in light air rather than in heavy weather. In light air with a big swell running, the boat has to be set up to prevent slamming and shock loading that can break battens, rip sails, destroy vangs, and even damage rigging.

   Conventional wisdom regarding sail trim in light air is to have everything relaxed. To create a fuller, more efficient shape on the mainsail, loosen the outhaul, ease the vang, ease the halyard until wrinkles appear on the front edge of the sail, and pull the traveler above the boat's centerline while easing the sheet slightly. For the headsail, easing the backstay until the headstay is curved but not pumping, easing the halyard to the same point as on the main, moving the sheet leads slightly forward, and easing the sheet will accomplish the same thing. On both sails, use the telltales to make sure that the sail is breaking evenly once you have made these adjustments.

   For a spinnaker (asymmetrical or otherwise), raise the clew to allow the spinnaker to take on a fuller, bellied-out shape. Center the sail higher than normal in front of the boat to take advantage of the slight differential between the wind speed at the water's surface and halfway up the mast. Change to lighter sheets to stop the clew from being dragged down and spilling the wind.

   Besides optimizing sail trim and allowing a wider groove to coast through lulls, this approach also builds some give into the sails so they do not shock-load the rig. But relaxing everything can lead to slamming when a large swell rolls the boat and forces the air out of the sail. To prevent that, the sails may need to be stabilized.

   Boom preventers are critical for stabilizing the main in light air. A preventer can be used to lock the boom in place, which keeps the swell from spilling the wind out of the sails or shock loading the rig. The preventer must be set up in a way that, in conjunction with the vang and the sheet, it can hold the boom solidly in one position over even the largest swells. In the Working Sails and Sail Handling section in Chapter 5, I describe our preventer arrangement and when we use it.

In a large, confused swell, the conventional wisdom of letting the sails breathe can result in so much slamming that the sails simply won't hold any air. Reducing sail area and keeping the sails flatter will often allow you to keep them drawing despite the roll. A mainsail or mizzen sheeted in flat on the centerline may steady the boat enough to keep air in a spinnaker or large headsail. Stabilizing the sails so they are less likely to collapse also helps. Poling out an asymmetrical spinnaker or large headsail will prevent it from spilling all its air. On some centerboard boats, putting the board down will reduce the rolling.

4. **Don't rock the boat.** In light air, any sudden move will disturb the air and water flow over the boat. A quick course change can stall the boat completely, and it may take a half hour or more to get the boat sailing smoothly again. The lighter the wind, the more it pays to think small: steer small, make small sail changes, correct the course in small increments. Then sit back and let the boat settle before making another small change.

   If the winds are really light and there is no swell, the boat may do better with the helm lashed rather than being steered by a wind vane, an autopilot, or even a person. The less movement in the rudder, the less underwater turbulence there is to slow the boat down. We sometimes sit at the helmsman's seat with the wheel locked and move it in one smooth motion a few degrees every 10 to 15 minutes as the boat drifts off her course.

   Minimizing steering also means tacking or jibing as infrequently as possible, even if we have to drift off the rhumb line. Offshore we will tack or jibe at most once a day, and we will take care to have the boat set up so that the jibe can be executed slowly and smoothly (see the Single-Handed Jibe sidebar below). We set our autopilot to economy mode to minimize rudder movements. If we need to trim a sail we adjust the sheet slowly. After any change, we leave the boat alone for at least 15 minutes to let it get back in the groove before we try anything else.

   Light winds rarely blow steadily from one direction. They tend to oscillate in bearing, often through 40 degrees, over a period of 15 minutes or so. This can make steering a challenge, especially when sailing close to the wind—if the wind goes too far forward, the sails will stall and we'll lose precious momentum. Going upwind in very light winds (3 to 5 knots apparent) we set the autopilot to compass on a broad course that will keep the sails from stalling even on the largest of the wind oscillations. In a little more wind we set the autopilot to steer to wind angle using economy mode so it will follow the wind shifts slowly and smoothly. Sailing downwind where the change in wind direction will not cause a jibe, we steer by compass and sail straight through any oscillations. This gives us the fastest average speed by minimizing rudder use and keeping the boat moving along a consistent course.

5. **Minimize underbody drag.** To maximize performance, you also need to reduce underbody drag. Set the sails so the boat is balanced. If that is not possible, at least avoid lee helm when sailing to windward. The braking effect of the rudder will offset most of your boat speed in 6 to 8 knots of apparent wind. To get rid of lee helm, experiment with your sail plan. Try adding more mainsail or reducing the headsail.

   If you have been moving slowly for a week or so in tropical waters and the winds are predicted to stay light, consider going over the side to give the bottom a quick scrub. Pay particular attention to the prop. But don't try to remove the gooseneck barnacles. They will die of their own accord when the boat stops moving completely, and they are virtually impossible to remove before that. They will slow your boat, but you will have to live with them until you get to port.

6. **When waiting for wind, keep the boat comfortable.** On both our boats we have been able to keep moving down to 2 to 3 knots of apparent wind except in a very large or confused swell. But below that the boat speed drops away and we lose steerageway. At that point, we can turn on the engine or wait for more wind. If we decide to wait, we have found that leaving some sail area up stabilizes the boat and limits the amount of slamming above and crashing below.

   If the water surface is flat, or in a slight swell, we roll up the headsail but leave the mainsail up and lock the rudder amidships. When the wind comes back, the boat will start sailing on a beam reach. The gurgle of water moving along the hull will alert us that we can start sailing again.

SINGLE-HANDED JIBE

We're in the Southern Ocean south of Madagascar, broad reaching on port tack in 8 knots of wind with a 3-meter swell on the port quarter and the mainsail prevented. The wind has been gradually shifting from the northwest into the southwest, and the forecast calls for a high-pressure system to fill in ahead of us. Before I took the watch 2 hours ago, we decided to jibe when the wind had shifted enough to allow us a south-southeasterly course in order to get below the light winds at the center of the high. It's now time to jibe, and with Evans getting the first sound sleep he's had in a few days, I don't want to wake him, so I prepare to jibe by myself.

The boat is rolling hard in the swell, so I need to be careful to keep the boom under control. First I set the autopilot control head, located on the instrument panel above the companionway, to steer on wind angle instead of compass. I put it on 110-degree wind angle. I open the clutch on the port (windward) preventer line that runs from the cockpit forward to the stays. Then I go forward and get the boom section of the port preventer line from where it's cleated near the gooseneck. I shackle it to the preventer line running up the deck after making sure to lead it outside of the lifelines (refer back to Figures 5-13 and 5-14). Then I furl the jib about halfway, far enough that it won't wrap around the headstay or hang up on the staysail stay when I jibe.

Next I put the starboard (leeward) preventer line on the winch on the starboard cockpit coaming, open the clutch, and take the preventer line out of the self-tailer, leaving three wraps around the winch. I hold on to this line while I move to the mainsheet winch under the starboard side of the hard dodger. While winching in the mainsheet, I gradually ease the preventer line until the boom is over the outboard edge of the hard dodger, keeping enough tension on it so that the boom can't escape and crash around in the swell. I take the mainsheet out of the self-tailer on the mainsheet winch and remove two wraps, but continue to hold the boom with another two wraps around the winch. Then I press the jibe button on the autopilot, which will cause the autopilot to change course so the wind angle goes to 110 degrees apparent on the other tack.

The autopilot is designed to do a slow-speed jibe, so I have enough time to release the starboard preventer and drop another wrap off the mainsheet winch as the boom starts to swing across the boat. I ease the sheet as the boom passes over me to minimize shock loading. Then I let it run out to roughly the right angle to the boat before cleating off the mainsheet again, grabbing the port preventer line and wrapping it around the secondary winch on the cockpit coaming. I winch in the preventer line with only a few swings and crashes of the boom, and lock it off in the self-tailer.

With the main jibed, I turn my attention to the now-backed jib. I sheet in the port jibsheet until I've taken up the slack on the backed jib, release the starboard jibsheet, and then unfurl the sail again before sheeting it to the proper angle.

After cleaning up the starboard preventer line, closing the clutch on the port preventer line, and changing the autopilot back to steer using compass course instead of wind angle, I'm finished. If we'd been sailing wing and wing, I would have furled the jib completely before jibing the main, secured the main, and then moved the pole to the other side of the boat before unfurling the jib again.

However, if there is a big swell, the mainsail will slam back and forth, damaging the sail and the rig. In that case, we first try dropping the mainsail halyard down about 2 feet. This often eliminates the slamming. But in a really big swell, any amount of mainsail will slam back and forth. At that point, we drop the main, set our staysail, and sheet it in to the centerline. While the staysail doesn't stabilize the boat as well as the main, it does minimize damage to sails and rig while reducing the rolling.

When Canvas Fails: Minimizing Motoring

While experienced voyagers vary a great deal in their willingness to motor, most agree that motoring is appropriate in three situations: when becalmed in a major ocean current, when crossing the doldrums, or when crossing the horse latitudes.

Being becalmed in the Gulf Stream or the Agulhas Current almost always means bad weather is on the way. Use the motor to cross the current before the weather deteriorates. If you are crossing the doldrums at a narrow

SHORTHANDED SAFETY TIPS

When sailing shorthanded it's critical to maintain as much of a safety margin as possible so that you have more leeway when things go wrong. In addition to avoiding fatigue, there are three things we regularly do on passage that we feel help keep us safe:

1. Use the engine to assist in maneuvering.
2. Secure the boom with a preventer at almost all times offshore.
3. Tack instead of jibe in large swells.

While we may be reluctant to use the engine to cover miles on passage, we're never slow to use it in situations where it can increase our safety. That includes motoring out of an ocean current before a storm comes or getting efficiently through the doldrums. But we also use it when maneuvering at sea to stabilize the boat and keep us out of trouble. We will often turn on the engine at the beginning of a maneuver just in case we need it but will end up turning it off without engaging the transmission.

The engine increases safety in the following situations:

- **Making sail changes in a large swell.** Sail changes often leave the boat undercanvased for a period, which increases the motion on deck just when we're trying to do things that require two hands, like setting up a pole. Motoring stabilizes the boat and reduces the roll, making it much easier to accomplish a sail change and reducing the risk of an injury or a crew-overboard situation.
- **Recovering from an accidental tack or jibe.** If the boat has tacked or jibed accidentally, it will often end up in a hove-to position or in irons. Rather than trying to manage the situation with the sails, we turn on the engine and bring the boat back through the wind.
- **Navigating through an area of line squalls.** The first time we encountered line squalls in the doldrums, we were lulled into thinking they would not be severe because they were visible from so far away. But when they reached us, the wind came up so suddenly and was so strong (up to 50 knots) that we had a hard time getting the sails off. After that, we learned to drop all sail and motor when we saw the black line darken the horizon, especially if lightning was flashing in the clouds. We use the radar to help us judge when to drop sail, but we're very conservative and do it when we still have an hour or more before we reach the squall band (when it is still 6 to 8 miles away). If the squalls don't develop into anything serious, we have wasted a couple gallons of diesel. But if they do, we avoid ripping the sails, breaking battens, and worse.
- **Getting debris off the keel or rudder.** Sometimes our boat speed will decrease for no apparent reason. After messing with the sails and the steering for an hour or so, one of us will suddenly realize that we have probably snagged something on the keel or the rudder. The easiest way to get rid of it is to back up. To be sure whatever is down there is not caught on the prop, we will turn the boat up into the wind until we come to a stop and put the prop in gear without turning on the engine. If the propeller spins freely, the chances are nothing is caught in it. Then we turn on the engine, drop the sails, stop the boat, and back up for 100 feet or so. We will usually see whatever was caught pop up in front of the boat.

We use a preventer to secure the boom at almost all times on passage. The boom is the most dangerous piece of equipment aboard, and whatever preventer setup you decide on should not only prevent an accidental jibe and keep the boom from crashing around in light-air, large-swell conditions, but it should also hold the boom firmly in place when the mainsail is down and furled in strong winds and big seas. A boom gallows is the best way to secure a boom during a gale but is impractical on most boats. Our preventer system can be used to lock the boom in place against the mainsheet if we ease the boom out over the side deck (refer back to Figure 22-5B).

Finally, when we need to jibe in big seas and strong winds, we often choose to turn the bow through the wind and do a long-way-around tack. As the boat comes through the eye of the wind, the boom crosses slowly from one side to the other. One of us makes sure that the mainsheet does not get caught on anything as the boom comes across. This minimizes the likelihood of the mainsail getting out of control and slamming up against the rigging, damaging the sail, battens, or rig. It also minimizes the chance of the boom or a preventer catching one of us as it crosses the boat, throwing us overboard.

point in the right season and you are becalmed, motor due north or south until you hit the trade wind belt.

Most experienced voyagers also motor when crossing one of the semipermanent highs in the horse latitudes, such as the ones that center around the Azores in the North Atlantic and around St. Helena Island in the South Atlantic. The old clipper ship routes avoided these areas of light air by sailing a backward-S course around the Atlantic: from the U.S. East Coast, to northern Europe, south to the Cape Verde Islands, west to Brazil, south to the Roaring Forties, and across the Southern Ocean to Cape Town and beyond. Traveling back to the United States and Europe from the Cape of Good Hope, there is no good way to avoid this high. Most boats end up motoring the last day or so to St. Helena rather than sitting becalmed.

Beyond these situations where most voyagers agree that motoring makes sense, the decision to motor varies from boat to boat. Some voyagers start to motor when boat speed falls below a certain point, whereas others base their decision on how much fuel they have left. Arctic adventurer Alvah Simon (author of *North to the Night*) recommends the rule of thirds and halves: "Divide your fuel into thirds. Use a maximum of one-third of the fuel on the first half of the voyage, one-third on the second half, and hold one-third in reserve for emergencies."

We don't like running the engine and prefer to sail our way out of light air. If the barometer, wind, sea state, and weather forecast all indicate that we will get wind in the next 12 hours, we sit and wait for it. In a generalized band of light, variable winds and squally conditions, there are always pockets of wind. If we can see squalls promising wind on the horizon, we sometimes motor to reach them. But we will turn on the motor when all our weather sources confirm there is no wind in the immediate vicinity but decent winds within a day's motoring.

ADAPTING THE PASSAGE PLAN

Passages begin, for me, not when we pick up the anchor and head out to sea, but many months before when we spread out the chart of an entire ocean on the table in our main saloon and first discuss the question of when and how we are going to reach our next landfall. Our planning begins by developing an overall strategy for the passage, as discussed in the Passage Planning section in Chapter 20. That plan will be modified and adapted in response to the specific weather we encounter during our crossing.

This section will walk you through each step of putting together the initial plan as described in Chapter 20, and then modifying it based on the actual weather we experienced on a passage. I use the example of our 3,850-mile voyage from the Cape Verde Islands off the coast of Africa to Punta del Este on the Rio de la Plata in Uruguay in September–October, 2001.

Developing an Initial Passage Plan

Our timing for this passage had to fit within the broader voyage we had embarked upon: from Iceland at the end of the northern summer to the bottom of South America at the beginning of the southern summer. To be sure we wouldn't meet up with the remnants of a hurricane in the North Atlantic as we traveled south from Iceland, we wanted to be south of the normal hurricane track before August. Most of this passage would be made in the trade winds and the equatorial region, which meant we would only need to worry about gales or storms south of 20° or 30° south. We wanted to reach the bottom of South America by early December, after the winter gales had abated but early enough to have a full summer season to cruise Chile.

Those constraints would have us arriving in the Canary Islands, our stop before the Cape Verdes, no later than early August and leaving Punta del Este between early and mid-November. The passage from the Cape Verdes to Uruguay would need to be made, then, between the middle of August and early November. We needed to decide on the optimal route and timing within this period. As discussed in Chapter 20, three things would influence our planning: the prevailing winds in the different climatic zones we would traverse, any currents we might encounter, and any potential hazards along our route such as shoals or other underwater features. In addition, we would take into account *Hawk*'s sailing abilities in deciding our final route.

As in any trans-equatorial voyage, the single biggest routing challenge lay in finding the optimal point to cross the Intertropical Convergence Zone (ITCZ). All else being equal, crossing as far to the west as possible, as discussed in the Wind Strengths section in Chapter 20, can easily save a week of frustrating sailing (or 100 gallons of diesel) on a trans-equatorial voyage. But crossing the ITCZ needed to be done in the context of the sailing conditions both before and after it. In this case, we would be passing through six very different climatic zones (see Figure 24-1), all of which would influence our choice of route and timing:

1. **Northeast trade winds.** The pilot charts showed that we could expect to be in the northeast trade winds from the time we left the Cape Verdes until we encountered the ITCZ.
2. **ITCZ.** Once we reached the ITCZ, the pilot charts showed that we could expect variable winds of less than 10 knots (Force 3) with calms 3 to 7 percent of the time. In September we should encounter the ITCZ just south of the Cape

Verdes at 15°N, at close to its widest point, and we could expect to have doldrums conditions to about 5°N. That meant up to 600 miles of difficult sailing conditions. By October, the ITCZ should have moved south to about 10°N and narrowed to 5° in width.

3. **Southwest monsoon.** From July until about November each year, the monsoon season brings rains to the African continent and south and southwest winds on the African side of the Atlantic between the equator and the Cape Verdes as far west as 20°W. The farther east we could cross the ITCZ, the wider it would be, but the better the angle we would have for making southing against these headwinds.
4. **Southeast trade winds.** At around 5°S, we should encounter the band of southeast trade winds, where we could expect southeast shifting to the east as we moved south. The southeast trades run as far south as 20°S in the mid-Atlantic. Once past the bulge of Brazil, we would be able to carry these winds on or just in front of the beam, which would allow us to ease sheets after getting through the southwest monsoon.
5. **Brazilian coastal winds.** From March to September, the southeast trade wind belt extends right to the Brazilian coast. But from October to February the trade winds shift to northeast off the coast, reinforcing the southwest-running current located there. This effect extends several hundred miles off the coast of Brazil from about 15° to 30° south. By not getting to that area until well into October, we could enjoy true downwind sailing for the second-to-last leg of the voyage, with a free gift of miles from the current.
6. **Temperate latitudes.** As we approached Uruguay, we would enter the temperate latitudes where highs and lows tracking off the mainland would determine our winds. Here the potential for encountering a gale or a storm would become significant for the first time on the passage. In September and October, the pilot charts show a gale frequency of between 1 and 3 percent from 20° to 30° south and from 5 to 10 percent south of 30° south.

To round the shoulder of Brazil, we had to make good some 1,300 miles to the south against predominately southerly quarter winds, but we could afford to lose no more than 500 miles to the west. The bands of southerly winds we could expect to encounter after the ITCZ dictated that we cross as far to the east as possible, even if it meant spending more time in the doldrums.

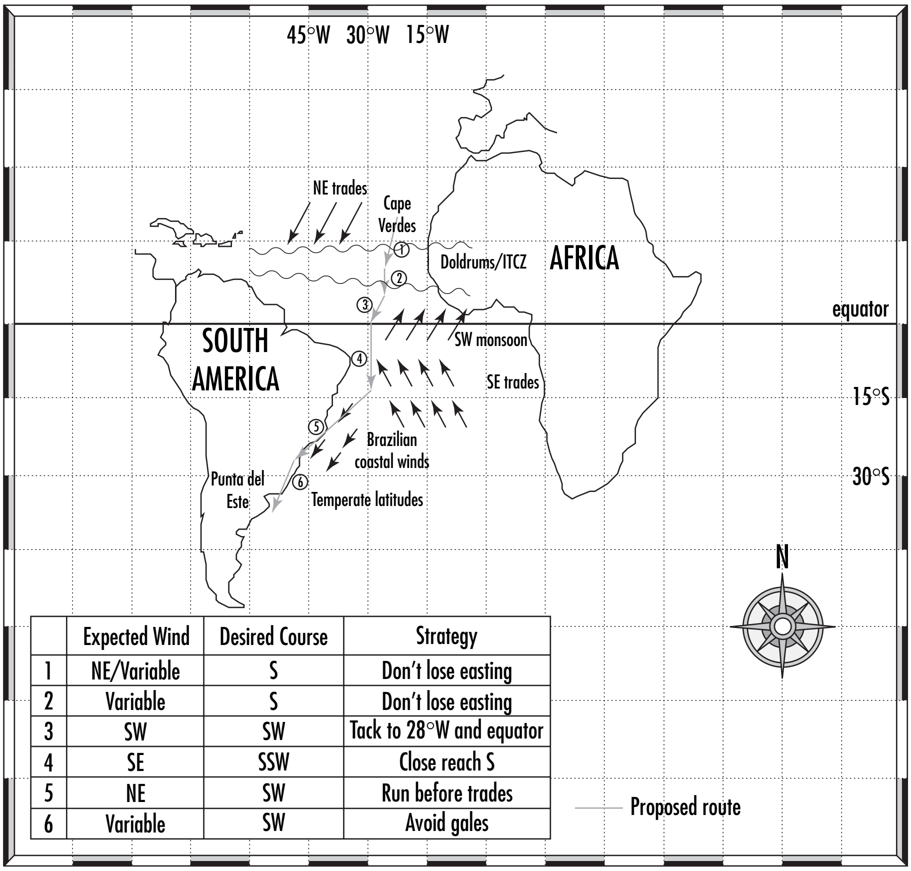
Having gotten a feel for the winds, we turned to the chart of the area, looking for shoal waters, currents, or other hazards that might affect our routing decisions. Two things were worthy of note: the extensive shoal area and the currents along the coast of Brazil. A series of 20- to 60-meter banks rising abruptly from 3,500 meters extends seaward starting at about 17°S and continuing for 250 miles to 21°S. These reach all the way to the Ilha da Trinidade at 30°W, some 600 miles offshore. The pilot chart shows the current running southwest at 0.7 knot along the Brazilian coast, but the *South America Pilot*, Volume 1, talked of currents of up to 3 knots and of potentially hazardous conditions with large, breaking seas when gale-force winds opposed the current. Staying to seaward of all the shoal areas would be impossible in the southeast trades. Though we couldn't alter our route to avoid this area entirely, we decided to make every effort to avoid heavy weather during this section of the passage.

Finally, we considered *Hawk*'s sailing ability. The southwest monsoons gave us an opportunity to make more easting before we left the African coast, and we needed to decide whether or not to take advantage of that. But *Hawk* sails very well to windward and in light air, so we were not too concerned by the southerly winds we would encounter after passing through the ITCZ. Further, with the ability to carry 200 gallons of diesel, we could afford to motor for up to 600 miles while still keeping a large reserve for other contingencies. If we had been on a boat that didn't sail well to windward, didn't do well in light air, or didn't carry so much diesel, we would have used the southwest monsoon to make additional easting after passing through the ITCZ.

After considering all this information, we put together our initial passage plan (Figure 24-1). We decided to leave the Cape Verdes as late in September as we could, just after the autumnal equinox, in hopes that the ITCZ would have begun its shift to the south by then. In the ITCZ and the southwest monsoons, our goal would be to lose as little easting as possible, and to make as much southing as possible. If we managed to reach the equator at or to the east of 28°W, then we would be able to start easing sheets when we encountered the southeast trades. We would then close with the coast of Brazil far enough south that we would be in the northeast trades and could run downwind to Punta del Este—assuming we didn't encounter any gales.

Modifying the Plan Based on Actual Conditions

We arrived in the Cape Verdes after a fast downwind run from the Canaries in the northeast trades averaging close to 180 nautical miles per day. We reached the



	Expected Wind	Desired Course	Strategy
1	NE/Variable	S	Don't lose easting
2	Variable	S	Don't lose easting
3	SW	SW	Tack to 28°W and equator
4	SE	SSW	Close reach S
5	NE	SW	Run before trades
6	Variable	SW	Avoid gales

Figure 24-1.
Climatic wind zones and proposed route on September–October voyage from Cape Verdes to Uruguay.

Cape Verdes in mid-September and began tracking the ITCZ on Internet sites. The weather was particularly unsettled with several tropical waves (the precursors of hurricanes if mid-Atlantic conditions are favorable) and a lot of thunderstorm activity on the northern edge of the ITCZ. This was located around 13°N and seemed to be moving northward. As we approached the last week in September, the ITCZ showed no signs of moving any farther south, so we left on September 22. Table 24-1 summarizes the weather we experienced in each leg versus what we had expected.

Leg 1. **17°N 25°W to 10°N 26°W.** When we left the Cape Verdes, we had expected a day or two of the same fast downwind sailing we'd had from the Canaries, but we were disappointed. On the night we left, we experienced heavy line squalls with intense lightning and thunder and winds of up to 50 knots. The ITCZ had moved even farther north, and we had set off right into it. It took three days to get clear of the active edge of the ITCZ, and there wasn't much we could do except make as much southing as possible in the light winds.

Leg 2. **10°N 26°W to 5°N 26°W.** When we made it through the northern edge of the ITCZ, we found ourselves in classic doldrums conditions with very light southeast winds predominating. Squalls were frequent and often large, but they were as likely to extinguish the wind as they were to augment it. We were able to sail much of the time, but this was frustrating sailing, for the wind was so light (6 to 8 knots on average) and the swell so large that we were not able to sail more than about 60 degrees to the true wind. We tacked on each favorable shift, trying to make southing without losing our easting, and making good less than 100 miles per day while sailing 150 or more. But we hadn't given up any easting by the time we reached 5°N and the wind shifted with the monsoon.

Leg 3. **5°N 26°W to 0° 28°W.** The southwest monsoon brought us first southwest and then increasingly strong southerly winds, and we sailed as close to these as we could. The wind built steadily from the 6- to 8-

TABLE 24-1. ACTUAL WEATHER CONDITIONS FROM THE CANARIES TO URUGUAY

Leg	Dates	Location	Expected Conditions	Actual Wind Direction	Actual Wind Speed (knots)	Actual Conditions	Nautical Miles Made Good per Day
1	9/22–9/25	17°N 25°W to 10°N 26°W	NE trades	Variable	Variable	Violent line squalls	140
2	9/26–9/28	10°N 26°W to 5°N 26°W	ITCZ	SE	< 10	Doldrums	95
3	9/29–10/1	5°N 26°W to 0° 28°W	Southwest monsoon	SW to S	10–15	Light headwinds	112
4	10/2–10/7	0° 28°W to 14°S 34°W	SE trades	SE to E	12–18	Light trade winds	165
5	10/8–10/15	14°S 34°W to 29°S 47°W	NE coastal winds	Cyclonic, then NE	20–30, then 8–15	Slow to avoid storm, then light NE trades	133
6	10/16–10/18	29°S 47°W to 35°S 54°W	Variable	NE	30–45	Gale/storm	184

knot average we'd had on the last leg to 15 to 18 knots by the end of this leg, and the seas built with it. This made conditions very uncomfortable below. We were approaching the equator and the heat was unbearable, but we had to keep the boat closed up because of the 6- to 8-foot waves that frequently boarded and raced down the decks. We gave up 2° of easting on this leg but still managed to cross the equator at our intended waypoint.

Leg 4. **0° 28°W to 14°S 34°W.** We found the southeast trades right where the pilot chart said we would—within 15 miles of crossing the equator. With each degree south, the wind shifted aft 10 degrees until we were sailing with the wind just aft of the beam making good 180 miles and more in a day.

Leg 5. **14°S 34°W to 29°S 47°W.** The wind went into the northeast with the beginning of the Brazilian coastal flow just as we were approaching the "danger area" of shoal water and strong currents. That was when we received a forecast for gale-force southerly winds with large seas and breaking waves in the area south of 17° south. After debating for a few hours, we decided to slow the boat down and let the weather pass to the south of us. We dogged along for 36 hours, forereaching into strong southerly winds. By the time we reached the shallow waters, the winds had eased and gone northerly, and we had a fast downwind run for another day in large but not dangerous seas.

After the gale, we had relatively light winds, but we were able to enjoy some fine downwind sailing in the northeast trades along the Brazilian coast.

Leg 6. **29°S 47°W to 35°S 54°W.** When we got another forecast for gale-force northeast winds a few days before we were due to reach Mar del Plata, we were well past the shoal water off the Brazilian coast. We would be running downwind instead of beating into it, and the forecast called for only 35 knots, so we were not particularly concerned. The winds turned out to be stronger than expected, and we ended up deploying our drogue when the winds went over 40 knots.

The storm had still not abated when it came time to turn inshore and head for the Rio de la Plata. We were worried about how large the waves might get as we crossed the continental shelf, and we debated whether to forereach and wait until the storm subsided. But I had a deadline to catch a flight back to the States, so we decided to head inshore. This was probably a mistake, as the seas along the continental shelf were among the biggest we have seen and many were breaking (refer back to Figure 22-7). We had to hand steer for 8 hours before we were through the worst of it, and another 6 hours later the wind had died to 30 knots. While we got through safely, it would have been more prudent to wait offshore until the seas died before crossing the continental shelf. Over the course of this voyage, we averaged 145 miles per day and took twenty-six and a half days to cover 3,850 nautical miles.

When a passage is complete and the chart gets folded away, we always remember the things that didn't go to plan. Yet in our experience, the pilot charts prove accurate the majority of the time. We knew the passage to Uruguay would be a challenging one, but our careful passage planning prepared us for the conditions we encountered, and we sailed as efficient a course as we could given the weather we actually experienced.

MAKING A SUCCESSFUL LANDFALL

A landfall made by sailboat involves a slow and steady familiarization, a refining of details as the land comes gradually into focus and then grows from miniature to human scale. Nothing could be more different than arriving by plane. Airports are sterile spaces, belonging to no particular place, way stations from which we emerge, passively transported, to a completely different geography, climate, and culture. But every landfall is unique, as distinctive as the shoreline before us slowly gaining in color and texture, growing larger and more vivid, beginning to fill our visual horizon.

It often takes us a full day to reach our port of entry after sighting land. In that time, we make the slow transition from sea to shore. I strip the sea berths and put together the laundry, make a grocery list, and put all the books for trading into a canvas bag. I inhale the scent of fresh-laundered sheets as I make our double berth in the forepeak and anticipate sharing it with Evans that night. Evans bags the staysail, coils and stores its sheets, and removes the jacklines. He reattaches the chain to the anchor and pulls the chain out on deck before flaking it back in the locker to ensure it will run free. Together we inflate the dinghy on deck and retrieve the mooring lines and fenders from their stowage areas. We take turns keeping watch for the freighters, cruise ships, and trawlers that suddenly populate our world. Neither of us says much. We are both savoring the last moments of our voyage.

Hawk is salt-scrubbed and shining. We are not in so exalted a state, however, so Evans shaves, and we each take a hot shower—using as much water as we want. Then we break out some clean clothes from the dry bags in the forepeak lockers, and we are ready to face people once again.

By this time we are approaching the harbor. We review the harbor chart and the state of the tide. We agree on our likely anchoring spot if no quarantine anchorage or customs wharf is indicated. We actively monitor the VHF to find out if we need to call the harbormaster for instructions or if big ships are maneuvering in the area. We turn on the depth sounder and compare our soundings to those shown on the chart to determine the chart's accuracy. We raise the yellow Q (quarantine) flag to the starboard spreader to signal our request for quarantine clearance. When entering a large port, we call the harbormaster and ask how to proceed.

Once in the harbor, our only rule is to take our time. We know that we are more tired than we feel because we are keyed up with the excitement of landfall. We check and then double-check. We circle as many times as necessary to understand the layout of the anchorage and to pick our berth or anchoring spot. When we drop the anchor or tie up in a berth, when the boat settles and sits quietly for the first time in weeks, when the motion stops and all is still, the spell of the ocean is broken. We drop the dinghy over the side or step off onto the dock, ready for our next adventure.

PART V
Foreign Savvy

TRAVELING BY BOAT offers a unique opportunity to experience other cultures and customs. But before you can begin to enjoy the place you have arrived at, you have to jump through a few bureaucratic hoops and put the boat back in order. When you finally get the chance to enjoy this new, exotic country, it can seem frustrating when the magic doesn't just happen. There are a variety of alternatives to find your way in to new cultures, to open doors to new friends and new experiences. But in most places, you will need to take the initiative.

Most new cruisers look forward to spending time in foreign cultures and getting to know people whose lives are significantly different than their own. But they often don't realize how important the community of their peers will become to them. For those who haven't experienced this, it can be difficult to understand both how small and how closely knit this community is. We voyagers may be dispersed geographically, diverse in nationality, from disparate political and economic backgrounds—but we are united by a shared set of values that comes from sailing the same seas, making landfall at the same places, facing the same dangers, and finally coming to see the world and our place in it in much the same way.

CHAPTER 25
Upon Arrival

ARRIVING IN A foreign country by boat is a terribly exciting event, nothing at all like arriving by plane. The difference is heightened when you actually drop the anchor or tie up the boat and go ashore. First, you have to clear in to the country in the same way as big ships do and not in the least like you would if you had arrived at an airport. After that, you have to get your bearings and figure out the lay of the land without the help of hotel clerks and tour guides. Where can you change money? Where can you pick up mail? Where can you get water and diesel? Where is the market? Just wandering around in search of a few vegetables can be an all-day immersion adventure in an exotic and intriguing place.

But all this can also be a bit overwhelming when you're exhausted from a passage and, perhaps, don't speak the local language. This chapter takes a look at what you need to do upon arrival and offers some suggestions for making your transition ashore a smooth one.

BUREAUCRACY REVISITED

When you arrive in a small island country by plane, at any time of day or night, you usually get whisked through customs and immigration in a scant half hour. Ninety minutes after entering the country, you can be frolicking on the beach or sipping a tropical drink by the pool. When you arrive by boat, you will spend an average of half a day filling out forms meant for freighters and answering questions about how many stowaways you discovered en route. You may be subjected to a search, and some of your stores may be confiscated or bonded. If you arrive on a weekend or after hours, you will have to pay overtime fees to be cleared in, or you will have to anchor off without going ashore until the officials are on duty. You may have to wait a day or even two for your frolic on the beach.

While we had read enough to expect more red tape than plane passengers face, we hadn't expected to spend quite so much time dealing with bureaucracy—on the order of several days for each country we clear in and out of. On the other hand, we have been pleasantly surprised by the professionalism and courtesy of the officials.

Bureaucracy is simply one facet of the voyaging life. During the course of a decade of voyaging, we have cleared into and out of forty-five countries. Though the process is rarely efficient, it is inevitable and unavoidable. To successfully unwind the red tape, there are several things you can do:

- **Have your key documents in order before you leave your home port.** See the Ship's Papers and Other Documents section in Chapter 12.
- **Research and comply with any additional requirements for clearing in to each country.** When you arrive in a new country, you will need to have a clearance form from your last port of call (see the Final Trip Ashore: Clearing Out section in Chapter 20) and, in many countries, a visa (see the Prepassage Bureaucracy: Obtaining Visas sidebar in Chapter 20). In addition, you may need to organize a cruising permit upon arrival.
- **Understand how to avoid bureaucratic hassles or learn how to manage them as efficiently as possible.** See the Managing Bureaucratic Hassles section below.

At every step of the way, arm yourself with patience and politeness, and maintain your sense of humor. After all, you are in paradise!

Clearing In

We spend a minimum of a half-day clearing in and a half-day clearing out in most countries, plus a day or more arranging visas where those are required (see the resources for this chapter in Appendix 1). Most of that was "hurry up and wait" time. We learned that the most efficient way to put the paperwork behind us was to accept the inevitable and be patient about the delays.

The stereotype of the petty bureaucrat with beady eyes and sweaty palms whose only concern is the size of the bribe turns out to be almost baseless. Out of the hundreds of officials we have dealt with, only three acted in any way dishonestly. Most officials pride themselves on their thoroughness, friendliness, and professionalism. Outside of the Caribbean, the customs and immigration officers generally deal with big ships, not with yachts, and their paperwork is designed for freighters. They are as frustrated as you are at having to fill out a dozen forms on cargo, bonded stores, and crew lost at sea. To make the process efficient and trouble free, be prepared, patient, and polite. They will appreciate your businesslike approach.

That approach starts with your appearance. Whenever dealing with officials, dress respectfully. If coming in from a passage, take the time for a shower, a shave, and a trim. If the officials will be coming aboard, make the boat as presentable as possible. Be ready to offer a hot or cold drink. Have all your papers handy and in order. Make sure there is somewhere for two or three people to sit and a table for one person to write on. Landfall preparations will stand you in good stead. By the time you are tied up to the customs wharf or anchored in the quarantine area, the boat should be ready to receive official guests.

Unlike clearing out (see the Final Trip Ashore: Clearing Out section in Chapter 20), clearing in generally involves the same officials at every port. Outside the Caribbean, they will usually come to you. In some countries you will be asked to tie up to a customs dock—often a monstrous concrete affair festooned with stanchion-eating tractor tires and nasty rebar poking out at odd angles. Once you are over the trauma of tying up to a dock like that, the tension only builds—as the tide comes in (or goes out), as the fishing fleet returns and ties up on either side of you, as a big ship maneuvers around you while you sit and wait for the last customs official. This is where patience is most essential.

Each official who comes calling is looking for something in particular. The sooner you provide it, the faster they will be on their way.

- **Quarantine officer.** A local physician who acts as quarantine officer should arrive first. This person establishes whether or not your vessel is free of contagion that could infect the local population. If all is well aboard, then the doctor will issue a *practique*, or clean bill of health. Once you have been granted practique, you can lower your quarantine flag and await the rest of the officials.
- **Customs officer.** The customs officer is concerned about contraband. This officer will want to be certain that you have no drugs, guns, controlled substances, merchandise for resale, or items subject to duty aboard. Any items found aboard in any of these categories may be bonded or confiscated until you clear out. You may also be requested to submit a list of all electronics aboard including make, model, and serial numbers to assist in retrieving the items if they are stolen. In most countries, customs will issue a temporary import form for the vessel that allows it to stay in the country for a specified period of time (normally three months) without paying import duties.
- **Immigration officer.** The immigration officer looks for illegal aliens. This officer will want to see all passports, issue temporary visas if you did not get one ahead of time, and review any visa that you did get before arriving. The immigration official will also be the most concerned about your movements within the country, will inform you if you need a cruising permit to leave the port of entry, and will explain how to obtain one.
- **Agriculture officer.** This official will confiscate your unused produce and other things that are deemed to pose a hazard to local flora and fauna. This may include such diverse items as garbage, spearguns, shells, and even the dirt from hiking boots and tent stakes. As discussed in the Strategic Provisioning section in Chapter 14, the best way to find out what may be confiscated is to go to the government's website and look up customs or agriculture controls.

On small islands, one person will wear all these hats. In the largest ports, a group of three or four people will crowd aboard for each of these functions. You will have to complete from one to a half-dozen forms and answer a number of questions from each official. While you are talking to them, ask whether or not you need to see them to clear out and find out exactly where their offices are located. This will save time when you're preparing to leave. When you think you've reached the last official, ask whether you need to see anyone else. Occasionally you'll be surprised to find that you are supposed to check in with the harbormaster, the Coast Guard, or the local police before you are legal. Failure to do so bruises delicate egos and may complicate life down the line.

Until you are officially cleared in, only the skipper is allowed to leave the vessel. If you have arrived on a weekend or late on a weekday afternoon, you may be charged overtime fees to clear in right away, or you may not be allowed to clear in until business hours. If you have to wait until Monday, you are technically not allowed to leave the boat, and in most countries you should not do so. On the other hand, when making landfall on small islands, you will probably have to go ashore to find the officials. If you haven't made radio contact and they don't show up after an hour or so, the skipper should head ashore with the crew's papers and ask what the procedure is.

Once you have been cleared, you will be instructed where you can anchor or berth. At long last, you can raise the courtesy flag to the starboard spreader and consider yourself official. But you may not be quite finished with bureaucracy. In a few countries such as Fiji, Australia, Panama, Mexico, and Chile, yachts are required to obtain a cruising permit. To do this, you must visit the relevant officials ashore before leaving the port of entry. The immigration officials will tell you the exact procedure when you clear in. You'll need your ship's papers and a detailed itinerary. As you approach these countries, decide which stops you wish to make and when.

Unless you have to deal with any of the bureaucratic hassles discussed in the next section, in most countries you are finished with bureaucracy until you clear out. In a few places, however, you are required to clear in and out of every port you visit. Throughout French Polynesia, you will be required to clear in and out of each island. In South Africa, you must clear in and out of every port. In parts of Fiji, you are required to check in with the headman of every village who will examine your cruising permit before inviting you to stay in the anchorage. Other cruisers will be your best source for figuring out what the rules are. Follow those rules for a hassle-free, enjoyable visit.

Managing Bureaucratic Hassles

Most of your interactions with officials will be limited to clearing in and out, and you will find the people you deal with professional and courteous. But sometimes you will have to deal with officials for other things. In some cases you cannot avoid these interactions, as is the case when you need to clear packages through customs. Other complications can arise from the choices you make, as in deciding to carry firearms aboard. In both situations, manage the resulting bureaucratic hassles and delays the same way: be prepared, and then be patient and polite.

Unavoidable Hassles

You may encounter frustrating bureaucracy if you need to have something shipped to you or if you choose to keep your boat in the country for more than six months or so. In both cases, understanding how the system is supposed to work will aid you in navigating the bureaucracy. Other voyagers will be your greatest allies in figuring out how to minimize the hassles involved.

Shipping yacht spares. Whenever I hear someone new to voyaging say, "If it breaks we'll just have a new one shipped in overnight," I have to stifle a chuckle. We have all been inundated with advertising saying "anywhere in the world in a day," so we believe it. Yet in the real world, it simply doesn't work like that for anything except documents. Large, bulky packages that go "clink" when you tap on them take longer—often much longer. The overnight guarantees are based on the assumption that the package can make it through customs without assistance. Most of the things that voyagers ship can't and don't.

Our first attempt at shipping yacht supplies internationally illustrates our experiences in most countries. We were in Madeira, a Portuguese island, after crossing the North Atlantic on *Silk*. We wanted to put everything right that we had done wrong in outfitting the boat before leaving the United States. We ordered a wind vane, a solar panel, an autopilot, and a cockpit instrument repeater. All boxes were shipped from the United States by various methods, and all were prominently labeled "Spare parts for yacht in transit."

The cockpit instrument repeater was shipped via UPS. We were told it would arrive in three to four days. Ten days later, we were informed that it was being held hostage in Lisbon and we would have to hire an agent and pay 50 percent VAT (value-added tax) plus an importation fee and duty. We sent off copies of our ship's documents, copies of our documents from clearing in to Madeira, notarized records of our voyage to date, and letters assuring them we would leave Madeira as soon as they released the box. When that failed, we hired an agent who told us he could get the box through customs without paying the taxes and duties. After another week, we gave up and paid the ransom. It had been twenty-two days since the package had been shipped, and the duties and taxes on the cockpit repeater almost equaled the purchase price of the equipment.

The wind vane and solar panel were shipped by different airfreight companies, both of whom promised three-day deliveries. Both companies "lost" the packages. We traced the wind vane from airline to airline, and it was finally located in a storeroom in Kennedy Airport in New York City a week after it had been shipped. It arrived on Madeira two days later, and we spent an entire day at the airport filling out forms and running from office to office to clear it through customs. In this case, the "yacht in transit" label was respected, and a customs officer accompanied us to the boat where he watched us put it aboard and would not leave until we used our trusty ship's stamp to make his documents official. After a total of thirteen days, we had our wind vane, and we hadn't had to pay any additional duty, bribes, or taxes.

The solar panel was located in Lisbon a week after it was shipped; the Portuguese airline had failed to pass it on to the puddle jumper to Madeira. Once it arrived, we again spent a day at the airport and ended up with a different customs officer. When we got to the point where we thought we would be heading off in a taxi back to the boat with this official, he told us that it was really at his discretion whether or not to make us pay duty. "Some days I feel like making people pay 100 percent duty, and some days I let it come in for nothing," he explained in broken English. We were helpless, and he knew it. We bartered and agreed that we would pay 25 percent of the value of the solar panel, for which he did not want to give us a receipt. You are supposed to insist, but to what end when there is no obvious higher authority, and you do not speak the language? After twelve days, we had our solar panel at a 25 percent premium.

When we ordered the autopilot, the company insisted that it shipped abroad regularly and that the best way was first-class mail. We argued with them, but they convinced us to try it and told us to start looking for it in seven to ten days. The autopilot arrived thirteen days later, and we cleared it through customs in the main post office downtown without having to go to the airport. The "yacht in transit" label was respected, and no one even suggested we pay taxes or fees.

On successive occasions we have tried most of the major overnight couriers and air express companies. The lessons that we learned on Madeira turned out to be broadly applicable. A friend or relative who is joining you for a time on the boat makes for the safest and most efficient delivery. Whenever possible, we wait for those opportunities rather than shipping parts by normal methods. When that won't work, the following steps will increase the likelihood of a trouble-free delivery. Be surprised and pleased when it happens, but don't expect it!

- **Ask others what works.** When you find someone who has already shipped parts into the country, ask them what service they used, what the procedure was, and whether or not they had any problem with the authorities.
- **Have the shipper put an invoice on the outside of the package and label it "Spare parts for yacht in transit."** If "yacht in transit" is not visibly displayed on the outside of the box, you can forget getting it into the country without paying taxes and duties. If it is there, you have a fighting chance. The invoice also needs to be packed on the outside of the box so that the customs officer can determine the legal value of the package.
- **Use U.S. Postal Service airmail outside of U.S. territories (Guam, American Samoa, U.S. Virgin Islands, Puerto Rico).** Within the United States or in U.S. territories, your shipping options include the full range of services you would expect, and they all work reasonably well. Outside these areas, the post office proved most reliable for packages it would accept. Customs clearance is usually faster and easier through the post office, perhaps because they assume the package is for personal use and not for resale. The post office won't accept a package large enough to hold a sail or a solar panel.
- **If using airfreight, obtain all shipping information from the shipper and track the package.** For many larger packages, airfreight will be the only option. We found that we had to keep track of the process or the package got sidetracked somewhere, even when shipping to New Zealand. Ask the shipper for the manifest number and all flight numbers and dates. If the package does not arrive on the day it should, immediately start chasing it down. The longer it sits in an airport somewhere, the more likely it is to be stolen along the way.
- **If you have to use a shipping agent, use the cruising network to find a reliable one.** You will often be told you need to hire a shipping agent for $100 and up. Before doing so, ask other voyagers who have shipped things into the country whether you really need one or not. In many cases, you can clear things yourself if you are willing to go to the airport and take the package through its rounds. In a few countries, an agent is the only way to clear a package; if you try to do it yourself, you will be stymied at every turn. Ask around to find a reputable agent. An agent's fees are easy to inflate and hard to debate. Information is your only ally.

In an ideal world, your boat would function perfectly, and you would never need to ship anything. But in the real world, things break aboard, and parts must be obtained. Remember that a simple boat will create fewer hassles. And when you do have to ship something to a foreign country, don't assume it will be trouble free.

Extending your stay. Many countries require you to pay import duty or VAT on your boat after you have been there for a certain period of time. In most cases you are considered a visitor and not subject to the tax for an initial period of three to six months. Unless the tax-free period is extended, after that time you are considered to be residing in the country, and your boat must be officially imported under the local laws. In practice, that means a payment of from 15 to 50 percent of the value of the boat—an amount few voyagers are willing to pay or able to afford. To avoid the tax, leave the country for a specified period of time (usually a month or more), and then return for another tax-free period. In most countries, the tax-free period coincides with the time your visa is valid, so everything normally works well.

Cruisers often want to spend more than three to six months in countries with large cruising grounds, such as Australia, New Zealand, Chile, Canada, the United States, and Europe. In most of these places, it is not difficult to extend both the duty-free importation of the boat and the crew's visas for up to a year. The procedure varies by country; the cruising grapevine is your best source of information. In most places, you will be required to show proof of financial resources (on the order of $1,000 per couple per month, with additional funds if you do not have boat insurance) in order to extend your stay.

The countries that make up the European Economic Community (EEC or EC) are considered as a single country for purposes of import. Foreign vessels are allowed to stay in the EC for a period of eighteen months, but many non-European cruisers want to cruise Europe for several years. There are three alternatives to avoid paying import duty:

1. **Put the boat on the hard.** Time on the hard does not count toward the eighteen months as long as a customs official certifies that the boat is on the hard for the entire period. Many cruisers leave their boat at a reputable boatyard and fly back to their home country for the winter.
2. **Import the boat.** Boats can be imported into the EC without payment of duties or import fees if they are the owners' "full-time, permanent residence." The easiest place to do this is Britain because the officials seem most conversant with the rules and they speak English, but we have friends who have done it in France.
3. **Leave the EC for a short period of time.** Sailing to a non-EC country for a week and returning restarts the clock. Many crews in the Med will cross over to Tunisia or Morocco for a short break in the summer and then return to the EC for a second season.

Recovering VAT on purchased items. In many countries that have VAT, the tax is intended only for goods that are going to be used within the country. In those countries, you don't have to pay the tax on equipment that becomes a permanent part of your vessel. Bureaucratically, this can be handled in one of two ways. In some countries or for some types of purchases, you must pay the VAT and keep records of how much you pay. When you check out, customs will inspect the boat to be sure that everything on the list is leaving the country with you. You will be refunded the money on the spot or in the form of a check issued a few weeks later. Most of the major equipment that we purchased in New Zealand was handled this way.

Alternatively, you may be able to avoid paying the tax in the first place and get the equipment at a healthy discount off local prices. In that case, someone must keep the records for you and report to the government. They will need copies of your ship's papers and your passports. In South Africa, the chandleries that would handle this paperwork got the bulk of the foreign yachts' business. In New Zealand, the work we had done in a boatyard was handled this way.

In most countries VAT is included in the quoted purchase price, so it helps to know how much it is and on what types of products it is charged. The tax is often on the order of 20 percent of the value of the equipment or materials, so it pays to find out if tax relief is available. In some cases, we could even get VAT refunded on grocery and fuel purchases made as we were leaving the country.

Avoidable Hassles

Some of the decisions you make will determine whether you run into additional bureaucratic headaches or not. This section points out problem areas so you can make an informed decision. In some cases—as in the case of carrying pets aboard—your choice may cause you to change your itinerary. Most situations involve issues of personal comfort or convenience.

Bribery. For the most part, bribery can be avoided. Problem areas are well known throughout the cruising community and are often discussed on sailing bulletin boards (see the resources for this chapter in Appendix 1). Of the hundreds of officials we have dealt with in the more than forty countries we have visited, only two people even hinted at a bribe when we were clearing in or out. The first was in the Galápagos, where an official took our boat papers, locked them in a drawer, and then wrote a figure on a piece of paper. It was clear we weren't going to get our boat papers back unless we paid him that amount of pesos.

On Rodrigues Island in the southern Indian Ocean, we had been cleared by two officials when the last officer came aboard. We filled out the normal forms and went through the usual chitchat. Then he said, "So, do you have something for me?" while he rubbed his thumb and fingers together. I said, "Of course," and went and rummaged around in a drawer. I handed him a photograph of *Silk*, a little memento we carried for friends we met along the way. He looked at it as if it would bite before taking it. After a strangled "Thank you," he left the boat. Other friends had similar experiences. When asked for a bribe, don't become incensed or assume that you have to play along. In some cases, the officials see no reason not to give it a try. They are easily discouraged by someone who doesn't appear to understand—especially if the confusion is accompanied by an excess of good cheer.

Indonesia and the Suez Canal are the only two areas along the trade wind routes where cruisers are likely to encounter officials looking for bribes. But there is a cultural aspect to bribery. George Day, publisher of *Blue Water Sailing*, has said, "Almost everything in Indonesia is negotiable. I sometimes felt we were negotiating over the price of clearing in, but I didn't feel I was being asked to pay a bribe." Mark Scott, who has sailed extensively throughout Africa aboard his Rival 38 with his wife, Liz Hammick, and daughter, Chloe, says, "[Americans] assume if we're asked for something, we're being blackmailed and we can't say no. That's not true in these cultures. The attitude is that they might as well ask, but no hard feelings if you refuse. The pilot of the boat that guided me into a Syrian port told me that the last American yacht had paid him $250 for his services. I gave him a couple of packs of Marlboros and he was happy."

In general, cigarettes still smooth the way, especially up the Red Sea. Many cruisers purchase cheap cigarettes in Sri Lanka before heading for the Mediterranean. They prove useful for everything from arranging security with a port captain to easing the way through the Suez Canal.

Firearms. The issues around carrying firearms were discussed in Chapter 11 (see The Most Personal of Decisions: Firearms Aboard sidebar). If you choose to carry firearms, you will need to declare them in every port. The authorities are often less forgiving and less friendly once they know you have guns aboard. Some cruisers don't declare their arms, knowingly breaking the laws of the countries they visit. If the weapons are discovered, the boat could be impounded, and the owners fined or imprisoned. In a few countries, people found with illegal arms can be put to death. Officials found undeclared arms on two boats we know. In Mauritius, the elderly couple got off with a very uncomfortable night in jail, a fine, and a warning. In New Caledonia, the skipper worked for six months to pay off the fine and free his boat from impoundment.

Many countries do not just consider guns as firearms. Stun guns, spearguns, and flare guns may also be confiscated. In Australia, Mace is illegal; if it is found aboard it will be confiscated, and you can be fined.

If you have a lockable stowage area, customs may be willing to seal the locker and leave the weapons aboard. In most countries, however, any weapons will be held by customs until you clear out. Before you can leave, you will have to return to your port of entry to get your guns. In many places, this will entail an uncomfortable windward sail.

Pets. We know many people who travel with pets aboard, and we have often thought about getting a ship's cat. Some of our friends have been forced to change their voyaging plans because of their furry friends. We began our travels without an animal aboard, and have decided not to complicate our lives by adding one. If you want to bring a pet along, be prepared for the bureaucratic difficulties that will result.

New Zealand and Australia require lengthy quarantine periods (usually several months) before the animal can be brought ashore. In those countries, you will be required to keep your pet aboard and to pay for regular inspections by a quarantine officer to prove that it has not gotten ashore. If you go alongside for fuel, you will have to keep the pet locked below. If the animal gets sick, you will have to pay the quarantine officer to accompany you to the veterinarian. If you violate any of the regulations, the animal may be put down.

Rather than submit to these harsh restrictions, some of our friends with pets chose to skip both New Zealand and Australia and head north of the equator to Guam, the Philippines, and then on to Thailand. Others purchased animals in New Zealand or Australia and had few problems the rest of the way around the world. If you have a pet aboard, you will need a rabies vaccination certificate that is no more than six months old, and you may need a Veterinary Health Certificate issued within ten days of the date when you cleared out of your last port. Some countries also require that your pet have a microchip implanted so they can verify that the veterinary records belong to that particular animal.

If you are thinking about having a pet aboard, check with the local embassies or consulates for each country along your proposed route to find out the exact rules, regulations, and requirements.

Changing crewmembers. As skipper, you are personally responsible for your crewmembers, whether they are your relatives or not. If you arrive in a country with a crewmember aboard, you are physically and financially responsible for making sure the crewmember leaves again—on your boat or otherwise. This is one of the biggest reasons why family and couple crews are the most common.

If you are taking on a crewmember, make absolutely certain the person's passport is valid. If a visa is required, agree with the crewmember beforehand how financial requirements will be handled. Decide if you are going to pay for the cost of obtaining the visa or, in French Polynesia, to post the bond. You also need to have a clear agreement regarding the duration of stay and the financial arrangements. Do you pay the crewmember, or does the crewmember contribute to your costs?

When the person leaves the boat, you will need to be officially released from your responsibility. If you try to check out without all the crewmembers you arrived with, you will not be allowed to leave. Make immigration aware of any crew changes when they occur. If the crewmember is flying home, go to the immigration office with the crewmember and show them the ticket. If the crewmember has signed on aboard another boat, go to immigration with the other skipper and inform them of the change. In both cases, immigration should remove the person from your crew list.

When taking on crew, arrange everything ahead of time. Make sure the crewmember has a valid passport and learn as much as you can about the person before you sign them aboard. You don't want to end up in jail for smuggling in an illegal alien or an alien who is smuggling, and you don't want to end up a hostage to a crewmember who refuses to leave your boat.

Burgeoning Bureaucracy

Every group has its sacred cows, but each also has its great grouses. For world voyagers, bureaucracy tops the list of complaints. Most voyagers believe a foreign country cannot impose its regulations on foreign-flagged vessels. But a close look at the reality does not support that contention. Countries have the right to impose restrictions on the voyaging community. As the number of yachts in foreign waters increases, we can only expect more regulation.

Cruising has traditionally been very inexpensive, in large part because cruisers were exempt from most social costs while they lived aboard. If someone was injured, they used the local health-care system (which is socialized in most countries around the world) and paid nothing for the service. There were no harbor fees, no pumpout fees, no water or electricity charges. In the past, countries were willing to tolerate a handful of yachties "freeloading" on local resources because the problem was too small to warrant the cost of a solution. With the explosive growth of cruising yachts and the increasing demands on national budgets, countries are no longer willing to subsidize foreign cruisers. Where the problem becomes visible enough and expensive enough, they will impose a fee on foreign yachts to offset the cost of their presence.

Cruising is becoming more expensive and more regulated because the large number of cruising boats taxes limited local resources. Most of the fees and restrictions that have been imposed are not inequitable. The real problem comes if countries start to impose fees to extract money from a voyaging community that has no voice or representation. The community's mobility offers a viable defense against that possibility. In the meantime, you will hear a great deal of incensed discussion about bureaucracy. Sit back and enjoy it.

GETTING YOUR BEARINGS

Our first day in a new port is usually devoted to checking in, a first foray ashore, a nice meal, and a good night's sleep. On the second day we find the energy to put the passage behind us and begin to get our bearings. Like many voyagers, we prefer to put the boat back into voyaging shape before we relax and enjoy our destination. The faster we can acclimate to the new culture, learn the area, and work our way through our to-do list, the sooner we can head off and explore this strange new land.

Although the exact order of activities may vary, we have three major objectives during our first week ashore in a large port. First, we want to get the boat as close to seagoing shape as we can. In addition to cleaning up and airing out, that effort includes ordering any spare parts that have to come in through customs and initiating any repairs that might take more than a few days. Second, as strangers in a strange land, we have to learn how things work—from the local currency to the local laundress. Third, we are always eager to reestablish communication with friends and family, and we often need to manage some things on the home front.

We rarely arrive in a port where we don't have some information on what to expect. Whatever cruising guide we have for the area offers advice on water, diesel, provisions, and services. If we have managed to buy or borrow a guidebook, we have a rough idea of the general layout of the town and where we might find an Internet café and tourist information. The SSCA bulletins offer advice on all aspects of a new port—from where to dock to where to get provisions.

But our best information comes from other voyagers. Voyagers from New Zealand and Australia cruise throughout the Pacific and are eager to offer suggestions about their home ports and the places they have visited. You will find Americans and Europeans in almost every anchorage, and many have a wealth of experience cruising not just in their home waters but also throughout nearby countries. You'll see South African boats frequently once you reach the Indian Ocean and throughout the Caribbean. If you see the flag of a country you think you might like to visit down the road, introduce yourself to the crew. That's the way the voyaging world works.

Returning the Boat to Normal

After our second passage, we were enjoying cocktails aboard another boat with a group of several yachties, most of whom were new to passagemaking. We were exchanging early impressions of the voyaging life when a woman single-hander said, "I'm still afraid to look in my lockers. Every time I open one, there's some sort of a surprise waiting. And it's never a pleasant one." We all laughed, but not wholeheartedly. I realized I had been subconsciously avoiding a number of areas on the boat for fear of what might be lurking there. One of the few experienced passagemakers in the group, an angular man who had been voyaging for a dozen years, said gruffly, "And what makes you think whatever's in there is going to go away without a little sunshine and some fresh air?"

Like our attitude toward maintenance, our attitude toward postpassage tasks underwent a radical change during our first year of voyaging. By the time we reached the Pacific, we had established a set routine to clean up the boat within 24 hours of arrival in a new port and to return the boat to passage-ready condition as quickly as possible. We apply our maintenance attitude to the entire boat after a passage, finding anything that is wrong right away rather than discovering it piecemeal. Then we can relax, knowing that every detail has been attended to and no unpleasant surprises are awaiting discovery in the lockers.

Airing Out and Cleaning Up

After we have cleared in and gotten some sleep, we flush the boat with fresh water and air it out. If we have a hose available, we rinse the boat off thoroughly, including all exterior stainless and teak, blocks, winches, genoa tracks, the wind vane, and the windlass. We open up the bilge from one end to the other and pour buckets of water with a mild soap down through the hawsepipe. We scrub the bilge with a long-handled brush or a large sponge and flush it with several buckets of fresh water. We leave these areas open for 6 to 12 hours until they are thoroughly dry.

If we do not have access to a hose, we flush the bilge with two or three big buckets of water and a small amount of soap and we don't rinse it afterward. We can flush out the entire boat from chain locker to engine sump with about 10 gallons of water, especially if we block the limber holes and scrub one area at a time.

Figure 25-1.
A boat in the process of being aired out and cleaned up after an Atlantic crossing.

The electric bilge pump gets a thorough workout during this process. We check the manual bilge pumps to be sure they are in working order. We run the pressure water and use the handheld shower in the head to clean out areas that are difficult to reach.

We open and air out all lockers that hold clothes or foul-weather gear. We sort through all the clothes in the forepeak lockers. Those stowed in dry bags or plastic bags need only a cursory check to make sure they are still clean and dry. The rest we sort into laundry and wool. We hang wool clothes and blankets in the cockpit for a day, where the sun and the wind eliminate any unpleasant odors. We also hang clothes from the hanging lockers out in the cockpit for several hours of sunshine. We give foul-weather gear a thorough rinse with a hose or in a bucket before leaving it to air out for 24 hours. Inside the boat, we let all lockers air out for several hours (Figure 25-1).

We do a quick inspection of any locker or area that hasn't yet been aired out. Through the course of airing out and cleaning up, we add a few more items to our to-do list, such as a latch that needs to be replaced or a deck fitting that needs to be rebedded. Once in a while we find something more major—a bilge or water pump to be rebuilt or a turning block on deck to be replaced. By the end of the day, almost everything is back where it belongs, and the boat smells as fresh and clean as when we left port.

The Postpassage Inspection

Once we have aired out and cleaned up the boat, we turn our attention to a thorough inspection of every piece of gear aboard. Even on the most successful passage, we have a few items on the repair list before we make landfall. After the salt is cleaned off the boat and the lockers stand open while they air out, we take the opportunity to make sure our repair list is complete.

If we are in a clean harbor, Evans dives and checks the bottom. He makes sure the rudder, prop, and zincs are all in good order, and he has a look at the bottom paint to see how it has held up. On most tropical passages, we have acquired a crop of gooseneck barnacles, which Evans ignores. These require water flowing over them to live, so they will die and fall off within a few days of our dropping anchor.

We discover any problems on deck when we hose off all the hardware. If the passage has been longer than ten days or if we have any reason to suspect a problem, one of us goes up the mast for a quick inspection of the masthead crane, lights, instruments, spreaders, and spreader lights.

We inspect every seam of our working sails and check for chafe, broken threads, or small rips. If possible, we take our asymmetrical spinnaker ashore and spread it out so we can inspect it for pinholes or rips and allow it to air out. We fix minor damage to any sails on the spot. We add to the to-do list any major damage that requires patching.

By the second day in a new port, we have completed our postpassage inspection, and the boat is back to normal. By our third day, we have organized the items on our to-do list, divided up the tasks, and begun to work through the list of jobs.

Managing the Repair List

We never complete a passage more than five days long without one or two small items needing attention when we get to port. After our early experiences, we never try to get parts anywhere but in major ports where we intend to stay for a month or more. If we have made landfall in a remote area without chandleries or boatyards, we make do with whatever spares we are carrying and the few things that can be purchased from a local hardware store. Anything that we cannot repair ourselves with the materials at hand goes on the long-term repair list for the next major port. In the meantime, we tackle one or two tasks every day until the immediate repair list is completed. The types of repairs we can do in remote areas don't really need to be managed—they just need to be done.

By the time we are approaching a mainland port with yachting facilities such as Auckland, New Zealand, or Fremantle, Australia, we always have an impressive list of necessary repairs. Most are minor, but a few will take several days or weeks to complete. We usually find a few more items that need attention during our postpassage inspection, and our repair list will often cover a page or more.

We have learned not to leave the work until the end of our stay. Things always take longer than anticipated. Trying to complete important tasks when rushed by an approaching departure date doesn't yield results that stand up to offshore demands.

We tackle long-lead-time tasks first. These generally fall into the following categories:

- **International deliveries.** Anything we have to order from outside the country and coax through customs always takes far longer than we expect. We carry a wealth of catalogs from which we can order parts. Having the part numbers ensures that we get the right parts into the country.
- **Specially made items and outside professionals.** We assume anything that has to be custom-made for the boat or that involves outside professionals will take more time, though sometimes we are pleasantly surprised. Fabricating hardware, galvanizing chain, and acquiring new sails or canvas all require several weeks of lead time, and almost inevitably these items arrive later than promised.
- **Haulout.** In areas where haulout facilities are scarce we will need to schedule a haulout several weeks in advance. Even where facilities are plentiful, we have to decide where and when we want to be hauled out and make sure we have all necessary supplies for the work to be done on the hard. We try to find a yard where we can do the work ourselves and live on the boat while it's on the hard.

During the first week, we try to get as many long-lead-time tasks underway as possible. We don't worry about the jobs we can do ourselves with the materials we have on board or can get locally. Once we have everything else underway, we return to these tasks and tackle one or two a day.

When in Rome . . .

For those who have not traveled very much, the idea of getting around in a foreign culture that speaks a different language can be intimidating. One of the greatest delights of traveling, however, is finding that the basics get done much the same way the world over. People everywhere have to buy food, obtain fresh water, get from place to place, cook, sleep, build houses, and so on. If you start with the assumption that things are going to work in a similar way to what you are used to, you will find the first few experiences easier to deal with.

After you have grown comfortable with the similarities, the differences become more obvious. Every place has its own variations on the themes. On Bora-Bora, baguettes are delivered by a bakery van to each house and are put in a 2-foot-long "mailbox" with a little roof to protect the bread from the rain. In New Zealand, hot and cold faucets are reversed, and you turn on light switches by flicking them down instead of up. In Tonga, pigs wander the streets as dogs used to in the United States before leash laws. These details add textures that define different cultures and add zest to traveling. If you are willing to make a few mistakes and lead the laughter each time you realize your faux pas, you will have no trouble acclimating to a new culture.

When you arrive somewhere new, your best information comes from other voyagers who have already mastered the culture and its idiosyncrasies. In most ports, voyagers congregate in one area and see each other frequently. That may be at the local yacht club or at a centrally located bar or restaurant. Chances are you'll know the details before you arrive, but if not, a hello to another boat and a couple of questions will give you the information you need. Several weeks later, you'll be the one answering the same questions for another crew with the watery look of a recent passage still in their eyes.

Yacht clubs are truly the home away from home for the offshore voyager. Since the days of the earliest voyagers, many yacht clubs around the world have opened their doors and offered their services to long-distance sailors. The Panama Canal Yacht Club and the Balboa Yacht Club on either side of the canal, the Royal Suva Yacht Club in Fiji, the Grand Baie Yacht Club in Mauritius (Figure 25-2), the Point Yacht Club in Durban, and the Fremantle Sailing Club near Perth, Australia to name a few, all welcomed us and dozens like us. When we enter a port where there is a yacht club, we know everything is going to be just a little bit easier.

Most yacht clubs hold mail for visitors, offer a laundry service, have dockage or a safe anchorage, offer fax and phone service, dispose of garbage, and invite visitors into the club bar or restaurant. All this is provided for free or for a small fee. We always find helpful people at the desk or behind the bar who know exactly where to find a machine shop, a chandlery, or spares for a Yanmar engine.

Figure 25-2.
The Grand Baie Yacht Club, Mauritius.

Most yacht clubs have showers, and these are a luxury after arriving from a long passage. Many clubs on tropical islands have only cold-water showers, but this is no hardship in the hot climate. Whenever you enjoy the unlimited water in these communal showers, wear flip-flops or thongs. Besides such fungi as athlete's foot, many types of parasites grow in the moist ground around these facilities. Bare feet are an open invitation to infestation.

When there is no yacht club, we need to figure everything out for ourselves. After finding a bank and getting some local currency, laundry and communications generally top our list. Our favorite way to acclimate is just to wander. We find most of what we need eventually and discover many interesting things along the way. If we don't have time for a leisurely stroll in a major tourist center, we head straight for the local tourist office. The staff speak English, have free maps, and give good advice for getting oriented.

Money and Communications

In any "civilized" culture, before you can buy the cold beer you've been craving on passage or pay for the berth where your boat is happily snuggled, you will need some local currency. Not so long ago, this could be a frustrating task. But today, ATMs make getting money pretty straightforward.

When you get your local currency, have a good look at it. Try to learn the differences between the bills and the coins as quickly as possible. You'll save yourself embarrassment and perhaps even money as you struggle to pull out the right bills at a store. Unlike American currency, which many foreigners find terribly boring, most countries differentiate between denominations using size, color, and even texture on their bills and coins.

Once we have some money, our next priority is communications. After a passage, we always want to get back in touch by checking our Hotmail inbox and making some phone calls. On our first foray into the village, town, or city where we have made landfall, we find out whether there are inexpensive international phone cards available and locate the Internet café.

Laundry

While there are times when the only way to do laundry is on board the boat in buckets, the best solution to dirty laundry is a clean self-service laundromat. These are not as unusual as we had expected. We have found good laundries in every major island port and throughout most developed countries. Laundries can be hard to come by on remote islands, in Southeast Asia, and up the Red Sea. Where there are no such facilities, your choices will come down to a local "laundry service" or doing it yourself.

The following ideas help in managing the laundry chore:

- **Stowing laundry.** When stowing dirty laundry on the boat for long periods, keep air circulating to minimize mold, mildew, and odors. Besides keeping the boat from smelling like a gym locker, this also limits the work required to remove stains. Mesh bags or milk crates both work well for stowing dirty clothes aboard.
- **Dry bags.** It can ruin your day if a stray wave rinses your freshly cleaned laundry as you are returning to your boat in the dinghy. Canvas bags, backpacks, mesh bags, and even pillowcases work for transporting laundry, but you'll want to bring along a few plastic garbage bags for the dinghy ride home. The best bags for getting your clean clothes back to the boat, though, are large, easily carried waterproof bags that can be closed with a watertight seal (refer back to Figure 11-21). The largest-size dry bags available (38 liters) from marine chandleries or kayaking stores make excellent laundry transport bags. A shoulder strap makes carrying them easier.
- **Laundry detergent.** On many remote islands, laundry detergent is very expensive and of poor quality. If we are using a laundry service, the price is often significantly lower if we provide the detergent. Purchase a couple of jumbo-sized packages before leaving a more-developed country. Your laundry water will be "discharged" directly overboard without treatment, so buy phosphate-free, environmentally friendly detergents. If you like fabric softener, whether in liquid or sheet form, take that along as well; you won't find it outside of developed countries. Put detergent and softener into small containers to minimize weight on the walk to the laundromat.
- **Drying laundry.** Dryers are often expensive and inefficient. If you are not in a yacht club or marina, put the clothes through one dryer cycle and take them back to the boat to finish drying on the lifelines in the sun. The UV radiation bleaches mildew stains out of white clothes and kills bacteria and viruses. If you are in a yacht club or marina, make sure the management does not object to clothes drying on the lifelines. Many do.

If there is no laundromat ashore, there is often someone who does laundry. Most yacht clubs without their own laundry facility have an arrangement with a reliable local person. If you find someone on your own, make sure to get some references before turning over your clothes and bedding. We heard several stories of laundry being taken hostage and returned only after an exorbitant ransom had been extracted. Negotiate the price beforehand and agree on what service is expected. I got back plastic bags full of soaking wet clothes in Tonga, but in Mauritius, our clothes came back dried and ironed—even our underwear!

The service provided bears little relationship to the price. In some places, we had the equivalent of three or four pillowcases full of laundry washed, dried, and folded for less than $10. In other places, we would have spent $60 for the same service. Where local prices are high, we pay someone to do only the garments that are difficult to manage ourselves; we would rather pay a premium for towels, jeans, heavy cotton sweatpants, and sheets than do them ourselves in a bucket on the deck.

Supplies

After taking care of the necessities, our attention turns to resupplying the boat. We usually need to find diesel and water, and we often need propane. If we are staying at a yacht club or in a marina, all three are straightforward. Otherwise, we find out from other crews where we can purchase fuel and water and ask about its quality.

Those with large-capacity watermakers will not need to take on water from ashore. We do not carry a watermaker, but we often go several months at a time catching rainwater. In some places, the only option for filling the tanks will be ferrying plastic containers back and forth from shore. If there are fishing boats in the area, we can always get diesel—even if we have to transfer it from a drum. If we only need a small amount, we much prefer to obtain diesel from a gas station because we know the fuel will be clean. Propane bottles can often be filled at gas stations as well.

Food comes next. I feel I am truly exploring a town or a village when I stroll, canvas bag in hand, from shop to shop. I communicate in a combination of English, sign language, and the local language. From the canned goods on the grocery store shelves to the fresh produce stacked in the stalls at the local market to the materials and hardware in the local equivalent of the five-and-dime, I see how people really live, what things decorate their lives, what they eat, what they wear, and what they hope for.

When shopping in the local market, ask around to determine the best time to get the freshest produce. Most of the villagers bring their produce on a specific day. The widest selection and highest-quality fruits and vegetables can be obtained early in the morning on that day. If you are told to be there by 6 in the morning, the good produce will all be gone by 8.

No bags will be available at the market, so take along your favorite carrying bags. Bring a container for eggs, or you will spend the day cradling a half-dozen wrapped in newspaper. If you do not recognize a particular fruit or vegetable, ask what it is and how it is prepared. The vendors will be delighted at your interest and will often cut one open and give you a taste.

Be prepared to negotiate. In many parts of the more-developed world, we have become embarrassed about money. A price is a price, and we accept it or not. We have become removed from the barter system, the original basis of all economics that recognizes that the value of a specific item varies from person to person. Negotiating is a game. As in many games, the social aspects matter more than the outcome.

Under the standard formula, you offer half what is being asked. Then you go back and forth until you end up about midway between your starting offer and the initial asking price. You will get grumbles from some sellers and smiles from others, but all will end up pleased. Many vendors find tourists who will not negotiate painful to deal with; the rules of good conduct are being broken. They think you are being cheated, and they feel awful.

Early on, before I understood how the game was played, many of the vendors took pity on me. After charging me their asking price for six tomatoes, they would throw in two or three more just to make things right. So view negotiating as a way to really understand value within the local culture. Use it to get to know the person behind the counter. Most of all, enjoy your hard-won trophies. There is something intensely satisfying about negotiating a better deal, even when the outcome is a foregone conclusion.

Getting Your Mail

As discussed in the Communications section in Chapter 12, snail mail is much less important in cruising life since the advent of e-mail. But there are still things that have to arrive as physical documents.

Where do you have your mail sent? That depends on the place. Where there is a yacht club or where we will be staying in a marina, we use their mail service. Where there are neither yacht clubs nor marinas, we use a local business recommended by other yachties. In most cases, that will be a small hotel or a bar/restaurant run by an ex-cruiser who will hold mail without charging a fee. Cruising guides recommend addresses for mail forwarding for many places. We avoid "poste restante" or "general delivery" at the local post office, because it will usually hold mail for only a few weeks before returning it. Where we can confirm through the cruising grapevine that a yacht club or business address is still operational, we are pretty comfortable having mail sent there before we arrive.

If we do not have a verified yacht club, marina, or business address, we do not have mail sent before we arrive at a destination. We stay in many places for a month or more, and first-class mail takes ten days to most places. We can almost always find someone willing to let us use their address, but if we can't, we have it sent "poste restante." If we send the new forwarding address as soon as we arrive, we almost always receive the mail before we leave. We always give a cutoff date for the last package to be sent, generally three weeks before our intended departure for the next destination.

AVOIDING PESTS AND PLAGUES

Even paradise has a few not-so-pleasant realities. Among them are biting insects, cockroaches, and rats—and the very best you can hope for is to avoid them. If they find you, then you will have to be prepared to do battle.

The best way to avoid mosquitoes and biting flies is to anchor off and use screens, mosquito netting, and mosquito coils. Beyond that, there is little you can do except wait for night when the flies sleep or day when the mosquitoes sleep.

In the Pacific, particularly in the Marquesas, small sand fleas called no-nos (like the no-see-ums of the Bahamas and the U.S. East Coast) have a painful bite that often gets infected. They stay near shore and tend to congregate near fresh water. The local solution was to add Clorox to shower water. Our water had a good amount of Clorox in it, but the no-nos seemed unimpressed. DEET bug repellents work best to keep most insects at bay including the man-eating mosquitoes of northern Australia.

If you are tied up to a wharf or dock, you run a risk of getting a rat or mouse aboard. Using poison may leave you with a decaying rat in the most inaccessible part of the bilge. Several friends successfully used traps, so start there if you get a stowaway. As usual, prevention works best. Don't tie up if you can avoid it. If you are tied up briefly to a wharf area where there is garbage, keep an eye on your lines. If you are going to remain tied up for some period in such a place, fashion some sort of a rat guard on each line to prevent rodents from coming aboard.

Cockroaches are the most common plague. We struggled for a year and a half with an infestation aboard *Silk*. They came aboard in Antigua when we were on the hard. We tried every one of the cruising remedies, from boric acid to flypaper to roach motels to curved jars with jelly or peanut butter inside. Then we tried more lethal attacks, including bug bombs and roach spray. What finally worked was an Australian product (the Australians really understand how to battle serious bugs). After setting off this roach bomb, the boat had to be left closed up for a full 12 hours before we could take a peek inside.

If you find yourself battling cockroaches, the following rules of engagement will help you win the war:

- **Single soldiers.** If you ever see one roach aboard, assume that you have a hundred. To find out for sure, leave something nice and sweet on the counter and turn on the galley light in the middle of the night. Seeing a few large roaches immediately after bombing doesn't necessarily mean disaster. Some of the bombs do not kill the largest adults, but they do sterilize them.
- **Reproductive cycle.** Roaches are some of the most efficient reproductive organisms on earth. Eggs hatch a mere two weeks from the time they are laid. That means one bomb is never enough. Even if you wipe out every adult aboard, anywhere from two days to two weeks later you will once again hear the patter of tiny feet. Although many of the products we used claimed to kill the eggs, after a half-dozen failures we stopped believing them. The only way to win the war is to bomb the boat at least twice, the second time two to three weeks after the first—long enough that all the eggs have hatched but not so long that the new brood has already bred and laid more eggs.
- **Cozy corners.** Our early attempts failed in part because we left the beasties places to hide. The first few times we left the quarter berth filled with blankets and sleeping bags, left lockers filled with line, and left other areas intact where the bugs could find enough of a pocket to survive. The last two times we bombed, we took the advice of an accomplished general in the cockroach wars and opened every locker, spread out blankets and sleeping bags, pulled out line and clothes, and then sprayed roach spray from a handheld can into every open locker. By the time we were getting ready to set off the bug bomb, groggy cockroaches were already fleeing the fogged areas, heading out in the open where the bomb could do its work.

Rather than go to all this trouble, prevent roaches from coming aboard in the first place. If you are careful never to bring cardboard on the boat in tropical and subtropical areas, you will outfox most would-be stowaways. But you are not completely safe. As we found out, they can come aboard when you are hauled. Worse, in some parts of the world they have evolved a set of quite functional wings. In evolutionary terms, we humans have no hope of ultimately winning this particular war. But don't let that discourage you from making every effort to keep your own boat roach free.

CHAPTER 26
Enjoying Being There

AFTER A WEEK in a new country, we start to feel at home. By that time, we have mastered some key words and phrases in the local language, figured out how the local currency translates into bread and beer, returned the boat to her normal shoreside state, reestablished contact with friends and relatives, and launched any major repairs that have to be completed before our next passage. We can finally devote our attention to the culture and the people we have come so far to see.

Exactly how we go about doing that depends on how developed the country is and how much of the country is accessible by boat. In the many island nations we visited aboard *Silk*, she acted as our main mode of transport, offering unique glimpses into village life and intimate encounters with local people. *Hawk* has provided us with access to the coastlines of a dozen countries, including Canada, Scotland, Ireland, Chile, Australia, and New Zealand. To reach areas not accessible by boat, we need to find a way to tour inland. In most places, the range of options for exploring are much the same as in the United States or Europe—buses, trains, rental cars, guided tours, backpacking trips, and so on.

Our social life sometimes includes visits from friends and relatives. Having guests aboard allows you to see your world through their eyes, to experience anew the wonder of life afloat. The rewards of having guests share your home are accompanied by the challenges of managing the logistics of their departure and arrival.

ASSIMILATING

Most people who dream of sailing small boats across large oceans want to experience new cultures. They want to step back through time to see the South Pacific as Cook or Bligh did. They want to reach across the boundaries of language and tradition to touch real people living real lives. While this is easier to do on a sailboat than it is traveling any other way, an effort is still required beyond simply showing up. That wasn't true in the days when a handful of boats completed major voyages every year. But nowadays, hundreds of boats per year pass through the main harbor on most Pacific islands. Many of those ports are now cities. While cities have their unique local flavor, they have more in common with cities everywhere than they do with the culture of the island.

To really see a new culture, voyagers must make an effort to visit the small villages where local traditions are still practiced. Our most magical experiences always occurred in the least visited places far off the beaten path. It requires effort to reach those places—obtaining a special permit in Fiji or sailing to windward for a day in Tonga. We were rewarded by local people who were eager to invite us into their homes and share their lives.

Once we find our way into a local culture, we are under an obligation to assimilate as far as possible for the period of time we are there. We must understand and adhere to local laws and respect local customs and traditions—even if we don't agree with them. When received with open hearts and giving hands, we need to respond in kind. While this seems obvious, it can be difficult to say "thank you" without obligating the receiver. Explorers and adventurers have always been cultural emissaries, and voyagers still act in that capacity the world over. We have a responsibility to make certain that our interactions reflect well on our own culture so those who follow us will be received with as much warmth and caring as we were.

Finding the Way In

The magic of being accepted into another culture is a deeply touching experience. Time and time again, people have opened their homes and their hearts to us, shared with us all the many aspects of their lives and relationships, and waved sorrowful good-byes when it was time for us to leave. To make this kind of magic happen, you have to be willing to seek it out, take a few risks with your boat and your dignity, and open yourself up to the many experiences that unfold.

The more remote an island or an anchorage, the more likely you are to come face to face with people who are interested in you and willing to let you into their lives. The fewer boats they have seen, the more of a stir you will cause, and the more you will be the center of attention for the duration of your stay. To experience cultural adventures, you must be willing to strike off on your own. That may mean traveling in waters that are less well charted, visually navigating through coral to reach a village tucked well inside a lagoon, or trusting a local villager to guide you to a safe anchorage. All this involves an element of risk, but the reward of meaningful personal interactions is all the sweeter for the effort your have invested.

How far do you have to go to get off the beaten path? In most cases, not nearly as far as you would think. Despite the sense of adventure intrinsic to offshore voyagers, the herd instinct often overtakes sailors when they arrive in a foreign port. To meet local people, cruisers have to shake themselves loose from their friends and the relatively sheltered life to be had in the main harbor of an island group. An overnight sail will often bring them to pristine anchorages and villages that have changed little since Captain Cook arrived.

In Tonga, for example, we made landfall in Vava'u, the northernmost island group. There we found a rich cruising ground with dozens of good anchorages and an active community of close to a hundred cruising boats, many of whom we had first seen in the Caribbean a year before. The villages in the area were fairly inured to visitors; only the children seemed interested in our presence. After spending a month in these islands, we headed south to the Ha'apai group. Located only about 50 miles to windward of the Vava'u group, it is poorly charted and reef strewn. For the ten days we spent sailing in this area, we saw only two other boats. We found ourselves the center of attention everywhere we went. We learned a valuable lesson in Tonga: the cultural experiences that we most treasure often lie a day or so to windward from where the voyaging boats congregate.

Even in more-developed areas, you can open the door to the local culture with a small effort. Children bridge the gap more easily than adults. If you are voyaging with children, you will never have to go to much effort to be invited into the local community. Your children and theirs will be interacting the minute you step ashore, and your own interactions will naturally follow.

Even if you do not have children, the children ashore offer ways to get involved with the local people. Throughout much of Polynesia, the children are taught in English. They can act as guides and interpreters. Even where language is an issue, children's natural curiosity tends to break down barriers (Figure 26-1). Some cruisers carry candy and small toys such as yo-yos or tops ashore with them and use these to make their first set of friends. We never did this but still found that children flocked to us on most islands we visited. If you follow the children to their school, you can suggest to the teacher that you talk a bit about where you are from and how you came to be here. That small bit of giving will often open an adult community to you, and you will leave the children with a significant memory.

You can also make connections through the local markets (Figure 26-2). When you buy fresh produce, ask lots of questions. Those selling the produce will be delighted, and you will learn all about exotic fruits and vegetables and how to prepare them. Get recipes, try them, and return to the market to tell the recipe giver how they worked out. In most countries we visited, the market is the social hub anyway, so it is a natural place to interact where you will be accepted quickly and easily. Learning the phrase for "what is that?" and pointing at something will almost always start a conversation.

You can easily cross the boundaries of language and culture in churches. In most places you will be welcomed at a local religious ceremony, as long as you dress appro-

Figure 26-1.
Some of our many small friends in Muani, a village on the island of Kandavu in Fiji.

Figure 26-2.
A new friend in a Caribbean market. (Laila Stjerndrup photo)

priately and participate reverently. Many of the Pacific islanders worship in open-sided, palm-thatched communal huts, and song plays an important part in the service. On Sundays, the whole world was clothed in harmony as the islanders sang for hours on end. We were touched by their voices and their worship—whether we were at anchor, ashore, or celebrating the sanctity of the day with them.

The camaraderie of the sea is shared by local fishermen who were often the first to reach out to us. They would stop by the boat and offer us some of their catch or ask if we had lures or fishhooks that we did not want. This was less a request for charity and more a way to begin a dialogue. If we met their gestures with equal interest in them and their lives, these seemingly casual encounters could lead to invitations to visit pearl farms in the Tuamotus or join the local fishermen in catching lobster on the reef in Fiji. In a few cases, we realized too late that what seemed just polite interest was an attempt to reach out to us and invite us into the village and its life. We regretted afterward missing those experiences. But we never regretted reaching out, and we were never rebuffed.

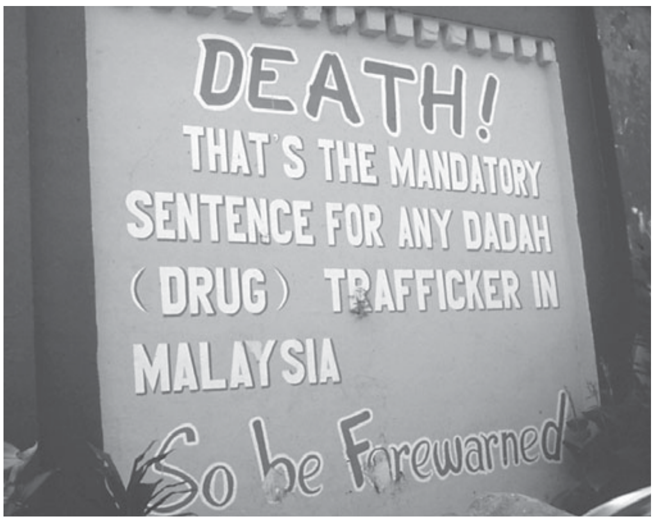
Once you find a doorway into a village, you can become involved in an infinite number of activities. You will be invited to visit the local plantation where they grow cash crops for selling in the main market. Women will be asked if they want to learn how to weave baskets from coconut palm fronds or how to smoke fish in the village smokehouse. Men may be invited on a late-night fishing expedition or to village ceremonies. We found that when we were anchored off a village where we had become accepted, we had no spare time to worry about how to stay occupied. We were doing what we had set out to do in the first place—learn about new cultures and make new friends.

Respecting Local Laws and Customs

As visitors, we have a responsibility to respect the local laws and customs—whether we agree with them or not. In most cases, we thoroughly enjoyed abiding by the rules of a foreign culture and often came to question our own cultural biases. But some of the traditions you are required to honor may be offensive to Western sensibilities, the most common example being the status of women in Muslim cultures. But with goodwill and a small amount of effort on your part, you should experience no real problems in most places. And you will not be held to exactly the same standards to which they hold themselves. But if something is going to offend you so terribly that you will not enjoy being there, avoid the area. You are not going to single-handedly change traditions that have existed for hundreds—or thousands—of years.

Abide by all local laws. The penalty for possession of illegal drugs in some of the Far Eastern countries is death (Figure 26-3). Don't assume you will be protected because you are an American citizen. Several Americans and Australians have been flogged, imprisoned for life, and even hanged for drug offenses in some of these coun-

Figure 26-3.
A sign like this one in Port Klang, Malaysia, must be taken seriously. (Scott Kuhner photo)



tries. The embassies and public opinion could do nothing to prevent it. When you are in a foreign country, you are subject to their laws. Ignorance is no excuse. In most cases the laws do not differ significantly from those in the United States or Europe, but often the penalties are far more severe. For this reason, do not carry pornography or drugs (other than those in the medical kit), and be sure to declare weapons if you choose to have them aboard.

When you are in a new culture, approach everything with respect. Watch and learn how people do things. To avoid a faux pas, follow the leader and do as the others do. When you form your own conclusions about how the culture functions, as you inevitably will, share them only if asked—and then only if the person asking really wants to know.

Although customs vary tremendously from place to place, some general protocols exist that will keep you out of trouble. Beyond that, there are three areas along the trade wind route where customs have the largest impact on voyagers and where a little knowledge helps to manage the situation: the kava ceremony in the South Pacific, Muslim cultures around the Red Sea, and boat boys in the Caribbean.

General Protocols

In most cultures, the only unforgivable breaches concern religion or sacred places. Profane behavior in a holy place or inappropriate dress for women should be avoided at all costs. On the other hand, issues of decorum—how you sit, how you greet people, how you eat your food—are viewed much less seriously. A failure in these areas is considered a breach of etiquette, which is easily forgiven. Before you get to your destination, determine which is which from guidebooks and other voyagers.

A few standard conventions will help you get your bearings and avoid offending anyone:

- **Paying respects.** In most remote island villages, a chief and several older men run things. By the time you have set your anchor, someone will probably come out and greet you. You should ask to be taken to the chief to pay your respects. In the western Pacific, the kava ceremony described in the next section formalizes this custom and offers you a framework for behavior. Elsewhere, you are not obligated to bring something as a gift. But you should seek out the village leaders and ask their permission to stay in their harbor and share in the village activities.
- **Women's attire.** In most of the world, women are still expected to dress conservatively. Throughout the Pacific, women should be covered from shoulder to ankle. Outside of resort areas, bikinis, swimsuits, and tank tops are definitely not appropriate attire. In large towns or port cities, women can wear knee-length shorts and short-sleeved shirts. In small villages, women should dress as the local women do—in a one-piece pareu or lavalava that is wrapped around the body and tied at the shoulder.
- **Sunday behavior.** Throughout most of the Christian and Muslim world, Sunday is devoted to religion and prayer. Secular activities are frowned upon. In most places, you will not be able to shop or eat out. Even working on your boat is considered discourteous if done in full view of a small village where you are a guest. Drinking alcohol on Sunday is strictly forbidden in many cultures.
- **Ownership.** On most islands in both the Caribbean and the South Pacific, everything is owned, either by the village itself or by individuals—every tree, every plant, every animal. Do not take anything without asking, whether it is a coconut, some fruit, or fish from a lagoon. Cruisers decry theft from their boats, but may not even realize it when they are stealing food from the local people. Take the time to ask, and you will generally be given more than you could possibly want.
- **Hats and sunglasses.** Sunglasses inhibit communication, as anyone knows who has tried to carry on an emotional conversation with someone wearing them. Especially in cultures where they are uncommon, as on most remote islands, sunglasses can easily make you seem unapproachable and alien. The head is sacred in much of Polynesian culture, and anything that hides the head is viewed as an effort to conceal a person's character. Leave your hats and sunglasses aboard when going into a village until you know that the people there will not be offended.
- **Accept what's offered.** If you're in someone's home, accept food or drink when it is offered. You are unlikely to get ill if your host is healthy, and the offense given by turning it down will be great. The food has probably just been prepared and will be fresh. At a large feast, you can get away with eating more judiciously. Food for feasts is often prepared a few days in advance, so you may want to avoid meat or fish if you can.

Privacy is an area where, to a certain extent, a double standard applies. On many islands, to show up uninvited and start wandering around a small village without paying your respects to the local chief is considered exceedingly rude—akin to wandering through suburban backyards and peering into windows. In most cases, villages consist of large extended families who view their village and the area around it as their private compound. They expect you to respect the privacy of that compound until you have been invited to share it, which you always will be if you approach the people respectfully and formally.

On the other hand, their curiosity about you and your boat will often blind them to the fact that you might like some privacy as well. Once you are accepted as part of the village, you truly become part of the family. You can expect "neighbors" to drop in on you at all hours of the day and night. They will be eager to step aboard and take a look at your home, just as you have looked at theirs. When we were anchored off a Fijian village where we had gone through the kava ceremony, we would be woken at dawn as the first fishing boat bumped into our hull and our first guests clambered aboard before we could even get dressed. For most of the rest of the day, we would be ashore with our hosts, walking to cassava plantations, smoking fish, weaving mats, and sharing meals. The minute we returned to the boat and collapsed with a sigh, another bump on the hull would alert us that our next set of guests had arrived. While you are anchored off a small village, whether in Newfoundland or the Solomon Islands, you are the local entertainment and the center of attention. Be prepared and enjoy it. These memories will be some of the most wonderful souvenirs you take home.

Even in larger harbors, offshore boats arouse great interest. If you are not anchored off, there are times when you will feel like you are living in a fishbowl. On tiny Rodrigues Island in the southern Indian Ocean, groups of people stood on the quay to which we were tied and watched us while we went about our normal activities aboard. In these places, the people wear the reserve of the larger town and small city. Unless you approach them, they will leave you to your tasks. But if you encourage a dialogue or are open to questions, you can quickly break down that reserve and make lasting friends.

The Kava Ceremony

Throughout the western Pacific, the kava ceremony is an honored tradition that provides a beautiful initiation into the local culture. It is practiced in parts of Tonga, most of Fiji, all of Vanuatu, and parts of the Solomon Islands, and in most of these places you will be invited to participate.

In more remote areas, you will be expected to present *yaqona* (pronounced "yang · gona") to the village chief. You can obtain yaqona at the produce market wherever you clear in. These bundles of dried twigs are the root of a plant that is a member of the pepper family. When ground into a powder and combined with water, it forms kava, a mildly euphoric drink. Some cruisers are insulted or intimidated by this requirement. Others are morally opposed to providing a form of drug in "payment" for visiting a village. However, we found this practice to be a unique cultural experience that allowed us insight into Fijian village traditions that extend to the era before the coming of the Europeans.

In Polynesian culture, the village communally "owns" not just the land in and around it, but also the air above it, the sea and reef that protect it, and all the fish, animals, and plants within that space. In presenting the yaqona, the visitor is asking to become a temporary member of the village—to be allowed to fish, to anchor, to take water, to harvest coconuts. The visitor is also requesting the chief's protection, which was of vital importance when this culture practiced cannibalism. To ask permission to be accepted by the village, the visitor places the yaqona at the feet of the chief. If the chief picks up the gift, he has accepted total responsibility for the visitors' well-being, and the visitor has become part of the village. If cruisers are lucky, they will be asked to participate in the ceremonial drinking of kava made from their yaqona.

Muslim Cultures

Although many of the islands we visited in the Indian Ocean had large Muslim populations, none of them were fundamentalist in their practices. We never saw women dressed in the chador, the head-to-toe black gowns with eye slits, and did not travel in areas where alcohol was not sold because it violated Muslim law. But if you travel up the Red Sea, you will encounter such practices in the countries from Yemen to Egypt. Our friends who have made the trip were rarely made to feel uncomfortable about their own behavior, as long as the women aboard dressed conservatively and everyone made an effort not to overtly violate any of the local traditions. However, they often felt ambivalent about seeing how women were treated—something they knew they could do nothing to change.

If traveling through this area, take the following tips from our friends who have been there:

- **Dress conservatively.** Men should wear long pants; shorts are not acceptable in most countries. For women, this means loose, opaque clothes in conservative colors with a hat or a shawl to cover the hair. In some countries, mid-calf skirts are acceptable; in others, skirts should go all the way to the ground. In some places such as Oman, the captain will be informed by one of the clearance officials as to what women should wear, and women will not make it past the military checkpoint dressed improperly. In other places, nothing will be said, and there is no checkpoint—but you must still honor the Muslim customs.
- **Women should avoid traveling alone.** Wherever possible, women should travel with their partner. Even if you are not married, wearing an inexpensive wedding ring will save explanations. If you must

travel alone, avoid eye contact with men. Where possible, sit with other women.

- **Men should never touch an Arab woman.** Men also need to be conservative, avoid looking at Arab women, and never touch them. Even a gesture as innocent as putting a hand on a woman's arm to help her into a car is considered an insult.
- **Women should never touch men.** One woman on a cruising boat touched a man when she tried to stop a Suez Canal pilot from boarding their boat. She almost ended up in jail.
- **Respect Ramadan.** For one month a year (the ninth month of the Islamic calendar), the Muslim world celebrates Ramadan, when Muslims do not eat, drink, or smoke between sunrise and sunset. If you are traveling in these countries at this time, respect the local custom by refraining from eating, drinking, or smoking in public during the day.
- **Respect Muslims at prayer.** Muslims are required to pray five times a day while kneeling on a prayer mat facing Mecca. Do not photograph or walk in front of a Muslim at prayer.
- **Try to be sympathetic to those asking for alms.** Almsgiving is one of the duties of a good Muslim. The beggars serve a respected function in the society. Give if you feel like it. Otherwise learn the words for "I have no money" and walk away.

Finally, remember that both pork and alcohol are forbidden to Muslims. Do not offend them by indulging in either, except in private.

Caribbean Boat Boys

Some cruisers are troubled by the boat boys who ply their trade in the Windward Islands of the Caribbean from St. Lucia south through the Grenadines (Figure 26-4). There, men in local boats (not boys—my upbringing makes me uncomfortable with the term "boat boy" but it is how they refer to themselves) offer to provide a variety of services to sailors for a fee—from tying a stern line to a palm tree to selling fish and coconuts. The offense comes from the implicit understanding that you cannot enter some harbors without enlisting a boat boy's aid. We heard cruisers refer to this as blackmail and tell stories of stern lines cut in the night if the boat boys were not paid.

In our experience, the boat boys provide a window into the real culture of the Caribbean, and the services they offer are always useful and often ingenious. In Bequia and Tobago Cays, boat boys delivered hot bread and newspapers to us first thing in the morning. In St. Lucia near the mighty Pitons, the magnificent twin peaks that drop straight into the sea, boat boys guided us to a local waterfall where we showered with a group of village women who were entranced by our shampoo. One young man scaled a tree to get us the perfect coconut and then showed us how to open it with our windlass handle (Figure 26-5), a skill we used throughout the rest of our voyage. They helped us tie stern-to and took it upon themselves to guard our boat and our dinghy, with no additional money changing hands.

To secure a line to a palm tree, they charged us a dollar ($2 or $3 EC, or Eastern Caribbean dollars, which is the local currency). To take us to a waterfall, they charged up to $10. Their prices never seemed out of line with the service rendered, and we often ended up seeing aspects of the local area and culture that we never would have been privy to on our own.

The boat boys can be quite persistent. The parade of people eager to do you some small service can become annoying if you are trying to enjoy an anchorage in peace. We learned to pick one person to be our assistant from among the dozen waiting as we approached an anchorage. Once tied up ashore, we would deal only with him

Figure 26-4.
Boat boys ply their trade in Marigot Bay, St. Lucia.

Figure 26-5.
Learning coconut etiquette from one of the boat boys.

for what we needed. If others came offering services, we said that so-and-so was already taking care of us, and that would be the end of the discussion. Within an hour or so, everyone in the area seemed to know that we were "taken care of," and our boat boy had assumed a proprietary interest in making sure that we were not disturbed. We would still be approached by people selling local handicrafts, but we always enjoyed seeing what they had to offer. We learned to bargain well, since the quality and prices varied tremendously.

Given the apparent disparity between the wealth of cruisers and the poverty of local villages, paying money for services rendered seemed a small thing to us. By treating the boat boys fairly and with respect, we were treated fairly in return. Those who approach the boat boys with hostility won't have their attitude improved by their interactions with these eager entrepreneurs.

Saying "Thank You"

Throughout your travels, you will be the recipient of all types of hospitality. People will share their food, their homes, their families, and their lives. You will want to share with them in return, and you will often want to leave behind a small memento. In the communal cultures of many islands, tradition requires that they feed and shelter a stranger who has been accepted into the village, even at the expense of their own needs. Many of these cultures are based on gift economies, where giving is the measure of one's wealth, and where gifts must be reciprocated or the pride and power of the village is diminished. In these cultures, you need to find a balance, giving an appropriate gift that reflects the value of what you have received. You do not want to leave the village the poorer for your visit, nor do you want to obligate the village by giving something too extravagant.

For brief encounters with people who have shown us some small kindness, we carry several dozen photos of *Hawk* with our name and address on the back. For trading or more substantial gifts, we carry an assortment of fishing lures, lines, hooks, and sinkers. We also carry extra corned beef and sugar, often welcome as gifts in remote villages. Cruisers on other boats carry T-shirts with their boat name on them, baseball caps, and cigarettes. We disagree in principle with handing out cigarettes, but they are still a valued commodity throughout the world. A photo taken on a digital camera and printed out aboard the boat is an invaluable gift. Many villagers in remote places have never seen a photo of themselves.

When the hospitality is more extensive—as when we have been invited into somebody's house to share their lives for several days—we reciprocate in a number of ways. In some cases, we invite the family aboard our boat for dinner. What seems like basic food for us is always exotic and special to them. Just being able to eat on the boat and see how we really live in our floating home is a thrill for most people we meet. Alternatively, taking a family or a group of children sailing for a few hours or a day is both the easiest and the most treasured gift you can give someone who has shared much with you.

The medical kit can also be a way of saying "thank you." You can provide a unique service to the village by giving antibiotic ointment to someone with an infected cut or offering some cortisone cream to someone suffering from an itchy rash. Although you have to be very careful playing doctor, most of the ailments you will see in island villages are minor and easily treated, and the relief to your new friends is tremendous.

Several times, we have spent a great deal of time with a family and felt we needed to give them something special. But we didn't know what was appropriate. We asked someone else in the village for advice. No one ever took offense at this, for they understand the need to give after having received. From those experiences, we learned that gaily colored pieces of material for making clothing are always welcome. News travels remarkably quickly through the coconut telegraph, and the recipient often knew what they were going to receive before we knew what we were going to give! Sending a postcard or letter from a few ports farther along offers your friends a firsthand glimpse of another place, something they might never get any other way.

SIGHTSEEING

After the intensity of the one-on-one interactions in small islands, we enjoy playing tourist in more-developed countries. The options are much the same for sightseeing the world over. Where tourists are common, you will find van or bus tours, train rides, rental cars, backpacking trips, and so on. Talk to the local tour operators and travel agencies once you have arrived at your destination to learn about the range of available options.

We prefer heading off on our own rather than taking a tour or going to the typical sights. We are always looking for ways to travel around a country that allow us to interact with the people who live there. The following solutions work in many different places:

- **Local buses.** In much of Europe, on the main island of large island groups, and in most South American countries, many local people rely on buses to get from place to place. These local buses have become our favorite way to see the interior of an island: they travel to all the villages and markets, are filled with local people who are often willing to act as informal tour guides, give us a real flavor of how the island or country functions, and are inexpensive.

- **Trains.** Train travel has also become one of our favorite modes of transport, second only to local buses. Some train trips take a day. A few use steam-driven engines to go to a nearby tourist area. These are often touristy, but fun. Australia, Europe, and South Africa have extensive railroad systems. This can be an economical way to travel that gives you an opportunity to meet local people and the time to really talk to them.
- **Backpacking tours.** If we do decide that the best way to visit an area is to take a tour, we find that the tours aimed at backpackers are often the least expensive and the most fun. We wanted to see a great deal in South Africa, but we didn't have the time to buy a car or a safe place to leave the boat for an extended period. So we selected a camping tour. Eight of us were packed into a van that pulled a trailer full of tents and supplies. Each night we stayed at a campground, pitched a tent, made a fire, and cooked our meal. We ended up seeing a large part of the country over the course of ten days for about $350 each. We have come across backpacking tour operators in many places, including South America, Australia, and New Zealand.
- **Bicycles.** On islands where there are roads and tourists of any sort, we can often rent bicycles and spend a lovely day pedaling sedately along quiet roads. Our favorite bike outing was on Bora-Bora, where we rented bicycles from the Hotel Bora Bora and rode all the way around the island in about 6 hours.
- **Car or motorcycle.** In New Zealand, used cars cost very little, and buying and selling them is straightforward. On both of our visits to New Zealand, we purchased a car and used it to run errands as well as to sightsee. Friends of ours purchased camper vans in Australia and toured that country during the cyclone season. Others purchased motorcycles in Europe and toured the continent for several months. Our U.S. driver's licenses have been accepted everywhere we've been whether we were renting a car or buying one. Most countries have mandatory insurance that can be purchased easily and cheaply when you buy a car.

When heading off for several days or longer, we have to decide how best to secure the boat. Everyone we know struggles with this at one time or another. Most people settle on one of the following standard solutions.

Cruisers like the Highlifes hauled their boats and left them on the hard for all or part of cyclone season. They bought a car or a small camper van and set off to see the country. This solution requires generous amounts of money and time. We generally find a secure marina where we can leave the boat and ask someone on another boat nearby to check her once in a while. Where there is no real marina, voyagers band together and stagger their sightseeing, leaving several people behind to look after the boats. That doesn't stop us from worrying, but nothing serious has ever happened while we've been gone.

In some areas, like Antigua or Tortola in the Caribbean, people leave their boats for several weeks or months while they return home to the States. If they do not have the boat hauled, they often hire someone to check the boat daily and run the engine. Make sure to get references for would-be caretakers. We heard several sad stories from distraught owners whose boats had been neglected or trashed in their absence. Generally those involved were not other cruisers; they were backpackers looking for crew positions or locals known in the community to be unreliable.

ENTERTAINING

You will want to share your new life with close friends and family. But when traveling by sailboat, the timetable for meeting in an exotic location can be easily upset, leaving you and your visitors in a difficult situation. We have heard far too many stories about voyagers heading out to sea when they would not otherwise have done so in order to keep to a schedule that had been arranged months in advance. Bad weather, broken gear, and an unhappy crew in no mood to entertain guests can be the unfortunate result.

One sensible rule for managing this problem is to allow guests to pick the place *or* the date, but not both. This allows you enough flexibility to determine where you are going to be when, and decide what the best schedule will be for your rendezvous with your guests.

We approach the problem a bit differently. We invite people to join us when we reach an area where we are going to stay for an extended period. We let them know as soon as we have arrived, and then they can make their own arrangements for any time over the next several weeks or months. We specify the time frame and the ports we can reach with a few days of sailing and let them decide the rest. We never leave on a long passage knowing we have to reach a destination by a certain time to meet up with someone.

Given the limited space on offshore boats and the normal wardrobe that most Americans bring on vacation, be explicit about what your guests will actually need and how much they can stow. For those who aren't sailors, tell them to bring only soft-sided luggage. For tropical locales, suggest they pack lots of sunblock, cool clothes, good sunglasses, and hats. For colder climes, give them some idea of how many and what type of layers they will need. When they come aboard, give them a thorough introduction to the boat, including a demonstration on how to use the head, basic safety and emergency procedures, and any onboard rules with regard to smoking or other personal habits.

Once the introductions are over, sit back and enjoy your guests' wonder at your world and your skills. Through their eyes you will see an accomplished offshore voyager—an image that just might come as a surprise until you realize that it has been well and truly earned.

MANAGING LOCAL RISKS

Since our return, we have been asked hundreds of times about theft, piracy, bribery, and so on. But everywhere we have been, when people approach us with their hands out, they are trying to give, not take. I can count the exceptions on one hand. After a decade in the business world, our three years voyaging aboard *Silk* restored our faith in humanity. This is one of the greatest joys of the cruising life, and one that changed us both dramatically.

But to suggest that anyone should approach the world with total trust and naïveté would be as much of a disservice as overstressing the less generous side of human nature. Like most things, interactions with others over the course of your trip will be a balance of good and bad. We have found the balance far more to the good than we had expected, but we also use common sense and avoid known problem areas. Use the cruising grapevine to identify and define local risks. Then make an informed decision about whether to visit a given area and how to behave if you go there.

Of the topics that fall under local risks, no one has ever asked us about the only real threat we faced. We have encountered volatile political situations in several countries. In one case, we could have been at significant risk. Part of your pretrip planning should be to educate yourself about the political situation in a country and/or region before you arrive. Deciding to leave if things get crazy is as valid as leaving because the anchorage becomes untenable in a storm.

Some would-be cruisers have become apprehensive about traveling abroad in a post-9/11 world. In our experience, the world is still a surprisingly safe place. In the wake of September 11, 2001, Americans' perception of the risks abroad changed significantly more than the actual risk level to foreign travelers around the world. The areas that weren't safe prior to 9/11 are still not safe now; for the most part, those that were safe still are. The one area where volatility and political instability have radically increased is in the Middle East. Many cruisers we meet express concern about going up the Red Sea. Yet with hundreds of yachts still making the trip every year, we hear about one or two incidents—maximum—in a cruising season. If that's a larger risk than you're willing to take, there are alternatives, including shipping your boat home and returning to the Atlantic by way of South Africa.

Volatile Political Situations

The most serious situation we experienced occurred in New Caledonia, one of many French colonies in the Pacific. After cruising around the island for several weeks, we returned to the capital, Nouméa, where the trucking union went on a rampage on a Friday night. Over the course of the night, we saw fires burning, heard sirens and people screaming, and watched rioters in huge trucks knock down light poles, concrete fence supports, and the corner of the guard house of the government building that stood just off the dock we were tied to. When we went ashore the next day, we learned that the government had decided to make the mines more competitive by breaking the trucking union. The truck drivers owned their own trucks, bought at government instigation, and now they had huge debts to pay on them. They were understandably upset: they had no jobs, and no way to pay for the worthless trucks. That Friday morning, they agreed to wait until Monday to begin negotiations.

Over the weekend that followed that wild night, more and more French troops arrived, along with a battleship from Tahiti. By Monday afternoon, the battle lines were drawn. That was when we decided to get out of there. I made the mistake of making a last run to the post office and barely got back to the boat through the police cordon. We anchored off for the night—a night punctuated by gunshots and helicopters flying overhead—and left at first light.

In our experience, limited though it is, the administrations of the French islands are very good at keeping such situations contained and out of the media's eye. But that means you won't have much warning before the fact. We became aware of the significant tensions against the government only after we arrived in New Caledonia. After we left, we could find no mention of any of it in the press. We scanned the airwaves and bought newspapers in Cairns when we made landfall, but we came up with nothing.

We were in Argentina when the peso was devalued, and most people lost their life savings overnight. Over the course of the next few months, there were riots and demonstrations in all the places we visited. We were very careful to be back on the boat before dark and to avoid the banks, where people were lined up around the block to get what money they could out of their almost worthless accounts.

To determine if there are political problems in areas along your route, talk to others who have been there, follow the SSCA bulletins, and talk to the U.S. consulate wherever you are about the area you wish to visit. Outside of the French colonies, general news reports offer good insights—although we have found that any violence is almost always overstated. If the political situation looks unstable, think long and hard about whether or not the visit is worth the risk. If you arrive and find that things are not as they should be, get the boat ready to leave again at a moment's notice.

Theft

Theft is a problem in only a handful of places. These locations are well known within the cruising community, right down to specific harbors or beaches where repeated thefts have occurred. For the most part, theft is limited to stealing outboards and dinghies. Along with money and some electronic gear, these are the only items local thieves really value. Keep dinghies and outboards locked and secured, even to the extent of taking them on board at night, to prevent dinghy theft.

Many of us do not even bother to lock our boats throughout much of the world. If anchored off a village in Tonga or Fiji, the entire village would view it as a disgrace if anything were taken. But the relative wealth of yachties can create a problem. We were asked by the father of a family that befriended us in Fiji how long he would have to work on his taro plantation to be able to buy a boat like ours. The answer, or the inability to answer, reflected an unbridgeable gulf, not in culture but in economics. While we were building friendships, there were times when we were aware that we were also raising uncomfortable questions for those who shared their lives with us. Thus, the problem of theft is likely to increase as voyaging becomes more popular and island villages become less remote.

To avoid theft, avoid situations where you could be a victim. That starts by not visiting areas where theft is a real problem, where actual incidents have been reported by several reliable sources. In areas where minor problems have been reported, lock the boat and the dinghy at night or when you leave them. Cruisers with dogs aboard rarely get bothered. Based on that, one couple we met developed an ingenious method for discouraging intruders. They carried a tape recording of a large dog barking and turned it on when they heard someone lurking around outside the boat. Our other precautions, all more or less common sense, include the following:

- **Make sure those outside the boat cannot easily see in.** On *Silk*, when leaving the boat for any period of time or when leaving it in an area where we needed to lock it, we would use our wooden hatchboards instead of our Lexan ones so the electronic goodies in the nav station were not visible from outside. An opaque plastic door can also be used to cover see-through hatchboards (refer back to Figure 4-28).
- **Strive for a conservative appearance.** Larger, flashier boats are far more likely to be the target of theft than small, unassuming ones. Wearing jewelry or openly carrying cameras ashore will draw attention and can make you a target. The more understated your dress, behavior, and boat, the less likely it is that something will be stolen.
- **Ask port officials for advice on safety and security issues.** In most ports where theft was an issue, we were warned by officials. If you have heard rumors, ask officials whether there are any problems and what precautions you should take. They will often give the best advice about where to anchor, what areas to avoid ashore, and what items have been targets of recent thefts in the area.
- **Anchor off if possible.** Unless there is controlled access to the quays or docks, anchoring off is always safer than being tied up alongside. Get to know those anchored near you. If there is a problem with theft in the area, set up a neighborhood watch and agree to challenge anyone who approaches nearby boats when the owners are ashore.
- **Leave a dinghy tied off the stern when you are ashore.** A dinghy tied off the stern means someone is home—both to voyaging friends and to would-be thieves. We had friends who kept their old dinghy when it wore out and tied that off the stern when they were leaving the boat. Short of keeping a watchdog aboard, this is one of the most effective, least expensive theft prevention measures.

Don't let these precautions worry you too much. You are no more likely to experience theft traveling by boat than traveling any other way, and it's less likely in many places, including much of the Pacific and Indian oceans. Take sensible precautions and then enjoy the amazing generosity of almost everyone you will meet.

CHAPTER 27
The Voyaging Life: Keeping the Faith

WHEN EVANS WAS trying to convince me to go cruising, I couldn't picture what the voyaging life would be like. I had no idea what activities would make up day-to-day life aboard. I could only come up with abstract moments with titles—"Cooking in the Galley" or "Sail Handling." Those snapshots were long on romance and short on gritty details. Like most cruising couples, it took Evans and me a year to leave shore life behind, and at least that long to let go of our preconceived notions about what voyaging was "supposed" to be like. Many cruisers find the first year difficult, and the rewards and the challenges are seldom what people expect. But those who make it through that often testing and trying period find a life that is both more demanding and more rewarding than the one they left behind.

This chapter looks at the voyaging community. It describes the cycle most voyagers go through, from first-year "newbies" to seasoned members of the cruising community to retirees from the liveaboard life. It charts the challenges and the pitfalls along the way, and discusses the glue that holds this remarkable community together. When we return and once again live a shore-based life, the voyaging spirit returns with us. It is difficult, but we can bring some of the lessons from the sea back with us and use them to alter the way we interact with the world ashore.

THE FIRST YEAR: RECONCILING THE DREAM WITH THE REALITY

Going cruising takes commitment, determination, time, and money. It means pulling up roots, leaving behind loved ones, and accepting a certain amount of discomfort and inconvenience. When people slip the docklines and sail off into the sunset, they do so in the expectation that the rewards of cruising will offset the investments and sacrifices. Yet our expectations about what those rewards would be when we began our circumnavigation in 1992 bore almost no relation to the reasons we left again aboard *Hawk* seven years later. Like most people, over the course of our first year afloat we gradually adapted our expectations to the realities of the cruising life, and in the process we found we had both given up and gained far more than we expected. On balance, we felt we gained more than we gave up; those who don't feel the same usually sell their boat and return ashore.

To explore the elusive reality of cruising and how it lived up to what new cruisers had expected before they set sail, we interviewed the crews of eight boats who had left their shore lives behind and had been cruising for an average of two years (Table 27-1) as of the middle of 2001. All these crews had experienced good times and bad; some had had to overcome major setbacks in terms of their health or problems with their boats. Yet all of them were still out cruising and planned to continue—so all of them had found something out there that made cruising preferable to shore life, at least for a while. Since 2001, three of these crews have completed voyages and returned ashore, though one of them is preparing to leave again. The rest are still cruising and enjoying it.

These newly experienced cruisers shared their thoughts with us on how voyaging differed from their precruising expectations.

TABLE 27-1. THE EIGHT CREWS AND THEIR BOATS								
	Allouette de Mer	***Feisty***	***First Light***	***Hopalong***	***Nanjo***	***Peace and Aloha***	***Resolute***	***Suishin***
Crewmembers	Maureen Durkin and Riley Besand	Jackie and Mel Cohen	Chuck and Kathy Hall	David and Sally Jensen	John and Nancy Suter	David and Ellen Ernisse and sons Eric and Jason	Howie Berger and Lynda Roy	Sue Bogat and Adrian Royle
Boat	Alajuela 38	Trintella 54	Hans Christian 33T	Freedom 39 cat-rigged ketch	Ericson 38-200	Bougainvillea 62	Caliber 40 LRC	Tayana Vancouver 42
Been out for	1 year	$1^1/2$ years	$1^1/2$ years	$2^1/2$ years	$1^1/2$ years	2 years	$1^1/2$ years	$2^1/2$ years
Cruising at time of survey	Ventura, California, to Mexico	Caribbean 1500 (from Hampton, Virginia, to Tortola) to Virgins and south to Trinidad	Caribbean 1500 to Virgins and south to Venezuela	Sacramento, California, to Mexico	San Francisco, California, to Mexico	Great Lakes, Maine, Intracoastal Waterway, Caribbean	Chesapeake to Caribbean; Atlantic circle	Florida, Bahamas, Caribbean; transatlantic to England
Plans for following season	Sea of Cortez	Leeward Islands	Ireland via Bermuda/Azores	Sea of Cortez	Sea of Cortez	South Pacific	Caribbean to New York City	Baltic

The Two Sides of the Voyaging Coin

When asked whether cruising had lived up to his expectations, Chuck Hall aboard *First Light* responded, "Our first year of cruising has exceeded my expectations, good and bad." Almost everyone interviewed had experienced a similar dichotomy. On the one hand, interactions with other cruisers, local people, and local cultures all proved far more rewarding than most people had expected. On the other hand, seven out of the eight crews said setting up and fitting out the boat to a level appropriate for full-time liveaboard cruising and keeping the boat and its equipment functioning took significantly more time and effort than they had anticipated.

The Good

Ellen Ernisse on *Peace and Aloha* felt the best things about the cruising life were "meeting many new, wonderful friends from around the world and seeing many different places; meeting locals, enjoying their culture, language, and food." For Adrian Royle on *Suishin*, "The best thing about our new life is the combination of meeting new people, seeing new places, accomplishing new challenges, and feeling fit and well again." Aboard *Allouette de Mer*, Maureen Durkin most enjoyed "getting out of ordinary life and the rat race; the other cruisers and local people we meet; and the great culture, art, and food of [Mexico]."

Although most people went cruising at least in part to experience other cultures, few had anticipated how important the "remarkable community of individuals and couples enjoying the [cruising] lifestyle," as Chuck Hall from *First Light* put it, would become to them. Jackie Cohen from *Feisty* explained it this way: "There is an instant bond formed with the cruisers. Whether standing on a dock, getting into your dinghy, shopping at the local market, checking in at customs, or anchored in the harbor, friendships develop easily and are maintained. Sailing into a new harbor brings with it not only the excitement of discovering and learning about the island, but [also] the excitement of possibly seeing old friends." Maureen Durkin from *Allouette de Mer* "knew there was great camaraderie in the cruising community, but it far surpasses all my expectations. Most everyone we have met is just great . . . friendly, helpful, and interesting."

But the cruising lifestyle also separates new friends after bringing them together. While David Jensen from *Hopalong* agreed that "Cruising friendships can be very special," he pointed out how hard it can be to maintain them within a completely mobile community. "I heard one sailor refer to friendships among cruisers as 'Friendship Lite,'" he said. "That's because you see most folks only briefly and are likely to never see them again. The need for socialization and deep friendships (including maintenance of old friendships) is something potential cruisers should think about seriously." Most crews used SSB radio nets and e-mail to stay in touch with both cruising and shore friends. But saying good-bye remains a regular—and often painful—part of voyaging.

Aboard *Peace and Aloha*, Eric and Jason Ernisse, both in their early 20s, had a different perspective on the cruising community. Eric said, "I had very few expectations [about the cruising life beyond] meeting people our age and girls. Most people out here are much older than us and some have a hard time relating." He included "extended periods of no social contact" on his list of the worst things about his new life along with "heavy weather, dragging anchor, and living with the parents sometimes."

The (Not So) Bad

The Ernisse family had *Peace and Aloha*, a Chuck Paine–designed Bougainvillea 62, custom-built for their planned circumnavigation. Eric's only other expectation, that "a new boat would not break down as much as ours did in the first year," reflects the flip side of the cruising coin. He wished he and his family had spent time "talking more with the cruising community about real life on a boat and the differences between a new boat and an old one."

But refitting an old boat can be just as frustrating, costly, and time-consuming as building and shaking down a new one. Adrian Royle described the difficulties he and Sue faced when fitting out their Tayana Vancouver 42, *Suishin*. "We underestimated the time and money it would take us to refit the boat by an order of magnitude." Initially, things went well. "In the first three months we had replaced the plumbing, the standing rigging, and the engine." Then unexpected problems surfaced. "When a tropical storm, the remnants of Mitch, went overhead we identified thirty-seven major leaks, and when we tried to sail her in strong winds in the Gulf Stream we found we couldn't handle her. As a result we have rebuilt/recaulked the windows and hatches and reconfigured all our running rigging. This effort, plus hundreds of other things that make life more comfortable and safe aboard, have taken over two years to complete."

Even once the boat has been refitted, the work doesn't end. It seems to make little difference whether a boat is old or new, production or custom: boats break when exposed to the demands of full-time liveaboard cruising and offshore passagemaking. Lynda Roy and Howie Berger bought their Caliber 40, *Resolute*, new and had her fitted out to their specifications. Although they felt they "did a good job outfitting [the boat] for a self-sufficient cruising environment," after two Atlantic crossings and a year and a half aboard, Lynda said, "*Resolute* takes more of our time than ever before—it's amazing what breaks on a boat!" Jackie Cohen on *Feisty* admitted, "The thing that we were least prepared for . . . was the constant attention the boat demands. The marine environment is very corrosive. As a result, the vast [majority] of systems on a boat can break any time and need regular maintenance."

"People should realize that cruising is a full-time job!" said Ellen Ernisse on *Peace and Aloha*. "Equipment does break, and we need to be plumbers, mechanics, electrical engineers, cooks, shoppers, linguists, nurses, watermaker and refrigeration specialists—plus sailors—in order to make a cruising life. There are definitely days when I ask myself, 'Why am I out here?' 'What am I doing?'" Adrian Royle put it most succinctly: "Cruising is for well-organized workaholics; in my opinion it is quite unsuitable for those looking forward to a peaceful retirement."

In the end, most of the crews had accepted fixing the boat as the flip side of the cruising coin, and took satisfaction in keeping the boat in cruising trim. "We really believe in the saying 'Cruising is working on the boat in exotic places,'" Sally and David Jensen on *Hopalong* explained. Kathy and Chuck Hall on *First Light* "now see breakdowns as a challenge rather than a headache." Mel and Jackie Cohen aboard *Feisty* "love this life more than we ever expected and are not in the least disappointed, bored, or unfulfilled. The islands, the cultures, the ever-changing scenery, the new discoveries, the variety of people we meet, and the new challenges of the boat keep us interested and stimulated."

The Ugly

Self-sufficiency in keeping the boat going most often resulted not from desire or confidence but from necessity. While Mel and Jackie Cohen had "learned over this past year and a half how to repair most things," they did so at least in part because "it is often frustrating, unproductive, and expensive to rely on workers on the islands to do the work for you." More than half the crews harshly criticized the quality of work and durability of products offered by the marine industry—the one aspect of their new life where the word "disappointed" appeared over and over again.

A few comments demonstrate the anger and bitterness some of these cruisers felt: "The entire industry is filled with fraud and rip-offs, from builders and architects to product makers with their bogus warranties and products." "The biggest disappointment by far has been some of the products and services that we have paid for to make our boat a safe and comfortable home, only to find out that they either don't work, are the wrong size, or [don't] hold up well." "We can count on one hand—no, three fingers—the number of 'professionals' in the sailing industry who actually treat us as valuable customers. It is remarkable that as fairly new cruisers, we believe that superior work on our boat will be performed by us, even with our limited knowledge and experience."

David Jensen on *Hopalong* also criticized the industry, but for a different reason. "It would behoove the boating industry to stop using fear to sell its products; the pitch is usually something along the lines of 'buy this gizmo or you will die.' Good sailing skills will get you through more hard times than any $1,000 gizmo. And quite frankly, if you pay reasonable attention to the weather and the boat, you are not likely to have any really hard times. Someday the industry will learn that it is frightening away more potential sailors than making new customers."

The only other source of disappointment resulted from what proved to be somewhat idealistic expectations about safety abroad. Unfortunately, another source of "trouble in paradise," as Chuck Hall on *First Light* put it, comes from increasing incidents of thievery, especially in the Caribbean. After arriving in the Virgins and tying up in "an 'American-like' marina . . . *[First Light]* was boarded while we slept, and we lost quite a bit of valuable property." Lynda Roy and Howie Berger aboard *Resolute* were "disappointed to realize that there is a fair amount of theft out there, especially of dinghies and outboards. Hard to believe, but we actually left the States without a secure chain and lock for them." Chuck and Kathy Hall "stopped wearing watches and all jewelry . . . became more alert when on and off the boat . . . and purchased intruder alarms for the boat." Such basic precautions—little more than most people would take as tourists in a foreign country—discourage most theft.

Changing Gears

The good, the bad, and the ugly reflect the surface of the cruising life by describing some of what fills the hours of every day. But something much more complex and subtle could be glimpsed in a central theme touched on by every crew in one answer or another. That theme had to do with a psychological shift rather than a physical one, and in discussing it people talked about control and freedom and a new and different relationship to time.

Howie Berger on *Resolute* found the best thing about their new life to be the "release from the regulated and structured routine of land-based life and the freedom of choice this brings. Each day is a new adventure with promise and spontaneity, be it deciding suddenly to take off for someplace else or just loafing around reading or sharing cocktails and conversation with friends." David Jensen aboard *Hopalong* said, "Having almost complete control of our time has been one of the best experiences of cruising."

Although a few people missed regular exercise and movies, most of what they felt they had given up fell into the category of people, pets, or comforts (Table 27-2). When asked what they missed least about the life they left behind, almost everything on the list from all eight crews had to do with how they used to spend their time. In fact, Table 27-2 suggests most of these crews felt a basic dissatisfaction with how they had been spending their time ashore.

All of those interviewed expressed satisfaction with how they spent their time on the boat. Ironically, many people found themselves struggling to manage time. Ellen Ernisse aboard *Peace and Aloha* "was not prepared for how long it takes to do *everything* aboard. . . . So much for hours of reading in my hammock sipping a mai tai! But people on land assume that is exactly what we are doing all day." As Sally Jensen from *Hopalong* said when asked what she could have done to better prepare for the cruising life, "An in-depth study of Zen may have helped [me] accept that having time to do dishes somehow makes having to do dishes OK." David Jensen added, "You can become consumed with day-to-day activities, which take an inordinate amount of time, and forget that there is more to life than wiping down the brightwork in the morning or cleaning the dinghy's bottom or washing dishes." He urged new cruisers not to "forget romance and its light touches."

Mel and Jackie Cohen on *Feisty* captured this dichotomy. "By far the worst thing about our new life is the way the days seem to fly by. Each day is filled with different tasks from sightseeing to maintaining the boat. This gives us little time to just read, relax, and enjoy the surroundings. We need to insert a day of rest every few days. The best thing about our new life is the sense of freedom we feel: the spontaneity of traveling when we're ready to move on, of not being restricted by a schedule, and just being on the water and cruising."

This changing relationship to time was also reflected in changing itineraries. Most of the crews who left with a schedule had decided to slow down after realizing how much there is to see and do and wanting to enjoy it. When Chuck and Kathy Hall left aboard *First Light*, "our itinerary was ambitious because we actually thought we would go to the Caribbean for just a few months (say November/December to April or so) and then head back up the east coast all the way to Maine, for an expected crossing of the Atlantic sometime in June! It didn't take us long to change that plan." David and Sally Jensen also decided to slow down after a year on *Hopalong*. "The South Pacific was in our sights when we started, but we really liked Mexico and figured that we might never get back once we headed out. The Sea of Cortez is a special jewel and remains to be explored in more depth."

Mel and Jackie Cohen had originally planned to "stay in the Caribbean for two years and then sail to the Med" aboard *Feisty*. "But the Caribbean is much bigger than we thought. We now plan to spend our third year exploring the western Caribbean and traveling inland in South America. If we feel satisfied with this, perhaps we'll then

TABLE 27-2. GAINS AND LOSSES

Boat	Crew	I/We Miss Most . . .	I/We Miss Least . . .
Allouette de Mer	Maureen Durkin and Riley Besand	"unequivocably . . . a bathtub"	"yardwork, television, answering machines"
Feisty	Jackie and Mel Cohen	"children, family, and close friends"; "a washing machine"	"television and hearing about the daily news"
First Light	Chuck and Kathy Hall	"our dogs . . . and our dearest friends"	"TV, crowds, driving a car, and the accumulation of 'stuff' that marked [our] former lives"
Hopalong	David Jensen Sally Jensen	"having a small garden" "daily contact with friends and family, comfort of a real bed"	 "regimentation of working life"
Nanjo	John Suter Nancy Suter	"fingertip access to the Internet and libraries . . . watching the grandchildren grow" "a real chair to sit in" and "grandbabies"	"the depression and disgust with the daily news" "television"
Peace and Aloha	Ellen Ernisse Eric Ernisse	"my daughter, my Dad, my family, good friends, my birdies . . . and my daily workout" "running water, a large bed, ice cream, new music and movies"	"all the hustle and bustle of everything in the USA" "driving, crowds, TV commercials"
Resolute	Lynda Roy Howie Berger	"shopping in the U.S. for availability and quality, running regularly to keep in shape, takeout, new movies" "working out at the gym, taking baths, the Sunday *New York Times*"	"smiling when the client is wrong, paying the telephone bill" "working, commuting . . . the noise, smell, and pollution of the NYC area"
Suishin	Adrian Royle Sue Bogat	"North American washing machines and dryers" "an adequate working shower with good water pressure" and "a filing cabinet"	"work" "office politics"

go to the Med the following year. One of the wonderful things about this lifestyle is the freedom that we have to follow our desires and not feel committed to maintain an itinerary. Check with us next year to see where we'll be." Their new attitude coincides with John and Nancy Suter's observation that "People who are happiest seem to be those who keep schedules to a minimum."

Only two crews, those aboard *Resolute* and *Peace and Aloha*, had originally planned to circumnavigate. Both altered their plans to a certain extent. Howie Berger and Lynda Roy detoured around the Atlantic, and in the process learned a great deal about passagemaking. "Originally we set our sights on making a circumnavigation. An eye-opener for us was how fatiguing passagemaking of more than a week would be for just two people. We are not interested in taking on crew, so we are reconsidering whether or not to circumnavigate." Lynda added, "Today Howie is the one most committed to continue cruising. I could walk back into land life tomorrow content with everything we have done to date." She was the only one of the eighteen people interviewed to express that point of view.

Crew issues also affected plans on the 62-foot *Peace and Aloha*. Originally, Eric Ernisse had planned to take only a year off from college and sail to New Zealand with his family. "Well, it is way past a year but [we won't arrive in] New Zealand until November. My plans [now] are to sail around the world . . . [for] two reasons. First, this is a wonderful chance to sail around the world in a wonderful boat, and the timing is right. Second, my parents need my help with the boat."

Finally, changing gears means more than just slowing down and smelling the roses. Most of the people interviewed expressed some sense of a deeper emotional change. John and Nancy Suter on *Nanjo* "recognize a psychological 'softening' of our personalities, being away from freeway traffic, shopping malls, the high pace of life, and the responsibilities of home ownership." Others talked of a different sense of priorities and changing values and a growing sense of wonder at the world and the people in it. But mostly, people expressed an overwhelming awareness of how lucky they are to be able to live such a unique and challenging life. Chuck and Kathy Hall on *First Light* said, "We are so fortunate to be able to do this cruising right now. We are physically able, have an adult child who does not need daily attention, and parents who are either deceased or healthy enough not to need us for support. We have no excuse, and as one down-to-earth individual we met in Trinidad said to us one day, 'Enjoy life because you be dead for a long time.'"

JOINING THE CRUISING COMMUNITY

It took Evans and me more than a year to move beyond our expectations about the cruising life and begin to embrace the reality—both good and bad. It took even longer before we felt as if we had become full-fledged members of the cruising community. For most people, that moment comes when—after taking from everyone they meet—they start giving back, when they are experienced enough to be able to help others trying to find their way.

When Evans and I left on our first voyage aboard our Shannon 37 ketch, *Silk*, we could hardly have had less experience. We bought the boat sight unseen in January 1992 when we were living in Sweden, and we shipped it to the original builder to be refit for offshore. We moved aboard in mid-May, day sailed around Newport, Rhode Island, half a dozen times, and then left for Bermuda in early June. Three days later we found ourselves in a Force 10 storm in the Gulf Stream in waves that towered over *Silk*'s mizzen mast and cross seas that slammed into her beam like freight trains. We ran under bare poles trailing warps for 48 hours, and we were so seasick neither of us could keep anything down, including water, for three days. When we finally made it to Bermuda, Neptune had defeated me in the first round.

My sailing career would have ended right there if it hadn't been for the experienced crews aboard the two-dozen salt-scrubbed yachts in St. George's Harbour. Though I can't remember any of their names or the names of their boats, I can still remember the words they used: "Someday you'll realize how lucky you were to face this on your first passage. Chances are you'll never see another storm like that even if you sail all the way around the world." "In twenty years of ocean sailing, I've never been in a survival storm like the one you're describing." "You did all the right things and you and *Silk* came through just fine. You've learned more in your first 600 miles than you'll learn in your next 6,000."

Those sailors gave Evans and me the courage to keep sailing. And every place along the way we learned from other cruisers. We took by the shovelful, but we weren't giving anything back.

I remember the exact moment when the tide turned. Two and a half years after we arrived in Bermuda, we were walking down the dock in Hout Bay, near Cape Town in South Africa. We came upon a South African yacht that had arrived a few days earlier. Foul-weather gear and cushions festooned the decks, and a broken boom lay on the dock. The couple aboard had rounded the Cape of Good Hope in a storm, and they were still in a state of shock. "I never imagined it could be so bad," the woman said, tears coming to her eyes. "We planned to go to the Caribbean, but now . . ."

"We had just 40 knots of wind," her husband said. "But the waves . . ." he ran out of words. He swallowed and continued. "We made it through, just barely. But all the guys around here talk about 60 knots or 70 . . ."

Evans and I looked at each other. Evans said, "We had a storm like yours on our first offshore passage. It was the best thing that could have happened to us. Ever since we've been able to look around and say we've seen worse." We told them how rare 40 knots of wind was, how terrifying it is the first time, how difficult these waters are, how much more predictable and moderate tropical weather would be . . .

I don't know if that couple quit or not. But in that moment, on that dock, Evans and I made a first payment on the debt we owed to countless other sailors who had helped us along the way. And for the very first time, we felt like full-fledged members of the cruising community.

You will come to value that community as you begin to climb the steep learning curve that will lead to your becoming an experienced offshore sailor. Like all communities, we need shared values and rites of passage to reinforce our unity. We also need a common etiquette that prevents disputes from arising. One of the greatest joys of becoming a competent sailor lies in participating in and passing along voyaging traditions that hold the cruising community together and celebrate the milestones of the voyaging life.

Voyaging Values

A special camaraderie exists among those who ply the sea. When sailing the seemingly endless stretches of the world's oceans, we come to a new understanding of humankind's relationship to nature, and thus our relationship to each other. We share this camaraderie with those in whose wakes we follow, with other sailors, fishermen, and mariners who feel at home on the sea. Those who share this bond will assist anyone at sea who is in trouble, and in turn they will never request assistance except in a life-threatening situation. Those of us who choose to venture offshore and test ourselves must be willing to keep that faith and to be held to that standard. Otherwise, the time will come when we will be prohibited from heading off to sea freely. If that should ever come to pass, the magic of sailing around the world would be diluted; spiritually, the world would be a poorer place.

The shared value of rendering assistance is the glue that holds the cruising community together. Whether the problem is an emergency at sea or a broken bilge pump, people who sail the ocean in small boats help one another. In any other community, this basic tenet would be abused. But it is counterbalanced by the fierce self-sufficiency of voyagers. The voyaging community's greatest asset is the stock of good will and generosity that, if it is to continue, must be contributed to by one and all.

Over time, cruising values have expanded to include other aspects of the way we interact with one another and with the cultures we visit. The SSCA promotes a "tread lightly" attitude in their "clean wake" philosophy—the idea that we should leave nothing in our wakes that will not benefit those who follow. That includes anything from garbage to ill will in a village. Every voyager should ascribe to this tenet. The hospitality with which we are greeted as we travel from place to place is both fragile and priceless. The thoughtless actions of the crew of one yacht can destroy the spirit of the sea. Just as we take responsibility for our lives when we head offshore, we must take responsibility for our actions when we return.

Voyaging Customs

A number of rites of passage mark milestones in the voyaging life. The first of these is christening the boat. This is supposed to take place at the vessel's launching, but it should also be done if the vessel is renamed (see the Sea Superstitions sidebar). At launching, the christening is accompanied by the breaking of a bottle of champagne on the bow. Traditionally, a woman, most often the owner's wife, breaks the bottle. Given the relative strength of champagne bottles and the delicacy of fiberglass finishes, scoring the bottle beforehand so it breaks easily and breaking it over a pulpit are wise precautions!

The bottle breaking is preceded by a speech describing why the boat's name was chosen, ending with, "I hereby christen this yacht ________." To rename a boat that is already in the water, the speechmaking is accompanied not by breaking the bottle but rather by opening it and pouring some on the boat, some into the sea, and some into the owner's mouth. Then the bottle is shared with guests. Some people claim that's all you need to do to be official, but for purists a renaming can occur only after a "denaming."

In a denaming ceremony, libations are offered to King Neptune, who is asked to forgive the sins the vessel has committed and discharge the debts it has incurred. After four to eight days while King Neptune gets everything in order, the renaming can proceed as above.

Other rites of passage celebrate the major landmarks on a sailor's journey. Crossing the equator has traditionally been celebrated by a baptism of the uninitiated carried out by Neptune (or Poseidon, if you prefer). Any crewmember who has previously crossed the line can stand in for Neptune. In the standard celebration, "Neptune" appears on deck clothed in robes, wearing a long beard, and carrying a trident just as you are crossing the equator. Each uninitiated crewmember is forced to pay homage by offering the god of the sea various gifts and services. When Neptune is satisfied, the crewmember is "baptized," which might mean having a bucket dumped over his or her head, being immersed in a tub of water, or even (if the boat is becalmed) being shoved overboard.

When completing a circumnavigation, there are two major landmarks: crossing your outbound track, and returning to your home port. In both cases, the standard celebration is similar to a christening, where a bottle of champagne is poured on the boat to celebrate her voyage, into the sea to thank the sea gods for a safe journey, and down the crew so that they can make merry. The same custom is often used for rounding one of the Great Capes, as the sea gods there are particularly jealous and require homage to forestall their fury.

Guest or visitor books have long been a tradition aboard, and many boats carry fancy, bound volumes (refer back to Figure 12-4). Guest books are also kept by those ashore who regularly interact with offshore boats and their crews. Village chiefs, hotel proprietors, and chandlery owners kept their own books and asked us to fill them out. Be prepared to do justice to your vessel and your trip in the records you leave behind.

Voyaging Etiquette

As the number of boats has increased in marinas and anchorages around the world, voyaging customs have been augmented by guidelines for common situations, such as anchoring, rafting up to other boats along a wall or wharf, and boarding someone else's boat. These unwritten rules tend to combine common sense and courtesy. We learned them as we went along, and sometimes we learned by violating them. Occasionally, someone got angry. More often, an experienced voyager took us aside and suggested a different approach. In that spirit, I share these thoughts with you—to use and to pass on to others who need to know.

Anchoring Etiquette

When entering an anchorage or a marina, do so at a dead-slow speed. Not only will this keep things under control, but you will minimize your wake and the effect you have on the boats already there. A good rule of thumb is, if you are not bored, then you are going too fast. As you select your spot, bear in mind that he or she who anchors first has rights. If you set your anchor and people on another boat are uncomfortable with your position, they have the right to ask you to move. If later you bump into them (or

SEA SUPERSTITIONS

Sailors are a superstitious lot—perhaps because after a certain point, luck plays such a large role in a boat's fate. There are a host of old superstitions, a surprising number of which are still believed by modern mariners. If you are the superstitious type, then take heed of the following age-old beliefs:

- **Changing boat names.** Once a boat has been christened, it is supposed to be bad luck to change the name. We did change *Silk*'s name, but the builder assured us that in Irish tradition (she was a Shannon, after all!) this was not bad luck if the first letter of the name was retained and the boat was rechristened with generous libations for the sea gods. Given that her old name was *Sea Squaw*, we felt we had little choice in the matter.
- **Leaving on Friday.** No self-respecting, superstitious sailor will ever set off on a passage on a Friday. A voyage begun just before the weekend is always supposed to end in disaster. I asked our British friends where this tradition came from, and the consensus seemed to be that seamen resented leaving their sweethearts just before they might have some shore leave. So they deemed Friday—subconsciously or otherwise—an unlucky day to depart.
- **Whistling for wind.** The seamen of the old British Admiralty believed that if you were becalmed, whistling would summon wind. They also believed that it was foolhardy to engage in this behavior, for the result was always supposed to be a gale or worse.
- **No rabbits aboard.** The French have an absolute phobia about rabbits aboard boats, believing it results in the worst of bad luck. I asked several French sailors why this was so and got many different answers. The most likely answer seemed to be that the rabbits ate the wood of the ships, which could cause a boat to sink. But another answer offered by a charming Frenchman could be correct: the rabbits' passionate breeding behavior drove French sailors mad with desire for the women they had left behind!
- **Naming your destination.** Respect for the sea and for the unforeseen combined with a good dose of humility make some sailors uncomfortable naming their destination before they reach it. Similarly, most people heading offshore for a number of years will not tell anyone if they are leaving to do a circumnavigation.
- **Sacrificing to Neptune.** When becalmed or in a gale, many sailors claim that a sacrifice to Neptune will change the weather for the better. Luckily, the days of sacrificing crewmembers are past, and today the sea gods get mostly liquor. In our experience, Neptune is somewhat picky about accepting sacrifices—only the best will do. Inferior spirits seem to infuriate him even more, so it may be better to live with conditions than offer cheap brandy!

Modern sailors have created and sustained their own set of superstitions, and you will encounter them when you go voyaging. Those who make a stop at the Azores will discover the importance of painting their boat's logo on the seawall at Horta on Faial. We saw artwork left by boats that had passed that way in the 1950s and 1960s, including Eric and Susan Hiscock's *Wanderer III*. Not putting your logo on the wall is supposed to result in unnamed disasters. The only person we know who did not follow the tradition was dismasted within two months. Good enough for us!

vice versa) and neither of you has dragged, you are the one who must reset your anchor. If you bump because one of you has dragged, whoever drags gets to reset their anchor since they have to do so anyway. All this applies equally to boats on moorings, so make sure to allow for sufficient room given the difference in scope between moored and anchored boats.

In theory, an empty mooring buoy should be treated as if a boat were on it, and that should be the approach you take whenever possible. However, in some anchorages the proliferation of mooring buoys makes that all but impossible in practice. In a crowded harbor with many mooring buoys, make every effort to anchor clear of all moorings, but if you can't and a boat returns to a mooring within your boat's swinging range, the crew can ask you to move, but you are not obligated to do so.

Don't pick up private mooring buoys without permission. Not only is this discourteous, but you have no way of knowing how the buoy is secured and for what size boat it is intended. If someone invites you to pick up their buoy, no true sailor will think you rude for asking about the buoy's construction and the date it was last maintained.

When anchoring, you want to make sure your boat is safe and you won't interfere with anyone else or cause them to interfere with you. If no one around you is using stern anchors or a second anchor off the bow, don't set one on your boat. If you do, your boat will not swing with the others. Eventually, something is going to go "clunk."

If you have to run an engine or a generator at anchor, try to do so when you are least likely to disturb others. The middle of the day is better than early in the morning or late at night.

Marina Etiquette

As discussed in the Marina Docking section in Chapter 6, boats should be secured in marina berths with a bow line, a stern line, and fore and aft springs. The area near the boat should be kept neat. Electrical cords should be run along dock edges or in cracks so people won't trip on them in the dark. Water hoses should be coiled neatly and kept out of the main walkways. Halyards should be secured so that they don't slap if it gets windy. This is especially important if you plan to leave the boat.

In many places around the world, it is quite common to raft up to other boats along a breakwall or a fishing wharf. Living cheek by jowl with your neighbors for an extended period of time requires a good deal of patience and courtesy. The first time you go ashore, ask permission to cross each boat if the owners are present. Carry your shoes and cross quietly in front of the mast over the foredeck to maximize privacy. Never cross through someone's cockpit. If you have to run a generator or engine, pick a time that will cause the least disturbance to others. Don't do it early in the morning, late at night, or at mealtimes, the British teatime (late afternoon), or cocktail hour. Keep the noise down after dark if you're having friends over for a party, and make sure they're very quiet crossing the other boats when the party ends.

Dinghy Dock Etiquette

When going ashore in many anchorages, you will leave your dinghy tied to a dinghy dock. Do not tie the dinghy up tight against the dock and then lock it so it cannot be pushed away. That results in a congested mass of dinghies blocking the dock face with no way for a new dinghy to work its way through them. Instead, make sure the painter and the wire "leash" that secures the dinghy and outboard are both long enough to allow the dinghy to be pushed back at least its own length away from the dock.

Try not to tie over anyone else's painter when you secure the dinghy, as they will then have to undo your line to get to theirs and may not take proper care retying it. If you have to undo someone else's painter to get to yours, make sure to secure it again to the same attachment point with the same knot. When leaving the dinghy, leave your outboard down, not up. The sharp edges of a propeller on a raised outboard can do a great deal of damage to other dinghies at the dock.

Boarding Etiquette

If you have been invited aboard another boat, say for cocktails at six o'clock, never go empty-handed. Everyone brings something, whether it's banana chips or a bottle of rum. Never board without permission, even if you have been invited. Knock on the hull or hail using the boat name, as in "Hello aboard *Sea Spirit*!" When the owner emerges, ask permission to come aboard. Take your shoes off, unless the owner says there is no need to do so. When the party gets underway, remember not to get too loud—sound carries remarkably well over water. Loud music is considered discourteous after sundown.

It is considered exceedingly rude to board a boat when the owner is not aboard. The only exceptions are when the boat is in danger or when no one is aboard in a marina and you need to raft up or secure a slapping halyard.

Radio Etiquette

Basic radio procedures are not difficult to master, and they do facilitate communication, so take the time to learn the rules. When hailing another vessel, use the appropriate hailing frequency and say the name of the vessel you are hailing three times, then the name of your vessel twice. For example: "*Sea Spirit*, *Sea Spirit*, *Sea Spirit*, this is the sailing vessel *Hawk*, *Hawk*." Or, *"Sea Spirit, Sea Spirit, Sea Spirit; Hawk, Hawk."* The repetition is important to make sure the party you are trying to reach understands you. If you do not get a response, try again. If there is still no response, say, "Nothing heard, this is *Hawk* standing by on one-six." That way if the person you are trying to reach heard you and answered, he or she will know that you did not hear their response.

When responding to a hail, make sure to repeat the name of the hailing vessel twice as well as your own vessel name, as in, "*Hawk*, *Hawk*, this is *Sea Spirit*." Usually the person who initiated the call picks a working channel, so the response would be, "*Sea Spirit*, this is *Hawk*. Go to six-eight?" The other person should acknowledge the channel, as in "Going to six-eight." Make sure to pick a working channel designated for pleasure traffic for that country.

The person who initiated the call should hail on the working channel in the same manner as they did on the hailing frequency. After that, conversation can become "normal," but it does help to end each transmission with "Over." When you have finished, end the conversation by saying what you intend to do, as in, "*Hawk* standing by on one-six." If you are going to turn off the radio, say, "*Hawk* over and out."

When speaking on the radio, be careful not to step on other people transmitting. If you pick a frequency to switch to and find it occupied, return to the hailing frequency and try again. When transmitting across a small distance, as when talking to someone in the same anchorage, use low power to prevent distortion. Many new cruisers do not key the microphone cleanly and speak too close to the mike. The first cuts off the end of the transmission; the second slurs words until they cannot be understood. Practice with another crewmember using a handheld radio to make sure you are transmitting clearly.

When dealing with officials and shore-based stations, you will need to know the phonetic alphabet and be able to spell your name and your boat name without hesitating. Posting the phonetic alphabet above the radio can be helpful, especially with children or guests aboard.

Flag Etiquette

All boats should fly their "colors"—the flag of their country of registration. Nautical almanacs include lengthy definitions of the proper size for a country flag as well as its proper position on the boat, but most cruisers ignore all this. Instead, if they fly their country flag at all, they tend to fly a small flag off their backstay or off a pole on the stern. This can be easily taken down when the weather deteriorates.

Most cruisers—and most countries—are much more concerned about proper flag etiquette with respect to clearing in and being in foreign waters. When entering a country's water for the first time, you should fly the yellow Q flag from your starboard spreader. This means that you are asking for practique so you can enter the country. You can either fly the country burgee under it or fly the Q flag alone. Once you have been through quarantine procedures, drop the Q flag and raise the country burgee and keep it at the starboard spreader for the duration of your stay.

LONG-TERM SATISFACTION

One of the biggest differences in our voyaging aboard *Silk* versus aboard *Hawk* has been the amount of time we've been able to spend in each country and the depth of the experience we've had as a result. On *Silk*, we were on a three-year sabbatical during which we completed a circumnavigation. The longest we spent in any country was in New Zealand, and that was only about six months. On *Hawk*, we have wintered over in many countries and we spent a year or more in Chile, Australia, and New Zealand. This means that we have had the opportunity to really get to know people in these countries, to come to understand their values and their politics, their most sacred beliefs, and their sense of humor. We have also ended up with many shore-based friends, whereas our long-term friends from our voyage aboard *Silk* are all cruisers.

On our first circumnavigation, keeping the boat going, exploring the places we spent time in, and performing the various activities described in Chapter 17 kept us well occupied, and we were rarely bored. But by the end of our three-year voyage, we were both starting to hunger for some intellectual stimulation or for a rewarding project. Although many long-term cruisers find satisfaction for many decades in the demands of cruising and passagemaking, others start to look for additional challenges after they have been out for several years.

Evans and I have found that challenge in writing and sharing our experiences with others. We both write professionally, but we also spend a great deal of time corresponding with those who are dreaming of going cruising and have questions or want advice. Contributing to the wider cruising community and helping individuals who are trying to change their lives have proven tremendously rewarding for both of us and have added meaning to our voyaging. Sharing our travels through slide shows and our knowledge through seminars remind us how fortunate we are to be living the life we live. It renews our commitment to cruising and revitalizes our sense of wonder at the world we are so fortunate to inhabit. Other cruisers find stimulation in working in different countries or in running cruising nets and doing weather forecasting.

After a certain amount of time, when being in a foreign country no longer feels exotic and a bit intimidating, many cruisers are no longer content to be "tourists." They want to really get to know local people and find a way to contribute. We have met many people who have had a lasting impact on the places they have visited. After an earthquake in El Salvador, a group of cruisers organized a rescue and recovery operation for one village that had been devastated. An organization called Boaters for Books has delivered children's books to schools throughout the Caribbean islands. Caribbean cruisers also carried $9,000 worth of medical supplies on their boats in one season to stock a clinic in George Town in the Bahamas. In the Pacific, cruisers have transported thousands of schoolbooks to children in Tahiti and thousands of dollars of medical supplies to a clinic in Tonga.

These types of activities add richness and depth to the cruising experience and allow us to repay in some small way the kindness we are met with the world over. If you worry that cruising may be too self-indulgent, that you won't be able to contribute, know that cruising will provide you with many opportunities to reach out to those around you and to watch change occur in the communities you visit. You will be able to have as large an impact as you have the time, energy, and commitment to realize.

SURVIVING REENTRY

Most cruisers end up returning to land at some point. If you don't make the decision yourself, then age and physical deterioration will drive you ashore eventually. It's unrealistic and somewhat irresponsible to believe you'll be able to sail the seas forever. Most people find that long offshore passages and living aboard full-time become too difficult physically somewhere in their mid-60s to early 70s.

Often the woman in the relationship instigates the move back ashore. Just as the web of relationships they form ashore makes it hard for many women to leave, it also tends to draw them back. When most experienced cruising women decide to walk away from voyaging, 90 percent of the time it has to do with the desire to spend more time with aging parents or growing children, not dissatisfaction with the cruising life itself.

Be realistic about the fact that someday your voyage will come to an end, and plan for it ahead of time. There's no way to know how long you will want to continue until you have been out there for several years. Even then, most people we meet who have been out for longer than two or three years say they will keep going as long as their finances and health allow. Toward the end of their voyaging life, many go through a few years of part-time cruising, spending more and more time with children and grandchildren, before both partners decide the time has come to return ashore.

Only when you return home will you discover how much you have really changed. Most voyagers find the transition back to shore much more difficult than the transition to voyaging. Life aboard is so full of color, intensity, and emotion that life ashore feels like a pale imitation. But in return for giving up the vivid extremes, we found luxuries we only dreamed of during our voyaging years. While we were ashore for four years building *Hawk*, I often stood under the shower head mesmerized by the flow of hot water. Evans and I ate oranges by the case and apples by the bushel, reveling in their fresh taste and their year-round availability.

But the adjustments do not come easily. We came back to a culture shock more profound than any we ever experienced traveling abroad. We expected things to be different in different lands, but we somehow expected that things in our own country were not going to change while we were away. But we were wrong. In the three years we were away aboard *Silk*, the country had marched on without us: Republicans and Democrats had changed political roles; 386 computer processors became 486s, then Pentium chips; people surfed the Internet and communicated on the World Wide Web; O. J. Simpson was no longer just an ex-football player who ran through airports chasing Hertz signs; the Generation Xers had replaced the baby boomers as the disillusioned younger generation.

Even more disconcerting were the changes that existed because we had changed. After the one-room tin shacks that pass for grocery stores in the Pacific, I was overwhelmed by the average American supermarket. I honestly wondered if anyone ever went stark raving mad in the cereal aisle, completely unable to cope with a hundred different brands leering at them from the shelves. Most of the islands we visited had neither cats nor dogs, as these are considered a delicacy in many places where meat is scarce. Here not only were there cats and dogs in plenty, but there were fat cats and dogs. What better proof could there be of America's general level of prosperity?

In the end, though, the most profound changes are the least tangible. We had long since left behind the materialistic yuppies who jet-setted around Europe and were bored by five-star restaurant meals. During our four years ashore, we lived a quieter, more introverted life than we did before we left. We tried to keep the spirit of voyaging alive by keeping things simple and living day to day. We took the time to go for walks and to watch sunsets. We did not own a television and had no interest in doing so. We tried to insulate ourselves from the busyness that marks our culture in order to stay in touch with the calm stillness of our watery souls.

On *Silk*, we had trod more lightly on our planet and were more conscious of the footprints we left behind. Ashore, we were sorely aware of how little impact we could have on our environment. We had so little control over how our electricity was generated, what happened to our sewage, or how much energy was used to transport our food. Like most Americans, we found that we had to own a car to function effectively, particularly in the professional world.

Yet so many little things could be done, and these were the manifestations of our voyaging spirit. The canvas bags that had carried pineapples and bananas back to the boat from village markets were used every week at the local supermarket. We reused plastic bags and recycled anything that was accepted at any recycling facility within 50 miles of us. We used water and electricity much more sparingly, and our bills for both were about half what they had been before we left. Instead of buying a television, we continued to entertain ourselves as we did on the boat, with books and conversations and journal writing and deep thoughts. We were painfully conscious of the pressure in our culture to be good consumers and to incur debt. We had to work to resist the almost overwhelming temptations of the American marketplace. Sadly, trying to incorporate our voyaging spirit into our daily lives often meant flying in the face of the current culture.

The wonder of what we have done comes home to us most strongly when we are ashore and get to share with other voyagers. I remember one dinner we had in Connecticut when we were building *Hawk*. There were fourteen people around the table, all but two with more experience than Evans and I, though we had circumnavigated. In the middle of that dinner, I leaned back and closed my eyes and just tuned in to the animated conversations around the table. Two people were discussing how the political situation had changed in South Africa—one had been there aboard a yacht during apartheid and another had been there just after Mandela was elected. One man was telling a story about how his son got invited to ride a sheik's horses in Oman. A woman was describing the weaving done in one of the Micronesian islands. Most of the people around that table had known only one or two of the other couples when they arrived for that dinner. Yet in a few short hours, we had become friends with far more in common than we shared with people we had known ashore for decades. We are still good friends with everyone that was around the table that night though we have lost touch with all of Evans's work colleagues and our neighbors from that same period.

The worldwide network of cruising sailors is a unique and wonderful community. We have found that most sailors who "swallow the hook" and return ashore still find ways to keep faith with that community. You can do the same. Share what you have learned with others who are eager to go. Try to give those who will never go a glimpse of what it was like and how it changed you; perhaps they will be changed just a little by your experiences. Help others understand the most basic lesson that voyaging teaches—that ordinary, everyday people can do the most extraordinary, adventurous things. With a dream and a will, we can make things happen. We can change the world—or at least our little corner of it.

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APPENDIX 1
Additional Resources

PART I. THE ESSENTIAL INGREDIENTS

Chapter 1. Committed Crew

If you have access to the Internet, you can find literally hundreds of sites that cater to the cruising sailor. These include sailing schools, cruising associations, owners' associations, chat rooms, bulletin boards, and much more. In this section, I've listed a few resources from each category mentioned in this chapter that we have personal experience with or that are well known and well respected throughout the offshore sailing community.

Cruising Associations

- **Bluewater Cruising Association (BCA).** With chapters in Vancouver, Victoria, and Calgary, this Canadian cruising organization consists of "doners" helping "dreamers" to become "doers." Contact: 8886 Hudson Street, Vancouver BC V6P 4NZ, Canada; Phone: 877-214-4917; www.bluewatercruising.org.
- **Cruising Association.** Founded in 1908, the London-based Cruising Association represents the interests of cruising sailors worldwide, makes available up-to-date cruising information, and promotes cruising interests. Contact: CA House, 1 Northey Street, Limehouse Basin, London E14 8BT, UK; Phone: 44-(0)20-7537-2828; Fax: 44-(0)20-7537-2266; www.cruising.org.uk.
- **Seven Seas Cruising Association (SSCA).** This Florida-based organization has some 10,000 members and provides information on all facets of cruising, from the price of diesel in Tonga to the best anchorages in Chile, through the monthly *Commodores' Bulletin.* Anyone can join as an associate member and receive the bulletins. Click on Links on the home page and then on Cruiser's Favorite Links or Member Websites to find information on the cruising life. Contact: 2501 East Commercial Boulevard, Suite 201, Fort Lauderdale, FL 33308, USA; Phone: 954-771-5660; Fax: 954-771-5662; www.ssca.org.
- **Trans-Ocean.** Based in Germany, Trans-Ocean provides cruising information through its monthly magazine of the same name. It also provides a number of services to its members including low-cost international health insurance. Contact: Postfach 728, D-27457 Cuxhaven, Germany; Phone: 49-4721-51800; Fax: 49-4721-51874; www.transocean.org.

Offshore Sailing Instruction

- **Challenge Business.** Chay Blyth's British Steel Challenge boats were originally built to race the "wrong way" through the Southern Ocean with paying, amateur crews aboard. Some of these large steel boats (over 65 feet) have been "retired" to use for instruction. The Heavy Weather Sailing Techniques course offers crews a real chance of encountering gale-force winds and practicing heavy-weather tactics. Contact: Meridians House, 7 Ocean Way, Ocean Village, Southampton SO14 3TJ, UK; Phone: 44-(0)23-8071-5300; Fax: 44-(0)23-8023-7111; www.challenge business.com.
- **Mahina Expeditions.** John Neal and Amanda Swan-Neal combine adventure charters with sail training aboard their Hallberg-Rassy 46, *Mahina Tiare III*. John and Amanda have a combined total of over 400,000 offshore miles of experience. They offer courses in offshore passagemaking and provide instruction on all aspects of cruising from diesel maintenance to provisioning to preparing a first-aid kit. Contact: P.O. Box 1596, Friday Harbor, WA 98250, USA; Phone: 360-378-6131; Fax: 360-378-6631; www.mahina.com.
- **Orange Coast College School of Sailing and Seamanship.** Orange Coast College in Newport Beach, California, runs an extensive series of sail training courses ranging from dinghy sailing to offshore passagemaking. *Alaska Eagle*, a 65-foot IOR-designed racing boat and an entrant in one of the early

Whitbread races, serves as the platform for the offshore courses. Contact: 1801 West Coast Highway, Newport Beach, CA 92663, USA; Phone: 949-645-9412; Fax: 949-645-1859; www.occsailing.com.

Homeschooling

Searching on "homeschooling" and your country in any good Internet search engine will bring up dozens of sites with useful information. Although many of these are trying to sell course materials, the good ones will include degree requirements, curriculum information, and pointers on homeschooling as well as chat rooms and bulletin boards for parents.

- **American School.** For over 100 years, the American School has provided correspondence courses leading to diplomas in high (secondary) school. It offers over 70 subjects, and the tuition for a full four-year program (16 units of credit) including textbooks and study guides is about $1,200. Contact: 2200 East 170th Street, Lansing, IL 60438, USA; Phone: 800-531-9268, 708-418-2800; www.americanschoolofcorr.com.
- **Calvert Education Services.** With over 100 years of experience, Calvert provides everything you need to instruct your children from kindergarten through grade eight. Materials can now be submitted over the Internet, and for an additional fee, your child can also participate in interactive Internet classrooms for grades five through eight. Contact: 10713 Gilroy Road, Suite B, Hunt Valley, MD 21031, USA; Phone: 401-785-3400, 888-487-4652; www.calvertschool.org.
- **University of Nebraska-Lincoln Independent Study High School.** Since 1929, the University of Nebraska at Lincoln has offered a fully accredited, self-paced curriculum for high (secondary) school students leading to a diploma. It offers more than 160 courses in 14 subjects in print, online, and CD formats. Contact: P.O. Box 88400, Lincoln, NE 68588-8400, USA; Phone: 402-472-2175; Fax: 866-700-ISHS (866-700-4747), 402-472-1901; http://nebraskahs.unl.edu.

Crew Resources

- ***Changing Course: A Woman's Guide to Choosing the Cruising Life.*** Debra Ann Cantrell. Camden, Maine; London: International Marine, 2001.
- ***Cruising with Your Four-Footed Friends: How to Have a Happy Voyage with Your Cat or Dog.*** Diana Jessie. Port Washington, Wisconsin: Seaworthy Publications, 2003.
- **Cruiser Log, www.cruiser.co.za.** This site has links to dozens of cruisers' websites—one-stop shopping for locating people out there "doing it" and following their experiences.
- **Eileen Quinn CDs.** If you decide to go cruising, someday you'll listen to Eileen Quinn's music and say, "She's singing about my life." Her lyrics perfectly capture aspects of what it's really like. Contact: Phone: 800-Buy-My-CD (800-289-6923); www.eileenquinn.com.
- **Noonsite, www.noonsite.com.** This site is an excellent resource providing everything from information on clearance procedures by country to links to other cruisers. On the home page, click on General and then on Cruising Families to find a place for cruising families to link up with one another and for those who are thinking about cruising with kids to communicate with those already out there.

Online Cruising Forums (bulletin boards and discussion groups)

- ***Cruising World*, www.cruisingworld.com/new_forum.jsp**
- **CSBB Forum, www.cs-bb.com**
- **Seven Seas Cruising Association, www.ssca.org/sscabb/index.php**
- **Yachting and Boating World, www.ybw.com/forums** (run by the publishers of *Yachting World*, *Yachting Monthly*, and other UK boating magazines)

Chapter 2. Adequate Financing

Superyacht Schools

You'll find a list of schools worldwide offering courses that meet Maritime and Coastguard Agency (MCA) requirements at **www.jf-recruiting.com/information/yacht-crew-training-centres.asp**.

Search on the Internet under "superyacht crew certification" to find additional schools offering MCA training.

International Health Insurance

We have dealt with the following and know them to be reputable:

- **International Marine Insurance Services (IMIS).** Al Golden has been serving the insurance needs of voyaging sailors for two decades, and his son, Gary, is continuing in his footsteps. IMIS offers a full range of excellent health plans, many underwritten by Lloyd's. Contact: 462 Kent Narrows Way North, Grasonville, MD 21638-1022, USA; Phone: 800-541-4647, 410-827-3757; Fax: 410-827-3758; www.imiscorp.net.
- **Kuffel, Collimore & Co.** Originally designed to meet the health insurance needs of charter boat crews in the Caribbean, their Lifeboat Medical program also insures long-term liveaboard cruisers who spend at least six months of each year outside

the United States. Contact: 1761 South Naperville Road, Suite 105, Wheaton, IL 60187, USA; Phone: 877-335-1234, 630-221-6000; Fax: 630-221-1453; www.lifeboatmedical.com.

Additional options for health insurance include the following:

- **Alumni, professional, or cruising associations.** Some associations provide health insurance to their members for a reasonable fee. **Trans-Ocean (www.trans-ocean.org)**, the German cruising club (see the Cruising Associations section in the resources for Chapter 1), provides insurance to many of its members. **Divers Alert Network (DAN; www.diversalertnetwork.org)** offers coverage for diving accidents at a nominal cost, and its policies include air evacuation for any medical emergency if care is not available where the injury occurs. Since most insurance polices exclude diving-related accidents, DAN's insurance must be considered essential for anyone who dives.
- **Homeowner's and boat insurance.** Many boat and homeowner's insurance policies include provisions to cover medical expenses, and these are often sufficient to cover even a relatively high deductible on a health policy.
- **Local health insurance.** Those planning to stay in a foreign country for several months or a year should look into local health insurance. For example, Mexican coverage can be purchased for about half what an international policy would cost and provides better coverage.
- **Local emergency services.** Local emergency services may include air evacuation. Throughout much of the Caribbean, the organizations that make up the **Search and Rescue Charitable Foundation (SEARCH; www.caribbeansearchandrescue.freeservers.com)** organizations will airlift a person to the nearest hospital. These are volunteer organizations dependent on donations for funding. When clearing into a new country or entering a new cruising ground, ask the officials about search-and-rescue services available and what you might have to do to join.

For insurance in the United States, the Web is the best place to start. Search on "health insurance" or try **www.insure.com**.

Boat Brokerage Websites

There are literally hundreds of websites where used boats are listed for sail. I prefer the following for their size, ease of use, and extent of information about each vessel:

- **www.boatshow.com**
- **www.boattraderonline.com**
- **www.boat-world.com**
- **www.soundingsonline.com**
- **www.yachtworld.com**
- **www.ybw.com**

Chapter 3. A Bluewater-Capable Yacht

Information on Specific Boat Brands

These three books provide detailed information on ocean-proven designs:

- ***Practical Boat Buying.*** 6th ed. The editors of *Practical Sailor.* 2 vols. Norwalk, Connecticut: Belvoir Publications, 2003.
- ***Twenty Small Sailboats to Take You Anywhere.*** John Vigor. Arcata, California: Paradise Cay, 1999.
- ***Used Boat Notebook: From the Pages of* Sailing *Magazine, Reviews of 40 Used Boats Plus a Detailed Look at 10 Great Used Boats to Sail Around the World.*** John Kretschmer. Dobbs Ferry, New York: Sheridan House, 2002.

To find out about other boat brands:

- ***Cruising World,* www.cruisingworld.com.** All of *Cruising World*'s boat reviews are listed on the website. From the home page, click on Boats & Gear, then on Reviews and Previews.
- ***Practical Sailor,* www.practical-sailor.com.** Based on a *Consumer Reports*–type format, *Practical Sailor* tests equipment and boats and reports on their performance. The magazine is not dependent on advertising income, so its reporting is more objective than that of many sailing magazines. It has reviewed dozens of boats, both new and classic designs. Reprints can be purchased by going to the website and clicking on Boat Reviews; you can view a synopsis of any available article for free. Their *Practical Boat Buying* book, cited above, includes detailed reviews and owner interviews for 240 new and used boats in today's sailboat market.
- **Yachting and Boating World, www.ybw.com.** Click on Boat Reports on the home page and then search on the brands you are interested in. All reviews for that model from *Yachting World, Yachting Monthly,* and *Practical Boat Owner* will be displayed. You can order reprints of any of these articles.

Potential buyers of established brands can also contact owners' associations. Do an Internet search using the boat brand and "sailboat owners" or "owners" to locate these.

"Bargain" Boats

Those with very little money to spend on a boat may be able to find a bargain through one of the following alternatives:

- **Repossessed or abandoned boats.** Government agencies, banks, and harbor authorities end up with repossessed, confiscated, or abandoned boats. They often sell these at auction for cents on the dollar. Some of these sales can be found by searching the Internet, others only by word of mouth or notices in local papers. All the items for auction by the U.S. federal government can be found at www.treas.gov/auctions.

- **Insurance write-offs.** Insurance companies will often write off a storm-damaged boat even if the damage is fixable. To find these boats, go to the Caribbean or Mexico after a hurricane, and then contact the insurance company and start negotiating. Boats on the hard when the hurricane hit often suffer less damage but still get written off. To be successful, you have to move fast because there are boatyards that specialize in salvaging storm-damaged boats and they have direct links to the insurance companies.
- **Unlisted boats.** Many of the real bargain boats, the ones for under $50,000 that have been for sale for years, aren't listed with any broker. To find them, you need to go to an area like Seattle/Bellingham or the Chesapeake in the United States, Auckland in New Zealand, La Rochelle in France, or Southampton in the UK. Visit as many boatyards and marinas as you can. Walk the docks looking for homemade "for sale" signs, and search the hard stands for boats that appear to have been abandoned. Then find someone who can tell you who the owner is. Even if the boat is not for sale, make an offer.

Marine Surveyors

Several of the brokerage sites listed in the resources for Chapter 2 offer resources for finding a marine surveyor. Contact the following organizations to find a qualified marine surveyor:

- **The International Institute of Marine Surveying (IIMS).** This is an international organization with good representation in Australia and New Zealand, though many members may not survey small craft. Contact: 3 Stone Lane, Gosport, Hampshire, PO12 1SS, UK; Phone: 44-(0)23-9258-8000; Fax: 44-(0)23-9258-8002; www.iims.org.uk.
- **National Association of Marine Surveyors (NAMS).** Even less international than SAMS (see below), but has good coverage throughout the United States and Canada. Contact: P.O. Box 9306, Chesapeake, VA 23321-9306, USA; Phone: 800-822-6267, 757-638-9638; Fax: 757-638-9639; www.nams-cms.org.
- **Society of Accredited Marine Surveyors (SAMS).** Primarily a U.S. organization, membership is growing in many countries around the world. Contact: 4605 Cardinal Boulevard, Jacksonville, FL 32210, USA; Phone: 800-344-9077, 904-384-1494; Fax: 904-388-3958; www.marinesurvey.org.
- **Yacht Designers and Surveyors Association (YDSA).** A UK organization that certifies marine surveyors. Contact: The Glass Works, Penns Road, Petersfield GU32 2EW, UK; Phone: 44-(0)1730-710425; Fax: 44-(0)1730-710423; www.ybdsa.co.uk/ydsa.htm.

In addition, **www.boatsurvey.com** provides a worldwide database for finding marine surveyors that allows you to search by vessel type; however, not all the surveyors listed on the site are accredited.

Performance Information

- **U.S. Sailing Association, www.ussailing.org.** Go to www.ussailing.org/IMS to get individual IMS certificates of rated vessels and to order or download performance packages (polar diagrams and VMGs). The more limited but less expensive LPP/VPP summary for rated vessels can be ordered from the US Sailing online store (http://store.ussailing.org, then choose the Racing category). You can purchase the *Sailmakers' Listing of IMS Yachts* (formerly *Performance Characteristics Profile of the North American IMS Fleet*) from the online store by searching on the title using Advanced Search. Or you can call 800-877-2451, x636.
- **Royal Ocean Racing Club (RORC) Rating Office, www.rorcrating.com.** Although the RORC does not provide data through its website, you can contact the Rating Office, which may be able to help you get the information.

PART II. REFITTING AND EQUIPPING THE YACHT FOR BLUEWATER VOYAGING

Once you have decided what equipment you want to carry aboard, you will need to decide what brand to buy. Any piece of gear you consider for offshore voyaging should come from a company with worldwide servicing capabilities and a reputation for good customer response. Take along the manufacturer's list of recommended service providers when you leave. To assist you in your decision making, watch for equipment reviews and comparisons in the sailing magazines, read discussions on websites and sailing forums, and try to communicate directly with offshore cruisers. In addition, three sources provide useful information in sorting through which equipment is most appropriate for your vessel and which brands hold up best.

- ***Practical Sailor,* www.practical-sailor.com.** Since this publication is not dependent on advertising and seeks out real-world experiences from offshore sailors, it provides some of the most objective (though still limited, statistically speaking) conclusions available in the industry. You can subscribe at the website or contact: Subscription Department, P.O. Box 420235, Palm Coast, FL 32142-0235, USA; Phone: 800-829-9087.
- **SSCA Equipment Survey, www.ssca.org.** Every four years, the Seven Seas Cruising Association asks its members to complete an extensive questionnaire. The resulting survey covers all types of equipment—from abandon-ship kits to wind instruments. Satisfaction ratings and breakdown rates are reported by brand. Small sample sizes make some of the data questionable, but much of the information offers useful insights into product performance.
- **West Marine, www.westmarine.com.** The West Advisor articles in the West Marine catalog offer excellent advice on which types of equipment and which brands are designed to meet coastal versus offshore needs. Go to the website and click on West Advisor Articles, visit a West Marine store, or call 800-685-4838 to request a catalog.
- ***Yachting World* ARC coverage, www.yachting-world.com.** Every year, *Yachting World* looks at equipment winners and losers in that year's Atlantic Rally for Cruisers (ARC), giving statistics by brand on performance including failures. While most of the equipment is new and the test is only one (admittedly long) passage, the information is quite useful for identifying the new equipment leaders. The ARC gear test issue usually comes out in March or April.

Chapter 4. Upgrading Your Boat

Refit Resources

These are a few of the many resources available for refitting a boat that we have used and can recommend:

- ***Boatowner's Mechanical and Electrical Manual: How to Maintain, Repair, and Improve Your Boat's Essential Systems.*** 3rd ed. Nigel Calder. Camden, Maine: International Marine; London: Adlard Coles Nautical, 2005. The most comprehensive resource for fixing anything mechanical or electrical aboard.
- ***Don Casey's Complete Illustrated Sailboat Maintenance Manual.*** Don Casey. Camden, Maine: International Marine, 2006. Combines five of Don Casey's maintenance books, plus Peter Compton's book on diesel engines, into one and covers everything from hull and deck repair to canvas work. *Inspecting the Older Sailboat,* an excellent resource for evaluating older boats, is included in this compendium.
- ***The Elements of Boat Strength: For Builders, Designers, and Owners.*** Dave Gerr. Camden, Maine: International Marine; London: Adlard Coles Nautical, 2000. If you need to upgrade the basic structure of the boat or you want to evaluate whether the boat's structure is strong enough, this weighty reference will answer the question.
- ***Offshore Sailing: 200 Essential Passagemaking Tips.*** Bill Seifert with Daniel Spurr. Camden, Maine; London: International Marine, 2002. Dozens of ingenious ideas for making a boat safer and more comfortable at sea. Those you choose to include on your own boat will need to be incorporated into your refit.
- ***Spurr's Guide to Upgrading Your Cruising Sailboat.*** 3rd ed. Daniel Spurr. Camden, Maine: International Marine, 2006. A comprehensive refit resource from the editor-at-large of *Professional Boatbuilder* and former editor of *Practical Sailor.*
- ***This Old Boat.*** Don Casey. Camden, Maine; London: International Marine, 1991. An invaluable step-by-step guide to refitting an old boat from purchase to sailing away.

Safety Upgrades

- **"Complete ISAF Offshore Special Regulations"** from the International Sailing Federation can be downloaded at www.sailing.org/specialregs. The U.S. version, titled "ISAF Special Regulations Governing Offshore and Racing for Monohulls and Multihulls," can be purchased from US Sailing (www.ussailing.org), which also offers a version for cruising boats titled "Safety Recommendations for Cruising Sailboats."

Other

- **Freeman Marine** makes a variety of watertight hatches. Contact: 28336 Hunter Creek Road, Gold Beach, OR 97444, USA; Phone: 888-FREEMAN (888-373-3626), 541-247-7078; Fax: 541-247-2114; www.freemanmarine.com.
- The **Shaft Razor** is made by The Evolution Company. Contact: 12 Moran Drive, Unit 4, Rockland, ME 04841, USA; Phone: 207-593-9009; Fax: 207-563-9229; www.evolutionmarine.com.

Chapter 5. Sails and Sail Handling

- **ATN Spinnaker Sleeve, www.atninc.com/sleeve.html.** ATN has some useful products, including the Spinnaker Sleeve. Go to their home page to see what else they offer.
- **Facnor gennaker furler, www.facnor.com.** The furler we use is difficult to find outside of Europe. To locate a distributor in your country, go to the website and click on Facnor Distributors.
- **Sailrite, www.sailrite.com.** This company has anything you could need to build or repair a sail, or to do any sort of canvas work. They carry everything from the sticky-back sail material we use for spreader patches on our high-tech sails to heavy-duty sewing machines for canvas work. Check out their website, or request a catalog by calling 800-348-2769.

Chapter 8. Other Equipment: Navigation, Communications, and Comforts and Conveniences

Onboard Software

- **Onboard e-mail over high-seas radio.** Airmail, a program you can use to access e-mail over an SSB or a ham radio, can be downloaded from **www.airmail2000.com**. For ham users, **www.winlink.org** provides complete information on configuring to do e-mail through the radio. For SSB users, the relevant information can be found at **www.sailmail.com**.
- **Onboard e-mail over satellite phone.** Several Internet service providers (ISPs) cater to the satellite e-mail market. We have used MarineNet Wireless, **www.marinenet.net**. Quite a few of our friends use UUPlus, **www.uuplus.com**.
- **Position reporting.** Posting your position to a website during a passage allows friends and family to follow your progress. Ham users can report through Winlink using the Position Reporter link on **www.winlink.org**. SSB or satellite phone users can post positions through YotReps at **www.pangolin.co.nz/yotreps/index.php**.
- **Routing software.** There are a number of routing programs available. The most comprehensive—and expensive—is MaxSea **(www.maxsea.com)**, which not only reads electronic charts of any format and reads and interprets GRIBs, but also includes a Velocity Prediction Program that will find the best route for a given passage based on pilot chart wind predictions or based on GRIBs. The Virtual Passage program, which can be purchased at **www.virtualsail.com**, is very inexpensive and provides rudimentary routing based on pilot chart data.
- **SSCA *Commodores' Bulletins*, www.ssca.org.** The SSCA sells a CD with multiple years of bulletins in a searchable form. This is very useful for quickly finding information on different ports.
- **SkyMate Pro.** Promar Software developed this computerized nautical almanac with data through 2100. You can download a test version and order the registered version at **www.promarsoftware.com**.
- **Tide information.** Free shareware called **WxTide32, www.wxtide32.com** provides accurate worldwide coverage with more reporting stations than any other program we have seen.

PART III. LIVEABOARD SKILLS

Chapter 11. Liveaboard Essentials: What to Bring and How to Stow It

To purchase marine books and charts, you can visit your local chandlery or West Marine outlet. However, the following companies specialize in marine publications and will be able to help with both mundane and obscure requests:

- **Bluewater Books and Charts/Armchair Sailor, www.bluewaterweb.com.** These two bookstores specialize in guides, charts, and courtesy flags, but they also carry a wide range of sailing books. They offer excellent service and a worldwide knowledge and capability. Store locations: **Armchair Sailor**, 543 Thames Street, Newport, RI 02840, USA; Phone: 800-29CHART (800-292-4278), 401-847-4252; Fax: 401-847-1219. **Bluewater Books and Charts**, 1811 Cordova Road, Fort Lauderdale, FL 33316, USA; Phone: 800-942-2583, 954-763-6533; Fax: 954-522-2278.
- **Kelvin Hughes, www.bookharbour.com.** The largest stocklist of nautical books in the UK, plus yachting charts, logbooks, and just about every reference necessary for an offshore boat. Contact: Southampton Mail Order Department, Kilgraston House, Southampton Street, Southampton, Hampshire SO15 2ED, UK; Phone: 44-(0)23-8063-4911; Fax: 44-(0)23-8033-0014.
- **Reed's Nautical, www.reedsnautical.com.** Specialists in worldwide mail order of nautical books, calendars, prints, etc. Phone: 44-(0)126-477-1389 (overseas), 0845-644-1911 (UK).

Chapter 12. Managing Life Afloat

- **VoIP.** The following websites offer VoIP programs: **www.skype.com**, **www.echolink.org**, and **www.peerio.**

com. Mobile phone companies are entering the market, but they do charge for the service. This area is changing rapidly. Try searching on "VoIP" on the Internet, and you should find the current offerings.

- **PocketMail, www.pocketmail.com.** For the technologically challenged, PocketMail offers a usable e-mail solution.

Chapter 14. Galleywise

Cookbooks

In addition to "cruising" cookbooks, make sure to bring along a general reference book like the *Joy of Cooking* as well as some of your favorites from your kitchen ashore. The following books all have good information on the idiosyncrasies of floating galleys:

- ***The Care and Feeding of Sailing Crew.*** 3rd ed. Lin Pardey with Larry Pardey. Arcata, California, Paradise Cay, 2006. A day-by-day review of menus over the course of a passage from Japan to Alaska. Offers a wealth of information on everything from baking bread to stowing veggies, all told with good humor in the context of a rough-weather passage aboard a 26-foot boat. The recipes are a bit dated as they rely less on fresh veggies and more on canned goods than would be necessary on a larger boat.
- ***The Cruising Chef Cookbook.*** 2nd ed. Michael Greenwald. Arcata, California: Paradise Cay, 2000. Again, a bit dated, but has lots of helpful information and some really wonderful recipes.
- ***The Essential Galley Companion: Recipes and Provisioning Advice for Your Boating Adventure.*** Amanda Swan-Neal. Friday Harbor, Washington: Mahina Expeditions Publishing, 1999. Talks about everything that matters from storing fruits and vegetables to catching fish. Recipes are easy to make with long-lasting ingredients that can be found in almost any country.

Canned and Dried Food

Searching on the Internet on "freeze dried food" will give you thousands of options. Make sure to buy some and try them before you leave. Following are sources we have used ourselves or that have been highly recommended by several cruising friends:

- **Brinkman Turkey Farms.** You can order high-quality canned turkey, beef, and chicken (with or without salt) in 28-ounce cans. They also offer pork, ground beef, turkey, and chicken broth, as well as several types of prepared meals. Contact: 16314 U.S. Route 68, Findlay, OH 45840, USA; Phone: 419-365-5127; Fax: 419-365-1284; www.brinkmanfarms.com.
- **Freeze-dried foods.** A few companies worth special mention are: **AlpineAire Foods**, TyRy, Inc., P.O. Box 1799, Rocklin, CA 95677, USA; Phone: 800-322-6325, 866-322-6325, 916-624-6060; Fax: 916-624-1604; www.alpineairefoods.com; **Mountain House**, P.O. Box 1048, Albany, OR 97321, USA; Phone: 800-547-0244; Fax: 541-812-6601; www.mountainhouse.com; **Backpacker's Pantry**, 6350 Gunpark Drive, Boulder, CO 80301-3337, USA; Phone: 303-581-0518; Fax: 303-581-9288; www.backpackerspantry.com.
- **Pressure-cooker canning resources.** The website **www.homecanning.com** offers information and advice for getting started as well as a complete line of specialty products to make things easier. The ***Complete Guide to Home Canning and Preserving*** by the U.S. Department of Agriculture (2nd rev. ed. Mineola, New York: Dover Publications, 1999; or download a copy at http://foodsafety.cas.psu.edu/canningguide.html) provides an overview of everything you need to know to get started home canning anything from vegetables to stews.

Chapter 16. Staying Healthy: Being Your Own Doctor

General Information

- **Centers for Disease Control (CDC), www.cdc.gov.** The CDC offers a range of services for Americans traveling abroad. Its publication the Yellow Book, *Health Information for International Travel*, is published every two years and contains detailed information on all aspects of traveler's health. The latest edition as of this writing is for 2005–06. You can review it and/or order your own copy online from the Travelers' Health page. That link also contains detailed information by country on vaccinations, health threats, and suggested precautions. Phone (general information): 800-CDC-INFO (800-232-4666); Traveler's Health Automated Information Line: 877-FYI-TRIP (877-394-8747).
- **International Association of Medical Assistance to Travellers (IAMAT), www.iamat.org.** This organization of English-speaking doctors of all nationalities provides services to travelers. Anyone can join IAMAT, and there is no charge for membership, although a small donation is requested. The organization will help travelers find an English-speaking doctor anywhere in the world. Its website includes some traveler's health links (click on Useful Links) and one of the best summaries of malaria prevention I've seen (click on Download Charts and then on

Protect Yourself Against Malaria). IAMAT has offices in the U.S., Canada, New Zealand, and Switzerland.

- **The Travel Doctor (TMVC), www.tmvc.com.au.** With dedicated clinics in most major cities of Australia and New Zealand and a growing list of international associates in North America, Europe, Africa, and Asia, this organization offers the most up-to-date international health advice and medical services to those intending to travel. Its website contains a malaria fact sheet with the latest thinking in Australia and New Zealand on preventing and treating the disease (click on Staying Healthy, then on Fact Sheets, and then on Malaria). We used its services in Australia and New Zealand for vaccinations, advice on updating our medical kit, and prescriptions. The staff was very knowledgeable and helpful. It has clinics in South Africa, Namibia, and Tanzania, which I would go to before going to local hospitals.

Offshore Medical Courses and Resources

If you cannot find a medical course designed for the needs of offshore yachts, wilderness medical courses are the next best alternatives, with Wilderness First Responder courses being ideal. These have become the standard for backcountry guides, survival course instructors, park rangers, and search-and-rescue teams. The time investment to take the course is much higher—often over a week—but you can be sure your crew will have a competent person aboard to render medical help if you ever need it.

Several companies offer medical advice 24/7. They can be reached by phone or e-mail, and some can be reached directly by high-frequency radio, or you can be patched through to a phone line in an emergency. If you have anyone on board with serious medical problems, it would be well worth paying for one of these services.

- **Marine Medical International, www.marmed.com.** This organization offers an Emergency Medical Training Program geared toward the needs of professional yacht crews taught by experienced paramedic instructors and nurses who are fully trained in all aspects of offshore emergency medical treatment. It partners with Maritime Health Services for 24/7 coverage. It has offices in Fort Lauderdale, Florida; Antibes, France; and New Zealand.
- **MedAire, www.medaire.com.** This subscription service provides global access to emergency room physicians 24 hours a day. It also offers marine medical training courses and medical kits designed by emergency response professionals and built specifically for the maritime environment. In the United States, contact: 80 East Rio Salado Parkway, Suite 610, Tempe, AZ 85281, USA; Phone: 480-333-3700; Fax: 480-333-3592. In Europe, contact: Farnborough Airport, Hampshire, GU14 6XA, UK; Phone: 44-(0)1252-517-951; Fax: 44-(0)1252-373-299.
- ***Ocean Navigator* seminars, www.oceannavigator.com.** *Ocean Navigator* regularly runs offshore medical seminars including "Introduction to Offshore Emergency Medicine" and "Your Offshore Marine Medical Kit and How to Use It." Click on Seminars on the home page for current information.
- **Radio nets.** Most of the radio net operators around the world have organized links to medical personnel who will offer advice over the radio. The response will rarely be immediate and could take up to half a day depending on time zones.
- **Wilderness Medical Associates.** Offers wilderness medical courses from Wilderness First Aid through Wilderness First Responder and Wilderness EMT to Outward Bound instructors, search-and-rescue organizations, camps, and travel organizations. With multiple courses and multiple locations throughout North America, these courses should be within reach for any Americans or Canadians preparing to go cruising. Contact: 400 Riverside Street, Suite A-6, Portland, ME 04103, USA; Phone: 888-WILDMED (888-945-3633), 207-797-6005; Fax: 207-797-6007; www.wildmed.com (www.wildmed.ca for Canada).
- **Wilderness Medicine Institute of NOLS (National Outdoor Leadership School).** For over a decade, WMI has been training students around the world. Courses cover the gamut from Wilderness First Aid through Wilderness First Responder and Wilderness EMT. Many dates and course locations make it possible to find something nearby. Contact: 284 Lincoln Street, Lander, WY 82520, USA; Phone: 866-831-9001; Fax: 307-335-2355; www.nols.edu/wmi.

Finally, if you think you might have trouble organizing your medical kit, Medical Sea Paks from Fieldtex Products **(www.firstaidpak.com)** offer a well-organized, simple alternative for creating a medical kit. West Marine carries similar medical kits for boaters. Make sure to buy the most extensive medical kit available, one meant for self-sufficiency offshore.

Onboard Medical References

- **First-aid references.** There are lots of excellent references available. A quick search on Amazon will turn up dozens. Two that have a good reputation are: *First Aid Taking Action.* National Safety Council. Dubuque, Iowa: McGraw-Hill Higher Education, 2007; *First Aid Manual: The Authorised Manual of the UK's Leading First Aid Providers*. 8th ed. London: Dorling Kindersley, 2002. The best wilderness first-aid book we have found is: *The Outward Bound Wilderness First-Aid Handbook*. Rev. and updated ed. Jeffery Isaac. New York: Lyons Press, 1998.

- **General reference book on symptoms.** Two to try are: *American Medical Association Family Medical Guide*. 4th ed. Hoboken, New Jersey: Wiley, 2004; and *Complete Guide to Symptoms, Illness and Surgery*. 5th ed. H. Winter Griffith, M.D. New York: Perigee Trade, 2006.
- **Shipboard medical reference.** We carry *The Ship's Medicine Chest and Medical Aid at Sea*, the standard text used by the U.S. Merchant Marine (you can download a copy at www.uscg.mil/hq/G-W/g-wk/wkh/smc).
- **Traveler's information.** Books in the Lonely Planet's Healthy Travel Guide series provide information on healthy travel by region; www.lonelyplanet.com.

Exercise Resources

The **X-iser** shown in Figure 16-1 can be obtained from X-iser at P.O. Box 406, Sellersville, PA 18960, USA; Phone: 617-510-6355; Fax: 617-663-6044; www.xiser.com.

Chapter 17. Staying Challenged: Following Your Heart

No matter what takes your fancy, you will be able to find dozens of books on the subject to bring along. We have seen the following on many cruising boats—if they are in your area of interest, you won't be disappointed.

- ***The Cruiser's Handbook of Fishing.*** Scott Bannerot and Wendy Bannerot. Camden, Maine; London: International Marine, 2000.
- ***Moon Handbooks South Pacific.*** 8th ed. David Stanley. Emeryville, California: Avalon Travel Publishing, 2004.
- ***The Marlinspike Sailor.*** Hervey Garrett Smith. Camden, Maine: International Marine, 1993.
- ***Seabirds: An Identification Guide.*** Peter Harrison. London: Christopher Helm, 1983; Boston: Houghton Mifflin, 1991.
- ***Seabirds of the World: A Photographic Guide.*** Peter Harrison. London: Christopher Helm, 1987; Princeton, New Jersey: Princeton University Press, 1996.
- ***The Stars: A New Way to See Them.*** H. A. Rey. London: Chatto and Windus, 1975; Boston: Houghton Mifflin, 1976.
- ***Celestial Navigation for Yachtsmen.*** Rev. ed. Mary Blewitt. Camden, Maine: International Marine, 1995; London: Adlard Coles Nautical, 1997.

Finally, the ***Smithsonian Handbooks*** offer some of the best guides to everything from flowers to shells. Go to Amazon (www.amazon.com; www.amazon.co.uk) and search on Smithsonian Handbooks and your area of interest. The Smithsonian Handbook titled *Whales, Dolphins and Porpoises* by Mark Carwardine provides a great deal of information on behavior, biology, and life cycles, not just the standard identification material.

PART IV. SHORTHANDED PASSAGEMAKING SKILLS

Chapter 19. Weather Basics and Onboard Forecasting

Weather References

These are organized from the most basic and easy to understand to the most complex and esoteric.

- ***Weather Maps: How to Read and Interpret All the Basic Weather Charts.*** 2nd ed. Peter R. Chaston. Kearney, Missouri: Chaston Scientific, 1992.
- ***An Introduction to Satellite Image Interpretation.*** Eric D. Conway and the Maryland Space Grant Consortium. Baltimore: Johns Hopkins University Press, 1997.
- **David Burch's Starpath Weather Trainer, www.starpath.com.** An interactive software program for learning how to forecast weather at sea. Click on the Marine Weather Section on the home page.
- ***Ocean Navigator,* www.oceannavigator.com.** *Ocean Navigator* offers seminars in weather forecasting including "Understanding Meteorology and Marine Weather" several times per year. Click on Seminars for current information.
- ***Mariner's Weather Handbook: A Guide to Forecasting and Tactics.*** Steve and Linda Dashew. Tucson, Arizona: Beowulf, 1998. For those interested in pushing to the next level of understanding, Dashew's book provides a comprehensive study of weather from the mariner's perspective with an emphasis on 500-millibar upper-air charts and weather routing.
- **Maritime Institute of Technology and Graduate Studies.** This organization offers a five-day course called Heavy Weather Avoidance intended for masters, mates, and pilots of offshore merchant ships. The course emphasizes the use of the 500-millibar upper-air charts to determine primary and secondary storm tracks. Contact: 692 Maritime Boulevard, Linthicum Heights, MD 21090, USA; Phone: 410-859-5700; Fax: 410-989-3206; www.mitags.org.
- **"Hurricane Force Extratropical Cyclones"** by Joseph M. Sienkienowicz, Joan M. Von Ahn, and Gregory M.

McFadden. An examination of HF extratropical lows and the use of new methods to detect them. It can be downloaded at http://ams.confex.com/ams/pdfpapers/94332.pdf.

Weather-Related Software

- **GRIBs.** GRIB files can be downloaded from several different sites on the Internet, including **www.globalmarinenet.net**, **www.navcenter.com**, and **www.raymarine.com**. Each of these sites includes an explanation of how GRIB files work and how to access them through that site, and provides software for reading the GRIB files once downloaded. At **www.sailmail.com** under Downloads you can download the AirMail WeatherFax Companion, which includes a GRIB viewer.
- **Weather fax.** The website **www.xaxero.com** offers weather fax software and demodulators for connecting the high-seas radio to the laptop computer to download faxes. Mscan Meteo fax software can be purchased at **www.mscan.com**. The AirMail WeatherFax Companion (available through Downloads at **www.sailmail.com**) remotely controls your radio to pick up weather fax broadcasts according to a schedule of preprogrammed times and frequencies (assuming you have a radio with a supported interface such as the Icom 710).
- **NOAA text forecasts.** There are a couple of ways to receive high-seas forecasts in text format via high-frequency radio or satellite phone. For an easy explanation, go to **www.sailmail.com**, click on SailMail Primer and go to Frequently Asked Questions. NOAA also has the information at **http://weather.noaa.gov/pub/fax/robots.txt**.

Weather Websites

Search on marine weather forecasting on the Internet and you will get hundreds of sites. Every cruiser has their favorites. The following are the ones we prefer because they are marine oriented, global, in English, and easy to use:

- **www.buoyweather.com.** Provides weather buoy data worldwide with real time reporting of wave heights and wind speeds. Their subscription service provides detailed information for your region via e-mail updates.
- **www.nws.noaa.gov/os/marine/home.htm.** You'll need to spend some time to learn your way around this site and bookmark your favorite links.
- **www.ndbc.noaa.gov.** The National Data Buoy Center has data on conditions at hundreds of ocean buoys worldwide. Go to the website and click on the map to see the location of available buoys. Buoy data can be downloaded from this site.
- **https://www.navo.navy.mil.** Click on Online Products and start exploring.
- **www.oceanweather.com.** Click on Current Marine Data and you'll get a map of the world.

A few sites with weather links are:

- **www.heatherk.com** (click on Weather Links)
- **www.ocean-pro.com**
- **http://cirrus.sprl.umich.edu/wxnet2** (click on Weather Software or Software for links to free weather-related software)

Make sure to take advantage of each country's weather service. Most countries have extensive and easy-to-use sites for marine weather.

Chapter 20. Preparing for Passage

Information on Formalities by Country

Most countries have customs and immigration websites in English that detail information on visas, clearance procedures, cruising permits, and quarantine restrictions. These vary a great deal in terms of organization and ease of use, but they are worth checking to verify what you find out through yachting sources.

Summary information for yachts can be obtained from the following:

- **Noonsite, www.noonsite.com.** Click on Countries for detailed and up-to-date information on visa requirements and clearance procedures by country.
- **Seven Seas Cruising Association, www.ssca.org.** The *Commodores' Bulletins* provide information on the clearance procedures and requirements for various countries. The searchable CD with multiple years of bulletins allows information to be looked up by country.

Information on U.S. Customs procedures can be found at **www.customs.gov**. You can download a copy of Customs Form 1300, "Vessel Entrance or Clearance Statement" by clicking on Forms at the top of the page. The U.S. immigration website **(www.uscis.gov)** is particularly user-*un*friendly, though they do have a downloadable document that explains the process. A straightforward discussion of the types of visas available can be found at **http://www.expatfocus.com/expatriate-usa-visas-residency**.

Gulf Stream Charts

- **Jenifer Clark's Gulf Stream, http://users.erols.com/gulfstrm.** Jenifer Clark spent 25 years charting the Gulf Stream for NOAA until her position was cut in 1995. Now she offers charts that show the north wall of the Gulf Stream, warm and cold eddies, shelf water, continental slope water, and so on.
- **U.S. Navy, https://www.navo.navy.mil.** Charts are posted daily to this website. Click on Online Prod-

ucts on the home page. If you can't find your way through, search on Google or go to one of the many weather websites linked to the Navy site, such as **www.heatherk.com/WeatherLinks/USNavyCharts.html**.

Chapter 21. Basic Passage Routines

To download a copy of the COLREGS (International Regulations for Prevention of Collisions at Sea) go to **www.navcen.uscg.gov** and click on Navigation Rules.

Chapter 22. Heavy Weather

Heavy-Weather References

- ***Adlard Coles' Heavy Weather Sailing.*** 5th ed. Peter Bruce. London: Adlard Coles, 2004. Although the latest edition offers a well-thought-out overview of storm tactics and a good collection of case histories, we still have an affection for the original K. Adlard Coles edition of this classic.
- ***Drag Device Data Base: Using Parachutes, Sea Anchors, and Drogues to Cope with Heavy Weather.*** 4th ed. Victor Shane. Summerland, California: Para-Anchors International, 1998. This is a compendium of over a hundred case studies of storm situations where crews deployed a drag device, either a drogue or a sea anchor. Reading this will make you aware of the incredible variety of things that can and will go wrong in survival storms, but will demonstrate that the vast majority of boats and people caught in survival storms do, in fact, survive.
- ***Fastnet, Force 10.*** Rev. ed. John Rousmaniere. New York: W. W. Norton, 2000. This classic about a killer storm reads like a novel. The lessons learned had a major impact on both yacht design and storm tactics.
- **"Investigation of the Use of Drogues to Improve the Safety of Sailing Yachts,"** U.S. Coast Guard, 1987. The detailed report of the tank testing of various drag devices including the prototype for the Series drogue. It offers a number of useful insights into the behavior of different hull forms when tank tested in breaking waves. You can view it by going to www.sailrite.com/techindex.htm and clicking on Coast Guard Series Drogue Report or download it from www.jordanseriesdrogue.com; the latter site also includes video footage of the tank testing as well as one amazing clip taken from a Coast Guard helicopter of a 64-foot ketch being hit by a breaking wave in the Gulf Stream.
- **"The NSW State Coroner's Inquest into the 1998 Sydney to Hobart Yacht Race."** This is the document summarized by Evans in the 1998 Sydney-to-Hobart Race: A Postmortem sidebar in Chapter 22; it makes fascinating reading. You can find a copy at www.equipped.org/sydney-hobart/default.htm.
- ***The 1994 Pacific Storm Survey: The Boats Which Survived and the Lessons Learned.*** Kim Taylor. Auckland, New Zealand: Captain Teach Press, 1996. This self-published pamphlet summarizes the major tactics and outcomes for the 20 crews Taylor was able to get information from in the aftermath of the storm. Though we do not agree with all of his conclusions, the catalog of case studies in real survival storm conditions is very useful. Contact: Boat Books Ltd., 22 Westhaven Drive, Auckland, NZ; Phone: (64-9)-358-5691; Fax: (64-9)-358-5817; www.boatbooks.co.nz.
- **The Wolfson Unit of Southampton University.** This is the preeminent tank test facility in the world and has been at the center of research on stability in sailing vessels since the 1979 Fastnet Race. To see a list of their published papers, click on Further Details on their home page. Most of these have been commissioned by clients, and the information in them is proprietary. The original tank testing that led to the basic rules of monohull stability have been included in all the editions of *Heavy Weather Sailing* (see above). To find out if a paper you are interested in is available for distribution to the public, contact: Wolfson Unit MTIA, School of Engineering Sciences, University of Southampton, Highfield, Southampton SO17 1BJ, UK; Phone: 44-(0)23-8058-5044; Fax: 44-(0)23-8067-1532; www.wumtia.soton.ac.uk.

Contact Information for Drag Devices

- **Delta drogue.** Para-Tech Engineering Company manufactures a parachute sea anchor and the Delta drogue, a reversed "cone" made out of fabric with specially designed vents. Contact: 2117 Horseshoe Trail, Silt, CO 81652, USA; Phone: 800-594-0011, 970-876-0558; Fax: 970-876-5668; www.seaanchor.com.
- **Galerider drogue.** Hathaway, Reiser and Raymond designed and manufactures the Galerider, a webbing "bowl" with wire rim. Contact: 184 Selleck Street, Stamford, CT 06902, USA; Phone: 203-324-9581; Fax: 203-348-3057; www.hathaways.com.
- **Jordan Series drogue.** Instructions for constructing your own drogue are included in the Coast Guard report listed in the Heavy-Weather References section above. Sailrite (www.sailrite.com) sells kits

for making the cones; click on Online Shopping and search under "drogue" or call 800-348-2769.

A kit with the cones already made or a finished series drogue can be purchased from **Ace Sailmakers** at 3-D Colton Road, East Lyme, CT 06333, USA; Phone and fax: 860-739-5999; www.acesails.com.

- **Parachute anchors.** Following is contact information for different parachute manufacturers: **Fiorentino Para Anchor**, 1048 Irvine Avenue #489, Newport Beach, CA 92660, USA; Phone: 800-777-0732, 949-631-2336; Fax: 949-722-0454; www.para-anchor.com; **Para-Anchors Australia**, P.O. Box 1377, Sale, Victoria 3850, Australia; Phone: 61-(0)3-5144-1244; Fax: 61-(0)3-5144-1320; www.para anchors.com.au; **Para-Tech Engineering** (see Delta drogue listing above).
- **Seabrake.** The Australian-made Seabrake consists of a hard-shelled, torpedo-shaped drogue meant to be towed off the stern. Contact: P.O. Box 501, Merimbula, New South Wales 2548, Australia; Phone: 61-(0)2-4324-3212; www.seabrake.com.

Chapter 23. Toward Self-Reliance: Managing Emergencies at Sea

- **Jury-rudder solutions.** Some innovative jury-rudder designs can be found at **www.well.com/user/pk/PCrudder-04.htm**.
- **Piracy websites.** Try **www.noonsite.com/General/Piracy** and **www.imo.org/home.asp** (click on Safety and then Piracy and armed robbery against ships).

PART V. FOREIGN SAVVY

Chapter 25. Upon Arrival

- **Information on clearance and customs regulations by country.** See the Information on Formalities by Country section in the resources for Chapter 20 above.
- **Cruising bulletin boards.** See the Online Cruising Forums section in the resources for Chapter 1.

APPENDIX 2

Conversions

TABLE A2-1. LENGTH CONVERSIONS		
Unit	**Symbol/Abbreviation**	**Relation to Other Units**
mil (UK: thou)	mil	≡ 0.001 in. = 10^{-3} in = 2.54×10^{-5} m
inch	in.	≡ $^{1}/_{36}$ yd = 25.4 mm
U.S. survey inch	in.	≡ $^{1}/_{12}$ U.S. survey foot = $^{100}/_{3,937}$ m ≈ 25.400051 mm
foot	ft.	≡ 12 in = 0.3048 m
foot (American; U.S. Survey)	ft. (U.S.)	≡ $^{1,200}/_{3,937}$ m ≈ 0.304800 610 m
cubit		≡ 18 in. = 0.4572 m
yard	yd.	≡ 3 ft. = 0.9144 m
fathom	fth	≡ 6 ft. = 1.8288 m; (sometimes ≡ $^{1}/_{1,000}$ nm = 1.852 m)
cable length (International)		≡ $^{1}/_{10}$ nm = 185.2 m
cable length (Imperial)		≡ 608 ft. = 185.3184 m
cable length (U.S.)		≡ 720 ft. = 219.456 m
mile	mi.	≡ 1,760 yd. = 5,280 ft. = 1,609.344 m
mile (American; Statute; U.S. Survey)	mi.	≡ 5,280 ft. (U.S.) ≈ 1,609.347219 m
nautical mile (International)	nm; NM	≡ 1,852 m = 6076.11549 ft. ≈ 1.1508 statute miles
nautical mile (Admiralty)	nm (Adm); NM (Adm)	≡ 6,080 ft. = 1,853.184 m

TABLE A2-2. AREA CONVERSIONS		
Unit	**Symbol/Abbreviation**	**Relation to Other Units**
square inch	sq. in.	≡ 1 in.^{2} = 6.4516×10^{-4} m^2 = 0.0654 cm^2
square foot	sq. ft.	≡ 1 ft.^{2} = 9.290×10^{-2} m^2 = 929.03 cm^2
square yard	sq. yd.	≡ 1 yd.^{2} = 0.836 m^2

TABLE A2-3. VOLUME CONVERSIONS

Unit	Symbol/Abbreviation	Relation to Other Units
teaspoon (Canadian)	tsp.	≡ 1/6 fl. oz. ≈ 4.736 mL
teaspoon (U.S.)	tsp.	≡ 1/6 U.S. fl. oz. = 4.929 mL
teaspoon (metric)		≡ 5 mL
tablespoon (Canadian)	tbsp./tbs.	≡ 1/2 fl. oz. = 14.207 mL
tablespoon (U.S.)	tbsp./tbs.	≡ 1/2 U.S. fl. oz. = 14.787 mL
tablespoon (metric)		≡ 15 mL
tablespoon (Imperial)	tbsp./tbs.	≡ 5/8 Imp. fl. oz. = 17.758 mL
cubic inch	cu. in.	≡ 1 $in.^3$ = 16.387064 mL
fluid ounce (Imperial)	fl. oz. (Imp)	≡ 1/160 gal. (Imp.) = 28.413 mL
fluid ounce (U.S.)	fl. oz. (U.S.)	≡ 1/128 gal. (U.S.) = 29.574 mL
cup (Canadian)	c (Canada)	≡ 8 fl. oz. (Imp.) = 227.3045 mL
cup (U.S.)	c (U.S.)	≡ 1/16 gal. (U.S.) = 236.588 mL
cup (metric)	c	≡ 250 mL
pint (U.S. fluid)	pt. (U.S. fl)	≡ 1/8 gal. (U.S.) = 473.176 mL
pint (U.S. dry)	pt. (U.S. dry)	≡ 1/4 bushel (U.S. level) = 550.610 mL
pint (Imperial)	pt. (Imp.)	≡ 1/8 gal. (Imp.) = 568.261 mL
quart (U.S. fluid)	qt. (U.S.)	≡ 1/4 gal. (U.S. fl.) = 0.946 L
quart (U.S. dry)	qt. (U.S.)	≡ 1/32 bushel (U.S. level) = 1/4 gal. (U.S. dry) = 1.101 L
quart (Imperial)	qt. (Imp.)	≡ 1/4 gal. (Imp.) = 1.137 L
gallon (U.S. dry)	gal. (U.S.)	≡ 1/8 bu (US level) = 4.405 L
gallon (Imperial)	gal. (Imp.)	≡ 4.546 L
cubic yard	cu. yd.	≡ 27 cu. ft. = 0.765 m^3
displacement ton	DT or dT	≡ 35 cu. ft. = 0.991 m^3
freight ton	FT	≡ 40 cu. ft. = 1.133 m^3

TABLE A2-4. MASS CONVERSIONS

Unit	Symbol/Abbreviation	Relation to Other Units
ounce (avoirdupois)	oz. av	≡ 1/16 lb. = 28.350 g
pound (avoirdupois)	lb. av	≡ 7,000 grains = 0.45359237 kg
pound (metric)		≡ 500 g
stone	st	≡ 14 lb. av = 6.35029318 kg
short ton	sh tn	≡ 2,000 lb. = 907.18474 kg
tonne (mts unit)	t	≡ 1,000 kg
long ton (U.S.) or ton (Imperial)	long tn or ton	≡ 2,240 lb. = 1,016.0469088 kg

TABLE A2-5. SPEED CONVERSIONS

Unit	Symbol/Abbreviation	Relation to Other Units
miles per hour	mph	≡ 1 mi./h = 0.447 m/s
knot	kn	≡ 1 nm/h = 1.852 km/h ≈ 0.514 m/s
knot (Admiralty)	kn	≡ 1 NM (Adm)/h = 1.853 km/h ≈ 0.515 m/s

TABLE A2-6. TEMPERATURE CONVERSIONS

Unit	Symbol	Relation to other units
degrees Celsius	°C	°C = 5/9 (°F − 32); 0.556 (°F − 32)
degrees Fahrenheit	°F	°F = 9/5 × °C + 32; 1.8 × °C + 32

APPENDIX 3

Performance Measurements Explained

Over the years, naval architects have created various ratios designed to quantify different aspects of yacht design. Table A3-1 summarizes several of these ratios, the formulas to calculate them, and typical ranges.

TABLE A3-1. CALCULATION AND INTERPRETATION OF PERFORMANCE RATIOS

Ratio	Formula	Range	High Value Implies	Low Value Implies
Displacement to length (DLR)	$(D \div 2{,}240) \div (0.01 \times LWL)^3$	From about 50 (very light) to above 450 (very heavy) for the boat's length	• High wave-making drag • Speed constrained by LWL • Slow, comfortable motion • Good weight-carrying ability • Large swell won't throw boat around • Passive tactics in all but survival seas	• Low wave-making drag • Can surf faster than hull speed • Fast, less comfortable motion • Easily overloaded • Large swell may throw boat around • Active tactics in large seas
Sail area to wetted surface area (SA/WSA)	$SA \div WSA$	From about 2 (little sail area) to about 3.5 (lots of sail area) for the boat's wetted surface	• Little friction at slow speeds • Excellent light-air performance • Responsive to puffs • Accelerates quickly • Easily driven with minimal sail area	• Lots of friction at slow speeds • Hard to get moving in light air • Slow to respond to puffs • Slow to accelerate • May need to motor frequently in light air
Sail area to displacement (SA/D)	$SA \div (D \div 64)^{2/3}$	From about 12 (little sail area) to about 35 (lots of sail area) for the boat's displacement	• Good sailing performance in all winds • Responsive to wind changes • Accelerates quickly in waves/puffs • Could be knocked down by squall	• Hard to get moving in moderate winds • Sluggish in wind changes • Slow to respond to waves/puffs • Unlikely to be knocked down by squall
Length to beam (L/B)	$LWL \div BWL$	From 2.5 (short, wide) to over 5 (long, narrow)	• Low wave-making drag • Easy to steer—balanced and stable • Low initial stability, may be tender • Not much space below	• High wave-making drag • More work/motion to steer • High initial stability, stiff • Spacious accommodations and stowage
Ballast	$B \div D$	From 30% to 50%	• Stiff boat that can carry a lot of sail • Extremely stable; hard to knock down • Good windward performance • Quicker, less comfortable motion	• More tender boat; must be reefed early • Less stable; more prone to knockdown • Poor windward performance • Slower, more comfortable motion
Motion comfort	$D \div [0.65 \times (0.7\ LWL + 0.3\ LOA) \times BWL^{1.33}]$	From less than 20 (very uncomfortable) to 50 (very comfortable)	• Spacious accommodations • Slow, comfortable motion • Easy to move around on, sleep at sea	• Not much space below for size • Fast, less comfortable motion • Hard to move around, sleep at sea

Key:	Typical of traditional voyagers	(white)	Typical of cruising "sleds"	(gray)

BWL = beam at the waterline in feet (can approximate with 90% of maximum beam)
D = IMS displacement in pounds
LWL = length at the waterline in feet
SA = working sail area, defined as total area of main and mizzen (including roach) plus area of foretriangle ignoring any overlap, in square feet
WSA = wetted surface area of immersed hull, rudder, and keel (not including centerboard) in square feet
B = weight of ballast in pounds

Unfortunately, comparing different boats using these ratios can be problematic due to a lack of consistency in reported numbers. Boatbuilders tend to overstate sail area and understate displacement in order to make the ratios look better. For instance, instead of half-load displacement—the displacement with half-full tanks and half a load of supplies—many builders report light-ship displacement—the displacement of the vessel as shipped from the builder with no stores, fuel, or supplies aboard, and, in most cases, without sails, ground tackle, and most of the equipment the boat will carry when offshore. Even half-load displacement does not include much of the weight a cruising boat will carry, such as generators, extra batteries, refrigeration, furling gear, and so on.

Therefore, although published figures can be used to roughly classify boats into different categories, they should not be used to closely compare the performance of two similar boats. That requires a set of numbers all calculated in exactly the same way. Throughout Chapter 2 and this appendix, I have relied on US Sailing's *Sailmakers' Listing of IMS Yachts* (formerly *Performance Characteristics Profile of the North American IMS Fleet*; see the Performance Information section in the resources for Chapter 3 in Appendix 1). For every boat measured under IMS, this booklet tabulates key measures, including displacement, waterline length, working sail area, and so on; computes DLR, SA/D, SA/WSA, and L/B ratios for each boat; and provides useful stability data.

Even the IMS data have drawbacks. IMS displacement is the displacement of the boat in IMS measurement trim, which means set up as the boat will be raced with at least two batteries, 275 pounds of ground tackle, and basic safety equipment, but with empty tanks and no stores. Boats of the same design can vary in displacement by several thousand pounds depending on construction details and whether or not they carry roller furling, radar arches, generators, and so on. Still, this is the best and most consistent source of data across the widest number of production boats that I have found.

Some simplified dynamics of sailing performance help clarify what the ratios tell us. At low speeds, the friction of the water against the boat's wetted surface determines the amount of effort required to move the boat. As the boat increases its speed, it pushes up a wave at its bow and eventually reaches a speed where the boat straddles the trough of a wave with crests supporting the bow and the stern. At higher speeds, the drag produced by creating this wave becomes much more significant than friction in determining the amount of effort required to move the boat through the water.

The maximum speed at which a wave can move can be calculated as 1.34 times the square root of the length of the wave. For a traditional, heavy-displacement boat that cannot plane or surf, wave-making drag increases exponentially as boat speed approaches the wave's maximum speed. These boats cannot overcome the drag produced no matter how much power is applied. At that point, the boat is said to have reached its *hull speed*—its theoretical maximum speed—which can be calculated as 1.34 times the square root of the wave it has created. For convenience, waterline length is used to calculate theoretical hull speed even though the wavelength underway will be somewhat longer than resting waterline length on most boats.

The maximum speed of a heavy-displacement boat, then, is determined by the wavelength of the wave the boat throws up at speed, which is in turn determined by its waterline length. Modern hull shapes with lighter displacements are capable of breaking free of their own bow wave to surf like a planing dinghy. The force required to do that depends on how heavy the boat is, but once surfing, the drag from wave making is all but eliminated. As anyone will know who has gotten a dinghy to plane, the boat moves through the water with much less effort. These boats' maximum speeds are not constrained by their waterline lengths, and they are able to exceed their theoretical hull speeds.

The **displacement to length ratio (DLR)** is a nondimensional number that measures wave-making drag by quantifying how many long tons of water the boat displaces for each foot of waterline length. A high value means that the boat must move a great deal of water out of its way for its length, and its speed will be constrained by that length. Low DLRs means low wave-making drag, which means that in the right conditions the boat can surf. High DLRs correspond to comfort and load-carrying ability; low DLRs correspond to speed.

The **sail area to wetted surface area (SA/WSA) ratio** is a nondimensional number that roughly corresponds to torque or low-speed horsepower in a car. It quantifies how much *wetted surface area*, or area exposed to the friction of the water (in square feet), the boat has for each square foot of sail area. A high ratio means the boat will be able to accelerate quickly and be easily driven in light winds. For all but the most patient sailors, a low ratio translates into more engine use in light air.

The **sail area to displacement (SA/D) ratio** is a nondimensional number that roughly corresponds to the power-to-weight ratio for a car. It quantifies how much sail area the boat has for each cubic foot of water the boat displaces. A high ratio means the boat will perform well, particularly in moderate to heavy wind conditions where friction is less important than wave-making drag in determining speed. High SA/D ratios correspond to agile, responsive boats under sail; low SA/D ratios, particularly below 15, mean sluggish, undercanvased boats.

Standard wisdom used to hold that an offshore boat should be undercanvased to protect it from being knocked down or dismasted if it got caught with full sail up in a 40- or 50-knot squall. For that reason, many traditional voyagers have stumpy masts for their size and SA/D ratios at the extreme low end of the scale. But on a trade wind circumnavigation, boats encounter a far higher percentage of light winds than heavy air (see the Offshore Sailing Conditions section in Chapter 5). Not being able to get up enough sail means either rolling heavily for days on end or motoring. Modern reefing systems make getting the sail off much quicker in an emergency. As long as the boat is ballasted for it and the rig is set up to manage the loads, having a high SA/D ratio is like having a car with a lot of horsepower for its weight: it's there when you need it, and when you don't, you don't have to use it.

The **length to beam (L/B) ratio** attempts to quantify something about the form stability of the hull. Beamy boats tend to have form stability—they heel less than narrow ones—but narrow boats tend to have directional stability—they track better than beamy ones. The ratio should be computed using the waterline length and beam rather than overall length and beam because the waterline dimensions have the most influence on the form stability of the vessel. Waterline beam can be approximated by 90 percent of overall beam. The higher the ratio, the lower the wave making will be for a given DLR and the better the control for a given SA/D ratio. That means, all else being equal, a boat with a high ratio will steer more easily, with less movement of the rudder, and will move more cleanly through the water, whereas a boat with a low ratio will have more initial stability and will heel less.

Most of the increase in this ratio has come from the increasing length of boats. While the traditional voyagers have often been characterized as "narrow," most had lower L/B ratios than more modern boats. Most traditional voyagers have ratios below 3, as do the smaller Catalinas, Hunters, and Sabres—all considered beamy coastal cruisers with lots of interior volume for their size. The major difference is that these boats carry their beam well aft, while traditional voyagers have narrow ends with little usable interior volume.

The **ballast ratio** quantifies the percentage of the boat's overall weight in fixed ballast. The ratio does not capture anything about where the ballast is located in the boat. Therefore, 5,000 pounds of lead lying on the cabin sole will result in the same ballast ratio as 5,000 pounds of lead attached to the bottom of a 12-foot keel, though the latter will provide significantly greater stability. Generally speaking, average draft has been increasing, meaning a given ballast ratio is more effective in more modern boats. The ratio has also increased over time as lighter materials have allowed yacht designers to take weight from the hull and put some of it back in the form of ballast. All else being equal, a high ratio means a stiff, stable boat, but at the extreme, one that may have a quick and uncomfortable motion.

Naval architect Ted Brewer created the **motion comfort ratio** as an attempt to quantify how comfortable a boat's motion would be in a seaway. A high ratio means the boat will have a slow, even motion and won't jump around in heavy seas. The ratio closely correlates to the absolute displacement of the vessel, so it is possible to get both high motion comfort and low DLR by spreading sufficient displacement over a long enough waterline.

Taken together, the ratios tell a lot about a boat, and, as shown in Table 3-1 in Chapter 3, can be used to delineate between the different types of cruising boats. That's partly a reflection of physical realities—a high DLR almost certainly means a full keel, which in turn means a low SA/WSA ratio—but also of evolving design philosophies.

APPENDIX 4

Upgrades for Boats of Different Ages

The following tables illustrate the range of upgrades that may be necessary for boats of different ages. Improvements for each age category include those for all the categories below it. For instance, in Table A4-1, on a 30-year-old boat it may be necessary to do everything listed under hull structure from reinforcing floors to adding lightning protection.

TABLE A4-1. IMPROVEMENTS TO THE BASIC BOAT

Boat Age	Hull Structure	Watertight Integrity	Insulation and Ventilation
20+ years	• Reinforce floors • Rebuild mast step • Replace keel bolts • Rebond/replace bulkheads • Reinforce chainplates • Reinforce coach roof • Reinforce cockpit	• Replace/remove teak decks • Replace/rebuild hatches • Replace/rebuild ports • Replace glazing in fixed hatches	• Insulate hull/coach roof
10–20 years	• Replace teak rubstrake • Rebed/glass hull-to-deck joint • Rebed toe rail • Strip bottom paint • Replace barrier coat/antifoul	• Replace/reseal deck locker lids • Rebuild companionway hatch • Repair any core damage	
5–10 years	• Fix osmotic blistering • Repair any core damage	• Reglaze, recoat, rebed hatches • Reglaze, recoat, rebed ports • Rebed all deck hardware	
New–5 years	• Add staysail chainplate • Add backing plates • Add lightning protection	• Reseal mast base • Upgrade/strengthen stanchions • Make deck pipe watertight • Upgrade backing plates on deck hardware	• Install dodger • Add hatches/dorades • Add screens/louvers over glass • Add rain covers for hatches • Make harbor awning • Make small tarps • Install fans • Improve locker ventilation • Improve bilge ventilation • Add screens for all openings

TABLE A4-2. IMPROVEMENTS TO BASIC SYSTEMS

Boat Age	Engine and Propulsion	Basic Steering	Basic Electrical	Basic Plumbing
20+ years	• Replace engine • Replace transmission/shaft/prop • Replace fuel system/tanks	• Replace rudder • Replace quadrant/sheaves	• Rewire entire boat • Install new AC/DC distribution panels	• Replace all through-hulls/seacocks • Replumb entire boat • Replace water tanks
10–20 years	• Rebuild engine • Rebuild transmission • Replace prop shaft • Replace stern tube • Replace exhaust system • Replace engine mounts	• Replace rudder bearings • Replace rudder packing gland/ lip seal • Replace rudder tube • Replace steering cables/linkages	• Replace corroded wires • Upgrade fuses • Install low-energy lights throughout	• Improve cockpit drainage • Replace marine toilet • Replace all sanitation hoses • Replace electric water pumps
5–10 years	• Align engine • Move engine controls • Replace Cutless bearing • Replace stuffing box with lip seal • Upgrade fuel system • Add fuel tanks	• Reinforce structure around rudder and steering quadrant	• Add red lights for night vision • Separate AC/DC distribution panels • Upgrade the grounding system	• Add water tanks • Replace any suspect fittings • Rebuild electric water pumps • Rebuild/replace manual water pumps • Rebuild marine toilet • Create shower pan in head • Add shower sump pump
New–5 years	• Change/re-pitch propeller • Add cutters to prop shaft • Redo tank breathers • Add primary fuel filter • Rebuild exhaust antisiphon system • Add exhaust cutoff • Install oil change pump • Add bus heater • Improve engine access	• Upgrade emergency tiller	• Create complete wiring diagram • Check for fusing, grounding throughout • Add reading lights • Add 12 V outlets for computers/ chargers • Add inverters—nav station/ engine room	• Create plumbing diagram • Improve bilge access/drainage • Add oversized manual bilge pump(s) • Improve anchor locker drainage • Create access to seacocks • Create sea chest/add seacocks • Replace sanitation hose on toilet • Add holding tank • Plumb gray water overboard • Ensure sink drainage in head/ galley • Install pressure water/water heater • Add shower in cockpit • Add deck washdown • Add manual pumps to galley/ head • Add saltwater pump in galley

TABLE A4-3. BELOW-DECK IMPROVEMENTS

Boat Age	Galley	Below-Deck Safety	Cosmetics and Comforts
20+ years	• Replace sinks • Add propane stove • Add propane tanks/locker		• Replace headliner/ceilings • Restore floorboards • Replace/restore all furniture • Replace saloon table
10–20 years	• Replace propane stove • Replace propane tanks • Add solenoid in galley		• Replace all cushions • Restore brightwork
5–10 years	• Rebuild icebox		• Paint bulkheads • Clean cushions
New–5 years	• Add workspaces usable at sea • Install large trash can	• Add companionway handholds • Add nonskid companionway steps • Add reachable handholds • Improve restraints in lockers • Add/improve fiddles • Secure all cushions • Install locks on floorboards • Secure fridge hatches • Ensure stove is capsize-safe • Stormproof other stowage • Tie down batteries	• Install innerspring mattress • Create visual space

TABLE A4-4. ON-DECK IMPROVEMENTS

Boat Age	Mast and Standing Rigging	Bow Platform	On-Deck Safety	Cosmetics and Comforts
20+ years	• Replace entire rig			
10–20 years	• Replace standing rigging • Reinforce mast • Rebuild/repaint mast • Replace mast wiring • Replace navigation lights		• Redo nonskid	• Repaint boat
5–10 years	• Replace any suspect rigging • Reinforce goosenecks • Reinforce boom at vang		• Replace/upgrade stanchions • Replace lifelines • Strengthen bow/stern pulpits • Replace cleats	• Restore brightwork • Polish stainless steel
New–5 years	• Inspect mast/rig • Add staysail stay • Add running backstays/checkstays • Install spreader lights • Add mast steps • Tune rig	• Add second anchor roller • Increase size of rollers • Install two oversized cleats • Move chain stowage aft • Find way to secure anchors at sea • Find way to attach sails to stemhead	• Add handholds/footholds • Add cages over dorades • Install tether points • Add hardware for drogue • Install boarding ladder • Resolve deck stowage issues	• Add gates in lifelines • Cover wheel • Add/replace cockpit cushions • Add cockpit table • Add adjustable deck seats

APPENDIX 5

Galley Substitutes and Equivalents

TABLE A5-1. SUBSTITUTES

If You Need	You Can Substitute	Comments
1 cup granulated sugar	3/4 cup honey, molasses, or maple syrup	Reduce liquid in recipe by 1/4 cup
1 cup honey, maple syrup, or molasses	1 1/4 cup granulated sugar	Increase liquid in recipe by 1/4 cup
1 cup granulated sugar	1 3/4 cup confectioners' sugar	
1 3/4 cup confectioners' sugar	1 cup granulated sugar plus small amount of flour	Use for frosting; experiment with flour amount to get the right taste
1 square unsweetened baking chocolate	3 tablespoons cocoa plus 1 tablespoon margarine	
1 cup whole milk	1 cup fruit juice or 1 cup potato water or 1 cup water plus 1 1/2 teaspoons butter	For baking
1 cup buttermilk or sour cream (less than 10% butterfat)	1 tablespoon vinegar or lemon juice plus 1 cup whole milk	Heat milk slightly before adding; let stand for 5 minutes
1 cup sour cream	1 tablespoon vinegar plus one can Nestlé's reduced milk[1]	Let stand for 5 minutes
1 cup light cream or half-and-half (10%–12% butterfat)	1 1/2 tablespoons butter plus 7/8 cup whole milk	For baking; if using nonfat dried milk add 1 more tablespoon butter
1 cup coffee cream (20% butterfat)	3 tablespoons butter plus 7/8 cup whole milk	For baking; if using nonfat dried milk add 1 more tablespoon butter
1 cup coffee cream (20% butterfat)	1 cup coconut cream	Can be purchased in islands or you can make it yourself
1 cup heavy cream (36%–40% butterfat)	1/3 cup butter plus 3/4 cup whole milk	For baking
1 cup butter	3/4 – 7/8 cup margarine or 3/4 cup cooking oil	Margarine is more oily than butter so use a bit less
1 egg	2 tablespoons cooking oil	Baked goods won't be quite as light
1 tablespoon lemon juice	1/2 tablespoon vinegar	

[1]A canned product widely available throughout the Pacific and in Europe that is similar to condensed milk but without the sugar.

TABLE A5-2. EQUIVALENTS

Item	Equals or Yields	Comments
1 lemon	1–3 tablespoons juice plus 1–3 teaspoons grated rind	For lemonade, use 1/2 cup lemon juice and 1/3 cup sugar per quart of water; adjust sugar to taste
1 lime	1 1/2–2 tablespoons juice	
8 ounces (3 cups) fresh mushrooms	1 cup sliced mushrooms	
1 pound uncooked macaroni	4–5 cups uncooked macaroni	
1 cup uncooked macaroni	2–2 1/4 cups cooked macaroni	
1 pound uncooked noodles	6–8 cups uncooked noodles	
1 cup uncooked noodles	1 1/4 cups cooked noodles	
1 pound dry spaghetti	5–6 cups uncooked or 6 cups cooked	
1 pound rice	2 cups uncooked or 6 cups cooked	
1 pound instant nonfat dried milk	5 quarts reconstituted	
1 package active dry yeast	1 cake or 3/5 ounce or 1 tablespoon yeast	Proof yeast before using to protect your other ingredients

TABLE A5-3. LIQUID MEASURES FOR COOKING

U.S. Amount	Approximate Metric Equivalent
1/4 cup	62.5 milliliters
1/3 cup	83 milliliters
1/2 cup	125 milliliters
1 cup	250 milliliters
4 cups	1 liter
1/4 teaspoon	1.25 milliliters
1/2 teaspoon	2.5 milliliters
1 teaspoon	5 milliliters
1 tablespoon	15 milliliters
1 ounce	30 milliliters

TABLE A5-4. CONVERSIONS

Item	Cups	Ounces	Grams
Butter or castor sugar[1]	2 1 1/2 1/4	16 8 4 2	500 250 125 65
Sugar/icing sugar[2]	3 1 1/2 3/4 1/3	16 8 4 2	500 250 125 65
White or self-rising[3] flour	4 2 1 1/2	16 8 4 2	400 250 125 65
Wholemeal flour	3 1/2 1 3/4 1 1/2	16 8 4 2	500 250 125 65

[1]A coarse sugar used for cooking in Europe, New Zealand, and Australia.
[2]Regular sugar in the United States; icing sugar in Europe, New Zealand, and Australia.
[3]Flour with baking powder or soda added for use in baking.

TABLE A5-5. OVEN TEMPERATURE EQUIVALENTS

	Degrees Celsius	Degrees Fahrenheit
Very slow	120	250
Slow	150	300
Moderately slow	160	325
Moderate	180	350
Moderately hot	190	375
Hot	200	400
Very hot	230	450

APPENDIX 6

Offshore Medical Kit

The following table summarizes the contents of our offshore medical kit. The various medications and supplies reflect our medical history. While you may want to use this list as a starting point, you should create your own medical kit in conjunction with your doctor that meets the needs of your own crew.

TABLE A6-1. OFFSHORE MEDICAL KIT

Type	Materials	Amount
Diagnostic materials	Stethoscope Rectal thermometer Electronic thermometer Tongue depressors Q-tips Cotton balls Rubber gloves Dental floss	1 1 1 One box Three packages One package One box One package
Surgical supplies	Rubber tourniquet Hemostat, curved, mosquito Hemostat, straight Surgical scissors Needle holder/suture scissors combination Scalpel holder Scalpel blades #11 Disposable single-edge razors Small pointed forceps Medium blunt forceps	2 1 1 1 1 2 One package of 6 12 1 1
First aid	Betadine Surgical Scrub[1] Betadine Solution Isopropyl alcohol Hydrogen peroxide Irrigation solution (saline) Burow's solution Large syringes (20 and 30 cc) for irrigation Rubber tourniquet 3 cc sterile syringes with #23 or #25 1 in. needles[1] Injectable lidocaine[1] (brand name Xylocaine) Lidocaine ointment Steri-Strip closures Friar's Balsam or Bag Balm Suture 4-0 silk with needle[1] Suture 4-0 gut with needle[1] 1/4 in. gauze drains Fabric Band-Aids 2 in. gauze rolls 3 × 3 in. gauze pads 2 in. adhesive tape	1 pint 1 pint 1 pint One 8 oz. bottle 1 quart 12 tablets 6 2 24 One 30 cc bottle One tube One box One container One box One box One bottle One box 6 One box Two rolls

(continued)

TABLE A6-1. OFFSHORE MEDICAL KIT *(CONTINUED)*

Type	Materials	Amount
Orthopedic	Ice packs (the quick-activation kind) Wrist splints, adult size Metal splints for fingers and toes Wrist brace with reinforced Velcro closure Airway resuscitation kit 3 in. Ace bandages Triangular bandages	3 1 3 1 1 5 2
Teeth	Temporary filling kit	1
Eyes	Sterile eye pads 10% sulfacetamide eye drops[1] Garamycin ophthalmic ointment[1]	6 One 10 cc bottle One 3.5 g tube
Ear	Ear wax removal kit Hydrocortisone with acetic acid ear drops[1] Neomycin-polymyxin-hydrocortisone ear drops[1]	1 Three 10 cc bottles Two 10 cc bottles
Dermatological	1% hydrocortisone cream 1% hydrocortisone ointment Zinc oxide Neosporin ointment Aloe vera gel Silvadene cream (silver sulfadiazine) Lotrimin AF (antifungal) 1% lotion	Two 1 oz. tubes Two 1 oz. tubes Two 1 oz. tubes One 1 oz. tube One large bottle One jar or tube One 30 cc tube
Digestive	Gastrolyte rehydrating solution Norfloxacin Tindazole Lomotil[1] Senokot tablets	One package 20 400 mg tablets 12 500 mg tablets One carton 50
Infections	Ampicillin, 250 mg[1] Clavulin Duo Forte (amoxicillin 875 mg and potassium clavulanic acid 125 mg)[1] Bactrim DS[1] Rulide (roxithromycin 300 mg)[1] Injectable cephtriaxone[1] Monistat cream and vaginal suppositories Diflucan (fluconazole) tablets, 150 mg[1]	100 tablets 100 tablets 100 tablets 100 tablets 12 vials Three 3-day treatment kits 7 tablets
Pain	Aspirin Ibuprofen, 200 mg Tylenol with codeine #3[1] Tramal caplets (tramadol hydrochloride)[1] Injectable Tramal (tramadol hydrochloride)[1]	100 tablets 4 per day 100 tablets 40 50 mg caplets 10 50 mg dosages
Allergic reactions	Claritin Pseudoephedrine or other decongestant Sinus medication Hismanal, 10 mg[1] Prednisone, 5 mg[1] 1:1000 adrenaline, 10 cc[1] OR EpiPens	1 per day for allergy sufferers 2 bottles One box; additional for allergy sufferers 80 tablets 100 tablets One 30 cc bottle OR 2 EpiPens
Seasickness	Stugeron Dramamine Meclizine (Dramamine Less Drowsy) Phenergan (promethazine), 25 mg[1] Ephedrine, 50 mg[1] Phenergan suppositories, 25 mg[1]	100 tablets 50 tablets 50 tablets 50 tablets 50 tablets 12
Colds	Dimetane DC cough medicine[1] $^1/4$% Neosynephrine nose drops NyQuil/DayQuil	1 pint Two 30 cc bottles One box each

[1]Only available in the U.S. by prescription.

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Numbers in **bold** refer to pages with illustrations