SAFETY EQUIPMENT

There are so many forms of sophisticated safety equipment available today that it's difficult to know what to choose. Deciding which gear is essential and which isn't worth the cost in dollars and storage space is a bit like deciding upon how much insurance to carry. You hope none is ever necessary. Still, the occasion may arise when a given item is required.

Cruising plans will have an impact on the decision, as will the type of boat being sailed, how safe one feels the vessel is, and the age and physical condition of the occupants.

As the various items in this section are reviewed we will try to outline our ideas on how choices are made. The tougher decision on what level of protection is required will be left to you.

FIRE EXTINGUISHERS

To begin with, where possible for the engine space, an automatically triggered fire extinguisher should be present. If you own an older boat and you have one in place already, chances are it will be a halon-type fire supressant. They are very efficient, compact, and make no mess.

While a lot of folks plan on using a portable fire extinguisher for engine-space fires, they are rarely successful. In fact, the Coast Guard estimates only about 10 percent of such fires are successfully controlled by portables.

The odds are an engine-space fire will go for awhile before it is noticed. This means it has a good headstart. At the same time it is consuming the available oxygen in the engine space, and as the oxygen is consumed, it becomes more difficult for the fire to burn.

Just about this point is where you notice something is amiss. Opening the engine-room door or access hatch to see what is going on and using the fire extinguisher admits a new bunch of oxygen-laden air. The fire expands rapidly as soon as this new source of oxygen reaches it. You now have a much bigger problem! Better to keep the space sealed off and let the automatic unit deal with the fire.

If you go out to buy a system today, it will have to be either carbon dioxide (just like in the old days) or one of the new halon replacements, such as the material used by Fireboy. The only problem with the latter is that it is about twice as bulky as the older style halon. However, it is still lighter than carbon dioxide.

You will want to carry a wide range of fire extinguishers in various spots in the interior, outside of but handy to the engine room, and (if you have one) inside the engine room.

We like to carry two large units, usually 15- or 20-pounders (6.8 to 9.1 kg), located close to the galley and to the engine room. Yes, these are probably way larger than they need to be, but I'd rather err on the safe side.

We have one small (5BC) extinguisher in each cabin, plus another small unit for the galley. That way, no matter where you are in the boat, an extinguisher is always close by.

With halon off the market you are limited to the powder-filled, or carbon-dioxide units. The powder units make an awful mess, but compared to the alternative (getting into the life raft), the mess is worth cleaning up. The CO_2 extinguishers are usually about four times as expensive and twice as bulky, but they do not make a mess.

We typically carry a medium-sized fire extinguisher under the saloon table.The only current source we know of for halon is Protection R.T. Inc. in Dorval, Quebec, Canada.

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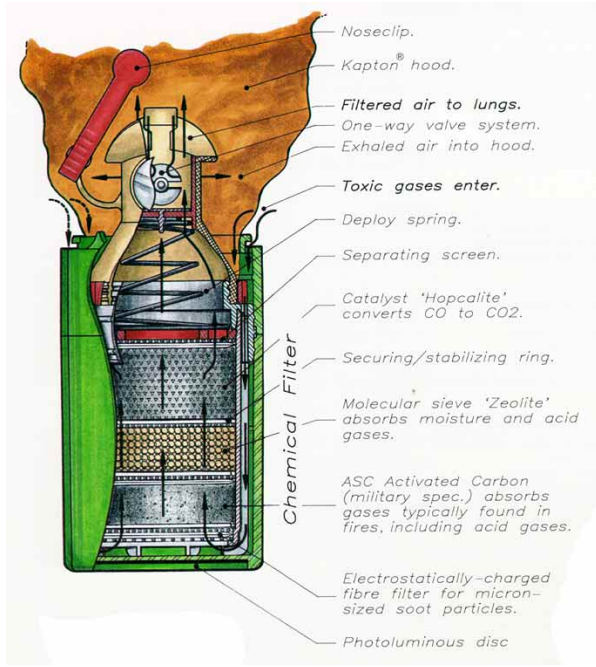
When looking at fire extinguishers you'll see different ratings. These are quite simple to interpret. For each digit preceding the "A" rating, the extinguisher has the stopping power of 1.25 U.S. gallons (4.5 liters) of water. The "B" rating indicates the ability to deal with a square foot of rating. Thus a 5B extinguisher could handle five square feet of fire. The "C" rating indicates the chemical agent is safe for electrical (non-conducting) fires. Never use water on an electrical fire!

Fighting a fire is not the time to learn for the first time how to use an extinguisher. Practice beforehand, or better yet, contact your local fire company for a demonstration. Most will be happy to oblige.

SMOKE HOODS

The last bit of fire-fighting gear that is essential aboard a small boat is a smoke hood. You can buy these from aviation-supply houses and fire-fighting equipment suppliers. Several types are available, but the better ones will yield five to ten minutes of working time in a smoke-filled interior. Otherwise, you have a minute or less to deal with the fire before you'll be forced on deck. At this point, if the fire is still burning, you'll be in the raft or dinghy before you know it. A smoke hood is cheap insurance.

Smoke will drive you out of the cabin during a fire long before heat; this means you only have seconds to get the fire out unless you have a smoke hood like that shown in these two photos. Brookdale International, a Canadian Company (Vancouver) developed these hoods for airline travelers and people in high-rise office buildings. We now carry one aboard our vessels, just in case. (Brookdale International photo)



FOUL-WEATHER GEAR

We've put foul-weather gear at the top of the safety section because staying alert and well rested is a key ingredient to safe cruising. To maintain this state, you need to keep reasonably warm and dry. Otherwise, fatigue sets in, decisions aren't made with a clear head (or are avoided altogether) and the risks to vessel and crew increase. Foul-weather gear is right up there on the list of investments to keep you warm and dry.

You would think that something as mundane as foul-weather gear would be a pretty straightforward purchase, but this is not the case. There are so many types and styles of gear, it's hard to know where to begin.

Good foul-weather gear is an absolute necessity. But just how good is good enough? For years we cruised with an amalgam of gear that had been collected along the way: Line 7, Helly Hansen,

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even some Patagonia we'd been given to test. Much of this gear was quite inexpensive at the time of purchase and is now old and covered with various patches.

We get away with this gear because of the type of boats we sail (typically dry on deck with good crew shelter) and the areas we like to cruise (usually warm).

Cruising Environment

Obviously the type of weather you cruise in will have a major impact on your choice of foul-weather gear. If your sailing takes place mainly in temperate-zone summers and the tropics, lightweight gear will be the most efficient. It's easier to use, can be quite reasonable in price, and takes less stowage space.

In the tropics we find that our tops are worn mainly when going forward to handle sails, when traveling in the dinghy if it's wet, and as raincoats ashore. Bottoms are almost never used. Aft, we usually sit under the dodger and don't even bother with a top.

The bottoms come into play when the weather turns a bit colder and we're more concerned with keeping our legs (and now pants) dry. Because pants are so much more difficult to get into and out of once on, they usually stay on.

Colder-climate cruising makes the level of protection more important. Details like wrist and ankle closures, hood design, hand pockets, and flap integrity become critical.

The actual weight of the foul-weather gear fabric, however, seems to be more related to longevity than function. Heavier materials, while less comfortable to wear and more difficult to stow, do last longer.

In our case, with the majority of our cruising taking place in the tropics, we prefer the lightest gear we can find for ease of stowage and comfort when wearing.

Important Features

There are several features that we find very desirable. Light-reflecting strips on shoulders and hood are a help in keeping track of foredeck crew — as well as of someone in the water.

The ideal hood should be able to enclose the face, and have a sun/rain visor, yet allow freedom of movement and good peripheral vision. A good storage detail is a plus as well for when the hood is not being used. This may be as simple as a Velcro strap or perhaps a pocket into which the hood folds.

Wrist and ankle closures usually take the form of Velcro straps, or pull-ties. Whichever system is used, you should be able to seal the ends of garments at one extreme and leave them nice and loose for ventilation under better conditions. You should be able to make these adjustments from the outside, without opening up the garment.

Pockets should be available for your hands, with an extra pocket or two for a hunk of line, knife, personal strobe, etc. You'll want drain holes in the pockets, too. If lined with one of the high-tech fleeces now available, they will help to keep your hands warm.

Some of the "breathable" fabrics are light and wear very comfortably. The new breathables are supposed to have solved their problems with watertight integrity.

Top Style

You have two choices in top styles — pullover and front-opening. The pullover is much more watertight, not having a flap to worry about. We used these for years in small-boat racing. But the front opening is so much easier to put on and take off that these are now our tops of choice. For most keelboats, the amount of water on deck doesn't warrant the hassle of the pullover.

There is usually some variety in the length of the top. The longer the jacket is, the drier it will keep your torso, while providing some protection to your shorts.

Pants

As for pants, bib-style are the best. The high front helps protect the torso from any leaks in the jacket. Check the strap hardware to make sure it's easy to use and to adjust and that it will stand up to long periods of salt encrustation. Most strap hardware today is plastic and works well in the marine environment, but some of the metal buckles rust and seem to rot the straps. When looking at foul-weather gear pants, consider the fact that you may end up wearing them when the decks are wet but spray isn't a problem, without a top.

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Zippers

In most cases zippers are going to be a part of your foul-weather gear top. If properly executed, these can be quite water resistant, maybe even watertight. Typically there will a single or, better yet, double storm flap, usually with Velcro closure, to protect the zipper from direct water velocity (much like hatch storm covers.)

Size

Tops should be sized to allow for several layers of warm clothing and a bulky sailing jacket. Be sure arm lengths are adequate after all these layers are on. You may also want to consider wearing a PFD (personal flotation device) under the foul-weather gear (which provides extra insulation for your chest area). Pants should also be generous with interior volume. This makes them easier to move about in.

Fabrics

Four basic types of fabric are available today. PVC has been around the longest and is a relatively cheap waterproof and durable material. We're still using some of this gear after 20 years of cruising! However, the early varieties of PVC were quite stiff. Today some manufacturers are using PVC in thin layers over nylon scrims. This results in a softer feel.

Polyurethane is probably the lightest of the materials used for foul-weather gear. Properly executed, it makes a very flexible material with good wear characteristics. However, it is not always well executed and you soon end up with delamination. Sometimes material is somewhat permeable, meaning it leaks! Good-quality gear with a good reputation made from polyeurethane is okay, but I'd stay away from off brands.

Neoprene is typically used for heavy-duty gear, typically used for offshore racing where it needs to take a really tough beating. It tends to be a little stiffer and heavier, although not necessarily more uncomfortable. The Patagonia bib pants are neoprene. They've been going strong now for eight years.

Finally, we get to the breathable fabrics based on Goretex technology. The first generation of Goretex material simply did not stand up to salt water. It allowed wet-weather gear to breathe (allowing sweat to escape, while keeping outside water at bay) and worked okay in fresh water. Nevertheless, salt water seemed to get through. Now comes the second generation: Tested in the 1995 Whitbread with apparent good results, a number of companies now offer Goretex in their top-of-the-line offshore range. However, it only makes sense to invest the extra bucks in this very expensive gear if you plan to do a lot of hard work in cold, high latitudes. Otherwise, not enough sweat is generated to make the investment worthwhile.

Seam Construction

How your foul-weather gear is assembled is a key element in how it will hold up, and in the suit's watertight integrity. The number one thing to consider is the seam taping. The seam tapes should be neatly and evenly applied. The bonding should be complete across the entire tape, without bubbles or lifted or rough edges. If the gear you are looking at doesn't have taped seams, it is probably best left in the marine store (or used for occasional guests).

Color

When choosing color, consider two issues. One is visibility. If, heaven forbid, a crewmember goes overboard, white is a poor choice. It's easily lost in the wave action.

Then there is "yummy yellow." The military has tested various colors on sharks in a feeding frenzy. They absolutely love yellow. If you've seen the movies of the yellow-clad dummy being attacked while the black-clad dummy floats serenely a few feet away (maybe the latter figure isn't such a dummy), there's an incentive to look for black foul-weather gear. Of course, the dark colors are no good at night, and after all, if you're in the water, is it better to be seen and picked up - or eaten? Besides, presently no black foul-weather gear is available.

A reasonable compromise is a high-visibility red or orange top with a dark set of pants. Blue is available from some suppliers.

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Boots

Boots are an integral part of a sailor's foul-weather gear. Comfort and efficiency are vastly diminished by cold, wet feet. Boots should have soft soles with maximum grip for a heeled, wet deck. A Top-Sider sole or equivalent is the best bet. The higher the boot, the better the protection. Our boots come up to mid-calf.

I prefer the inside of my boots to be large enough to allow me to wear two pairs of socks when it's cold. This allows my bare foot to slip a bit, but it is a trade-off I live with.

One problem we experience with boots is odor. The canvas liners are difficult to dry and become foul smelling after awhile. "Odor Eaters" seem to be of some benefit. But my boots, at least, usually end up stored in the engine room.

Sailing Jackets

A sailing jacket with built-in flotation is a wonderful piece of gear. Not only does it keep you warm, it provides some protection in the event of a dunking. To be really efficient, however, the float coat will need some form of a crotch strap to keep the coat from floating up to your shoulders.

Gloves

It's important to protect the hands, but I've never liked sailing gloves for everyday wear. It always seemed better to have the feel of my hands against the wheel or rope. It only takes a couple of weeks to get the hands toughened up for sailing, and if one is using gloves that can't happen.

Still, when the weather turns cold I'm not bashful about staying warm. The best system seems to be an inner and outer liner. The outer liner keeps the glove dry and protects from chafe, while the inner liner keeps your hands warm. Spare liners can be exchanged while a wet set is being dried.

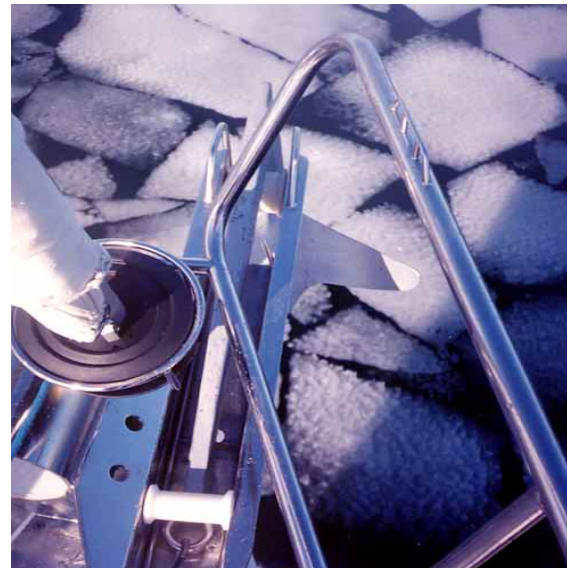
Sometimes cold weather is unavoidable (if you are late leaving for the tropics), in which case good preparation will allow you to enjoy the weather. (North Sails RI photo)

COLD-WEATHER CRUISING

Having (happily) spent most of our cruising careers in the tropics, it wasn't until we started to think about sailing to Alaska that the topic of cold-weather clothing really got serious consideration in our family. As it turned out, sitting in Mexico's Sea of Cortez was the ideal place to gather data as we were to meet a variety of Canadian and Alaskan yachts. Surprisingly, for once the correct answers seemed to be universal amongst our friends.

The basic issues of a cold-weather cruising wardrobe were put into focus for Linda and me at the end of a leisurely day-long circumnavigation of beautiful Espiritu Santo Island, just north of La Paz. Coasting slowly along the magnificent red cliffs Linda spotted two kayaks, each with a couple aboard.

These folks (John Page and Jill De La Hunt in one kayak, and Jeanne Molitor



If you happen to find yourself down slope from a glacier some day, you will appreciate modern cold-weather clothing. The air temperature in this photo was about 34° F (2° C) with a nice breeze to keep us refreshed. Surprisingly, we were not uncomfortable, except for the many layers of clothing that restricted our movements.

and J.R. Patee in the second) were from Alaska. They spent their summer vacations traveling by kayak in that invigorating part of the world. If anybody would know the right clothing to wear, these folks would! The first thing John told us was, "we look at clothing from a drying-out standpoint. If we capsize, or get really wet, the ability of the clothing to maintain our body heat while wet is a matter of survival. We also need to be able to dry wet clothing quickly over a small fire."

So far, this was sounding sensible.

"Stay away from cotton," Jill chimed in. "It absorbs water, has no thermal value when wet, and is difficult to dry." (The same characteristics that make it so desirable in the tropics are what make it a poor choice for high latitudes.) "We use synthetic materials. Polypropylene is the best," she added.

"We work on a layer system," was J.R.'s comment. "Starting with a light layer, then a medium weight material, then an expedition-weight layer. This gives you the ability to dress up or down as conditions require."

A 3M Corporation product called *Thinsulate* has enormous insulation value, comparable to down, but much thinner. This makes for excellent outerware when it's really cold.

In the old days some of the polypro materials picked up body odors after a few days. Nowadays, however, Capilene is non-odor-absorbing.

Jeanne had come aboard wearing a pair of gloves, which got me to thinking about the extremities. "How about hands and feet?" I asked.

"We use glove liners like these," Jeanne said, "with some form of outer shell for protection from water. To keep my feet warm I like to use wool socks with polypro liners."

Over all of this, if required, they suggest synchilla (long-haired polypro) jacket and pants.

Linda then asked "How many sets of these layers do you carry?"

"A minimum of two but preferably three sets," Jill answered. That way you can have a damp pair or two drying out while there is one dry one to wear!"

Insulated Foul-Weather Gear

In the last few years Mustang and Stearns have developed foul-weather gear lined with flexible Airex foam for warmth and buoyancy. These suits keep you dry, warm, and can reduce the chance of hypothermia in the water. They feature special closures at the wrists and ankles that restrict water movement, creating a wetsuit effect. This approach seems to make sense compared to a full-on survival suit. You don't have the problem of storage that comes with a survival suit, and the immersion suits are designed to be worn and worked in. If they're aboard, you're going to be wearing them in cold weather any time you're on deck.

We've met a number of cruisers who use Mustang immersion suits for everyday sailing once they've left the tropics. While you'd think that a one-piece jumpsuit would be difficult to get into and out of, they report just the opposite. Apparently they are, in fact, easier to get into and out of than separate top and bottom foulies.

Perhaps a good compromise for cruising in all sorts of conditions is a light set of foulies for normal usage and the immersion suit for higher-latitude sailing.

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Immersion Suits

Immersion suits were developed for professional seamen making their living in harsh cold-weather conditions. The concept is to provide enough protection to keep you alive in the water or on a raft until help arrives. These suits typically cover the entire body, except for a small patch of the face.

Most are made from neoprene insulation (similar to wet suits) about 3/8-inch thick. Since the buoyancy thus provided tends to be distributed from top to bottom, the wearer tends to float horizontally rather than vertically.

To give better control of your flotation attitude, most suits incorporate inflatable chambers in the chest area. In smooth-water conditions, the ideal float attitude is horizontal, which minimizes the amount of suit area in contact with the cold water. However, as sea conditions deteriorate, spray and foam may dictate a more vertical positioning to gain freeboard for your nose. They also usually have lifting harnesses built in for rescue. The suits are sealed at the wrist to heavy gloves, while the feet are typically built in, similar to the "jammies" you used to wear in childhood.

Where thermally insulated foul-weather gear will typically keep you alive for six to eight hours in 50° Fahrenheit water, an immersion suit will keep you going almost indefinitely in the same conditions. In order to do the job properly, these suits must fit well. This means you'll need to try various suits on to find the right match. Even children's suits are available today. Of course, here you have to worry about the kids growing out of this year's suit.

Knowing how to get into an immersion suit takes a bit of practice. An emergency is not the time to be going through a learning curve. Take the time to get familiar with the suit when you buy it, and then practice putting it on periodically to stay familiar.

Now, lest you think the need for these suits is theoretical in the extreme, let me relate the experience of John Conser, a veteran seaman and top-notch sailmaker.

John was involved in a Quebec-to-St. Malo race aboard Bob Hanel's catamaran, *Double Bullet*. At the last minute Bob Hanel asked John to pick

A Viking thermally insulated work suit (top left). It is designed to allow freedom of movement and give good protection in case of falling overboard.

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Every cruiser's dread. Trying to get an injured crewmember back on board. It is a lot easier into a dinghy than back onto a deck that is much higher off the water. Of course at sea this doesn't work so well. (West Marine photo)

up some survival suits. Not that he thought they would need them, but crossing the North Atlantic was a serious matter, and these were experienced, prudent seamen.

Several days into the race, while power-reaching in moderate conditions, *Double Bullet* hit something and the leeward daggerboard tore a gaping hole in the starboard hull. The hull quickly began to fill, and the boat started to list alarmingly.

The immersion suits that John had picked up at the last minute were stuffed in the bow of the sunken hull, now under 10 feet (3.1 m) of water. In the cold North Atlantic the odds for survival were remote in general. Without the immersion suits, a quick death by hypothermia was guaranteed.

John Conser dove down into the submerged hull and began to bring out the immersion suits. After several trips to the bow everyone was wearing their own suit.

They clambered onto the windward hull, now awash in the big seas, and lashed themselves to the rudder.

Eighteen hours later they were picked up by a passing freighter. Had they not been wearing the immersion suits, nobody would have made it.

All the cold and overcast weather makes these thermal pools really inviting. If you look carefully at the left of the photo you can see *Sundeer*'s mast in the background.

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A safety harness is an essential piece of cruising gear. We usually wear ours whenever we leave the cockpit. In this photo, my Dad is at the helm of *Deerfoot*. Notice how his safety tether is attached to a pan eye to windward. If the boat is smacked by a sea, he can only lurch a short distance before the tether pulls him up short.

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HARNESSES

The safety harness is a simple but very important piece of personal gear. We make a habit of wearing ours any time we are out of the cockpit when sailing. Hence, it's important to make them easy and comfortable to wear.

Whether you make your own (as we have done) or buy them, they should be strongly made with heavy-duty webbing, triple-stitched to "D" rings. The Ocean Racing Council specifies breaking strengths of 3,400 pounds (1,542.6 kg) for an approved harness.

If closed-cell foam is worked into the shoulders, they will be a bit more comfortable. Having a place to hold a personal strobe and whistle is also a good idea.

Several of the more expensive foul-weather gear sets have jackets with built-in harnesses. While this seems like a good idea, you will still need a free harness for use when working on deck in nice weather.

Another approach is to have a harness sewn onto a float coat. Linda and I did this with our sailing jackets, and find that these see almost more use than our normal harnesses.

Harness tethers are best if they have shackles at both ends. On the harness side, a conventional snapshackle will do the job, while a single-handed carabiner-style hook is best for the free end. These have a sliding lock over the moveable section so they cannot accidentally slip loose. Gibb makes a very strong hook with a second locking arm that is still usable with one hand. I have two tethers for my harness — a short one for use at the helm when I want to be held in tight, and a longer one for working the foredeck. Be sure that the snapshackle is one of the modern designs with the hinge point more than halfway around the top, allowing the pin to unlatch under load.

Harnesses are now available with built-in flotation. For the Whitbread boats and many other offshore racers the harness/flotation combination is considered essential.

We have not yet tried living with this gear, so we can't comment on the comfort. However, before we go cruising again, the odds are we'll have a couple of these harnesses aboard.

PERSONAL STROBE LIGHTS

We've always carried personal strobes for each crewmember, updating the batteries every six months or so. The ones available now are lightweight, easy to stow on the harness or in a pocket, and valuable insurance in case of a disaster. Space should be made on the harness to attach the strobe to the *back* of the harness. Otherwise, if it's in front it will blind the user when activated. Recently there has been some question about strobe lights. The Royal Navy apparently has found that under some circumstances, prolonged exposure to strobe lights at a close distance can induce epileptic-type seizures in some people. Keep your ears open for additional information on this subject.

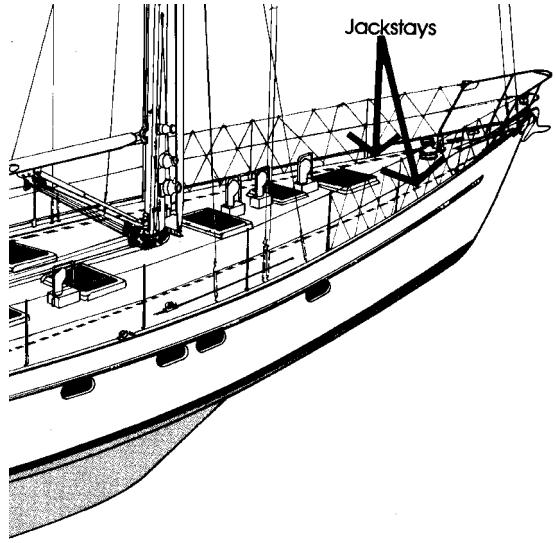
WHISTLES

Every crewmember should have a whistle when on watch, preferably mounted right on the front of the harness. This little device can be invaluable in alerting other crewmembers to the wearer's need for assistance.

LIFE JACKETS

Most national authorities require some form of flotation for each crewmember. What's legal in the United States, however, wouldn't pass in most other parts of the world. The buoyancy provided is barely adequate for smooth water. Throw in a couple of feet of chop, and you have problems.

If you are serious about your life jackets (i.e., if they are there for more than to just satisfy the authorities), consider the following. Life jackets don't do any good unless they are worn, so they need to be comfortable to wear, allowing freedom of movement. You will have to decide whether you want to wear them over or under foulweather gear, as this will affect fit.



Jackstays should run from the bow aft down the deck. Ideally they will be made from flat webbing (which doesn't roll under your feet like line or wire). This drawing shows two separate jackstays stretched tight between bow cleats and padeyes aft. An alternative is to make the jackstay in the form of a "U" around the cabin trunk and/or cutter stay, so you can go from port to starboard side without unhooking.

The top photo shows a carabiner-style tether hook for attachment to your jackstay. The other end has a snapshackle with pull cord for attaching to the safety harness. The snapshackle gives you a means of releasing should you find yourself overboard being dragged underwater (Survival Tech photo).

The bottom photo is a Gibb hook. We prefer this style because it cannot accidently unlock itself.

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The buoyancy required to give you the freeboard necessary to breathe in a chop varies with body size and composition. If you tend toward a lean frame, with lots of muscle, more buoyancy will be required than if you have higher levels of fat.

We typically carry two high-buoyancy vests for Linda and me, and then a series of the minimal-requirement vests to meet legal requirements for guests.

Another issue is storage area. Four or six life jackets will take a fair amount of space. Remember, they need to be stored where they are accessible. Here we have a conundrum of needing an easy-to-wear, high-volume, comfortable life jacket that stores in a minimum of space.

Inflatable Life Jackets

The answer lies in the inflatable vest. These are compact, easy to wear (meaning they will see more use), and relatively reliable. Even better, the units made for the yachting community do double-duty as a safety harness.

The issue of "freeboard" for the person in the water is crucial. Under smooth-water conditions there's no problem. But when a sea is running and waves are breaking, chances are the swimmer is going to be breathing a lot of water mixed with air. Even a couple of inches of extra freeboard can enhance chances substantially. I wouldn't be surprised to find the USCG modifying it's outmoded regulations in the future.

When looking at inflatable life jackets, there are several things to consider. The first is buoyancy. Next comes comfort when wearing the unit. If it is comfortable to wear, it will be used, which, after all, is the reason for buying the inflatable life vest in the first place. Given a constant level of comfort between models, I'd go for the one with the most buoyancy. (Note: When considering comfort, be sure to check mobility, or how much motion is restricted when wearing the inflatable life vest.)

Finally, you need to look at how the inflation mechanism works. There will be both carbon dioxide charges and manual inflation. Make sure the inflation cylinders are easy to service. The manual inflation tubes should be easy for you to reach when in the water.

Some models come with automatic inflators. These have a safety advantage if the wearer is knocked unconscious as he falls overboard. However, they introduce a level of maintenance that may not be appropriate for long-term cruising.

MAN OVERBOARD

Before we get into the specifics of man-overboard equipment, there are a couple of very important concepts to understand. First is speed of action. Any time a crewmember goes overboard, chances are the boat will be moving at a good clip. At 6 knots a vessel will travel roughly *10 feet (3.1 m) per second*. Consider that for a moment. In the time it takes you to realize that someone has fallen overboard, get up from the cockpit seat and make your way to whatever systems you have — maybe 10 seconds — you're already *100 feet (30.5 m)* from the swimmer. And 10 seconds would be one hell of a fast time to get to your system and deploy it.

The second factor is windage and sea conditions. Even the strongest swimmer will be almost immobilized by his clothing and foul-weather gear. His or her odds of being able to swim toward a stationary lifesaving device in a moderate sea are pretty slight. I remember a story I heard years ago about a crewmember who fell overboard during a spinnaker takedown in an Admiral's Cup race in the English Channel. Even though man-overboard gear was deployed and cushions were thrown, the swimmer was unable to reach any of the flotation aids. The boat drifted off to leeward faster than he could swim. What saved him was a float coat he was wearing.

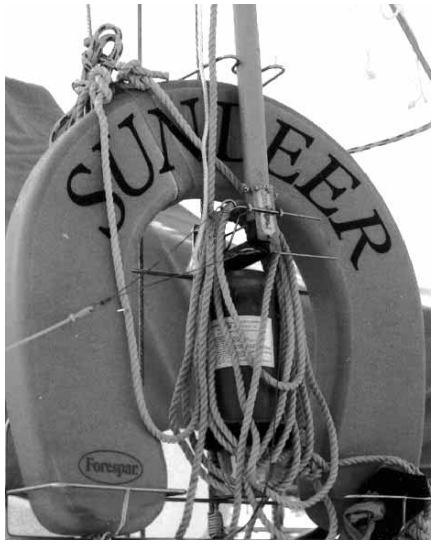
The third aspect is what happens once you get back in the vicinity of the swimmer. Remember, he is almost immobilized and may be hurt to boot. Just getting within a few feet isn't going to get the job done unless there's a way to get a line to the swimmer quickly and accurately.

Finally, there are many, many stories of fully crewed yachts having finally worked their way back to the swimmer, only to find it impossible to get him back aboard. It sometimes takes three strong men to bring one person aboard.

Ideally, wearing a safety harness, working with good lifelines and plenty of handholds, and always being wary, will keep everyone aboard. But you do need to be prepared for the eventuality of a problem.

Locating Systems

We've grown up with the poles, horseshoe rings, strobe lights, and sea-anchor systems inspired by ocean-racing rules. While this gear is bulky, difficult to stow, and can be a nuisance in heavy



Sundeer's traditional MOB system with a Forespar launcher. A single pull on the lanyard deploys pole, strobe light, horseshoe, and sea anchor. Offshore, we fasten this to the top of our lifelines to keep it clear of any breaking seas. Onshore, we drop it down to deck level.

weather, it still seems like a cost-effective approach, provided the signal pole itself can be seen in heavy conditions. If you go this route, most important will be speed of deployment. Seconds are crucial.

In the past we've used a Forespar launcher, which allows us one pull to send the whole kit over the side. When we're sailing close to shore, the gear is carried between the upper lifeline and the rail. Offshore, the launcher and poles are moved up to the top of the lifelines to keep everything clear of the stern wave when we're knocked down. In all our years of sailing we have yet to lose an MOB rig to a wave.

A tall pole, preferably 15 feet (4.6 m), is best. These usually have the biggest floats and the most ballast, which helps them stand up in a breeze. The floats typically used in stern-tube launchers are so small that in 15 knots of wind they'll be knocked down to just a couple of feet off the water!

Whatever type of pole you use, check its flotation characteristics in 25 or more knots of wind. The stand-up characteristics can be improved by increasing flotation, adding ballast, and *raising the point of attachment* between the sea anchor and the pole. By experimentation, you will find an attachment spot that helps to reduce the heeling angle. (Note that if the sea anchor is attached to the bottom of the float, it will tend to capsize the pole!)

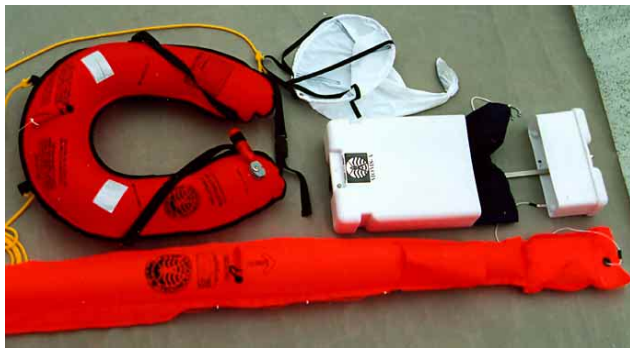
The various elements should be connected with floating polypropylene line, which needs to be renewed annually.

A critical part of the package is the sea anchor. This should be at least 12 inches (305 mm) in diameter and preferably larger.

There is some debate about strobe lights. They are definitely easiest to see at a distance, although with no depth perception. Once you're close to the light, an incandescent bulb is better. Ideally, then, one would have both strobe and incandescent.

Man-Overboard Modules

Survival Technologies Group has developed a man-overboard module consisting of an inflatable pole, small raft (with a black-colored bottom rather than "yummy yellow"), and other assorted bits and pieces. The system is well thought out and makes sense, although it's expensive. The "pole" has a water-activated light at the top, and the kits are available with flares. The sea anchor is the first thing to deploy when the system is launched. This strings out the rest of the gear.



The Survival Tech MOM is a clever, compact way of dealing with a man in the water. The system is inflatable and can be launched within seconds with a simple pull cord. They have a fancier model that includes a mini-raft. (Survival Tech photo)

The raft provides several hundred pounds of buoyancy and, from the standpoint of hypothermia, offers far better protection than anything else you can use. The kits come in a molded plastic container that needs to be serviced periodically to keep the carbon-dioxide cartridges up to date.

When the MOM unit is installed, it needs a clear trajectory to the water. This means if you have a large swim step, the unit will need to be mounted off to the side where it can drop down the transom flats on one side or the other of the swim platform.

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Steiner Throwable Module

I really like the concept of the MOM, but on a boat like *Sundeer* or *Beowulf*, with the cockpit so far from the stern, I felt too much time would be lost getting back to the transom to deploy the module. Also, our swim steps are so large that it is tough to find a good location to mount the MOM.

Enter Greg Steiner. Greg's unit is a throwable module, which can be mounted close to the helm (or to the companionway, as on *Beowulf*). It includes an inflatable life vest and pylon. The fact that you can immediately toss this unit to the swimmer is a large bonus: the 15 or 20 feet (4.6 or 6.1 m) that it's thrown reduces the required swimming distance.

Electronic Position Finders

A number of manufacturers have developed mini-EPIRBs to be worn by crewmembers. These units trigger an alarm when they hit the water, then send out a homing signal to help locate the lost crewmember.

Development has been spurred by Whitbread racers as well as by the commercial fishing industry, and new products are coming to market all the time. (A lot of old ones are leaving the market, too!) You'll want to do some research on what's available just prior to leaving.

Man-Overboard Buttons

While on this unpalatable subject, we should discuss the MOB buttons featured on many integrated performance instrument systems and GPSs.

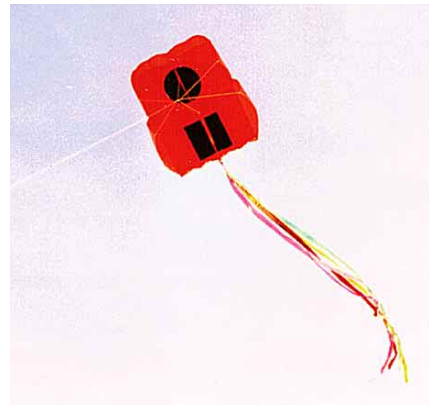
The key factor in a man-overboard situation is finding your way back to the location of the person in the water. This is difficult enough on a fully crewed yacht, where one or more crewmembers can try to maintain a constant watch on the person in the water. But, if you're sailing as a couple, the person left aboard has to get the boat turned around and deal with the myriad of shipboard duties this entails. He or she will not be able to keep their eyes on the swimmer. If your GPS or instrument system has an MOB button, this will enter a waypoint to return to. An instrument system will keep track of the DR position away from the swimmer. This makes it much easier to get back to the area of the person in the water.

Getting Back Aboard

The most difficult part of a man-overboard situation is recovering the person in the water. It's very difficult for several people, let alone someone working alone, to pull a healthy adult out of the drink and *up* onto the topsides.

This is what led to the development of the stern swim platform on *Intermezzo II* and on my dad's *Deerfoot* years ago. We both needed a better chance to get someone back aboard, and a good-sized step at water level seemed the logical answer. The other benefits — for swimming and for getting in and out of the dinghy — were an offshoot of the basic recovery solution.

There are several man-overboard alarms on the market today. The manufacturers claim they will put a waypoint onto the GPS and even turn the boat around. (Emerald Products photo)



This "Sky Alert" kite from SE Ventures in King George, Virginia, is an interesting concept. A 7.5-square-foot (0.7m) signal is flown at the end of a 100- to 300-foot (30m to 60m) line. Assuming you can launch it under emergency conditions from a raft, it will be a very effective signal (as well as a means of propulsion, which may or may not be a good idea). (SE Ventures photo)

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A heaving line also made by Survival Tech. This has the advantage of being eaiser than a Lifesling, which must be dropped in the water and then trailed back to the swimmer. On the other hand, the Lifesling does not secure the swimmer to the boat.

A Survival Tech throwable inflatable life preserver.

Nevertheless, even with a swim step, you need to get the person in the water close to the boat.

Heaving Lines

Keep some form of heaving line aboard. This can be as simple as a monkey's fist (a weight with a line around it) connected to 100 feet (30.5 m) or so of 1/4-inch-floating (6.35mm) polyethylene line, loosely stowed in a small bag. You could also purchase one of the commercial heaving lines now available. The advantage of the commercial products is that the bag and line travels with the weight, paying the line out as the device travels, thereby reducing friction and increasing range and accuracy.

Lifesling

The Lifesling, developed by a group of Seattle-area sailors as a way of recovering and winching a person back aboard, is now marketed by West Marine. It's an excellent approach to the subject, even if you have a swim step. The key to this product is getting the person in the water "captured" and tied to the boat, even if you are some distance away. Remember, the boat must be dead in the water. Even if you're drifting at just two knots, the forces are so tremendous on the swimmer that he could easily be pulled under water and drowned. If you go this route, test the system before you have to use it in an emergency situation.

Part of the Lifesling concept is that you use a halyard to winch the person back aboard. To do this you will need to make sure your halyard is long enough to reach the sling; many times it will not be. Then there's the issue of making the attachment between sling and halyard. A normal main halyard with captured shackle will be difficult to use under adverse conditions.

My feeling is that it is better to have a long pennant, on the Lifesling, (made out of a heavy enough polyethylene), with which to lift the person. This pennant should have a snapshackle on one end to attach to the main halyard. This will allow the crew on deck to fish the pennant out of the water with a boat hook should they not be able to reach it from the topsides.

The Lifesling is not a substitute for proper man-overboard gear. It's too slow to deploy and, being attached to the boat, doesn't give the swimmer any flotation options if it takes more than a few seconds (which it will) to get the boat stopped and turned around. However, in conjunction with man-overboard gear it is an excellent means of getting the swimmer attached to the boat and pulling him in. We always carry one of these units.

Avoiding Problems

The best way to avoid all problems associated with a man-overboard situation is to stay aboard. This means having a good jackstay system and using your safety harness. Once you're in the water, the odds of survival drop dramatically.

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A series of photos showing the Lifesling in action in slightly different circumstances. The key factor is to get the sling to the swimmer, and then to get him to don the sling. Then, you have time to get organized for hoisting. Note how calm the sea is. This procedure will be a lot more difficult offshore! (West Marine photos)

In the 1989 Whitbread there were a number of MOB situations, one of which resulted in the loss of a crewmember's life. In each case the crews were wearing their harnesses but had them unclipped at the critical moment.

Consider the case of Jordi Domenek, a crewmember aboard the Spanish ULDB *Fortuna*. Jordi spent 16 minutes in the near freezing water of the Southern Ocean after being swept off the foredeck. He was saved by a combination of thermal clothing, oilskins, life jacket, fast crew work by a trained Whitbread racing crew, and the fact that he was wearing a mini-EPIRB that helped guide the crew back to him. When Jordi was interviewed about the incident he stated that he had probably only had his harness unclipped for a total of ten minutes during the entire leg!

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THE LIFE RAFT

To begin with, the odds are infinitesimally small that you will ever have to take to a raft. In this regard, we can't stress too strongly the foolishness of abandoning ship before it is absolutely certain that the boat's going down. There are far more stories of sailors whose vessels have survived after being abandoned than there are of sailors who have survived long sojourns on life rafts.

The problem is that the standard yacht life raft is truly effective only in areas where help can be summoned quickly. Most of the long-distance cruising tracks, of course, are out of shipping and aircraft lanes, and the odds are that if you take to the raft you're going to be there for a good while. That means you need to look at your abandon-ship materials in the light of an *extended* stay.

Prior to purchasing *Intermezzo*'s raft I read the Baileys' *Staying Alive* and Dougal Robertson's *Survive the Savage Sea.* Both are excellent, graphic accounts of long periods in a raft and make *interesting* reading before you make any decisions. The Robertson's raft lasted a little more than two weeks, and then they were forced into their hard dink. The Baileys, on the other hand, had the pleasure of just under four months in their raft, with their inflatable dinghy alongside for extra room and supply-carrying ability.

Not the most pleasant conditions to be testing a life raft, but realistic nonetheless. (Viking photo)

More recently, the Butlers spent 66 days in a "coastal" Switlik raft. The key factor in their case was the fact that their raft had double tubes, a critical issue since the outer tubes were holed during their sinking.

Most companies make several types of rafts. Some are sold as "coastal" designs, and others are for "offshore." The difference is usually in the ballasting system, and sometimes in the construction. However, from our experience the worst wave and sea conditions are usually found close to shore, where water is apt to be shallower and currents more likely to oppose the wind creating breaking seas. So, if you're serious about a raft, I would be sure to get one rated for offshore work.

An interesting photo of an unballasted and unmanned raft. Kind of makes you think about what it might be like out there in really heavy weather with breaking seas. Perhaps the large ballast chambers are a good idea! (Givens photo)

The next question deals with insulation. Some raft models come with double bottoms to help insulate the occupants from cold as well as from the bumping of fish and turtles, which can become very annoying.

Finally, for several years now a debate has raged about ballasting systems. Various government bodies have been involved with all sorts of tests, and claims fly back and forth. Everyone

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seems to agree that a substantial ballasting system is required. The form of this ballast system, however, is still open to debate. I think it's safe to conclude that the old-fashioned ballast "pockets" do not provide enough counter force to breaking waves.

Givens Raft

While we were busy cruising, Jim Givens was developing his patented raft and ballast chamber. The Givens raft has an enormous circular bag deployed below it, which, when filled with water, prevents the raft from capsizing in heavy seas. For years Jim fought an uphill battle against government bureaucracies and industry inertia. But as reports started to come in of his rafts surviving hurricane conditions with the occupants intact, it began to shake up the status quo, and he now supplies many yachts, as well as commercial and government agencies. Jim's rafts are a little more expensive than conventional units but well worth the cost. We've used them on most of our recent boats. One disadvantage of the Givens raft is its packed size and weight. It is somewhat larger and heavier than other rafts.

An eight-man Givens raft (top) with two men inside pulling a third crewmember aboard. The weight of all three men is concentrated in one area but the ballast chamber, visible below the inflation tubes, keeps them upright (Givens photo). In many other raft designs, this would result in a capsize.

One of the Switlik rafts (bottom) has a removable canopy. This makes a lot of sense in tropical waters to assist in ventilation, watchkeeping, and general morale. It also makes climbing aboard from a vessel a lot easier, as you can see here. The compromise comes in heavy weather. The removable canopy may be dislodged by breaking seas or very high winds. Your decision on this feature will be based on the possibility of needing the raft in stormy weather. (Switlik photo)

Switlik Rafts

A competitor of the Givens raft is made by the Switlik company. It uses a "toroidal"-shaped ballast chamber, essentially a ring all the way around the outside of the raft. Kelsey Burr of Survival Technologies Group feels that the Switlik is as good in heavy weather as the Givens. He has tested both in the Gulf Stream.

One very clever feature of the Switlik is the adjustable canopy. This can be used to fully enclose the interior, or can be partially opened when conditions are favorable. Psychologically, this has to be a bonus. For keeping watch or just relieving oneself, it's also a big plus.

When we decided on a raft for *Beowulf* we chose one of the Switlik models. Fortunately, we can't tell you which works better.

Periodic Service

We serviced our raft on two occasions during the 3 1/2 years of our circumnavigation. The first time was by a professional. The raft was in good condition, but some of the accessory items were not. I was glad to be on hand to tell the chap working on the raft what to reject.

The second time I did the work myself. What I learned this time was really interesting. First, batteries left in the flashlight had burst and corroded, although they were only one year old and had been kept dry. The flashlights were ruined. Next, moisture, either from condensation or leakage, had puddled in the bottom of the canister. We replaced the food supple-

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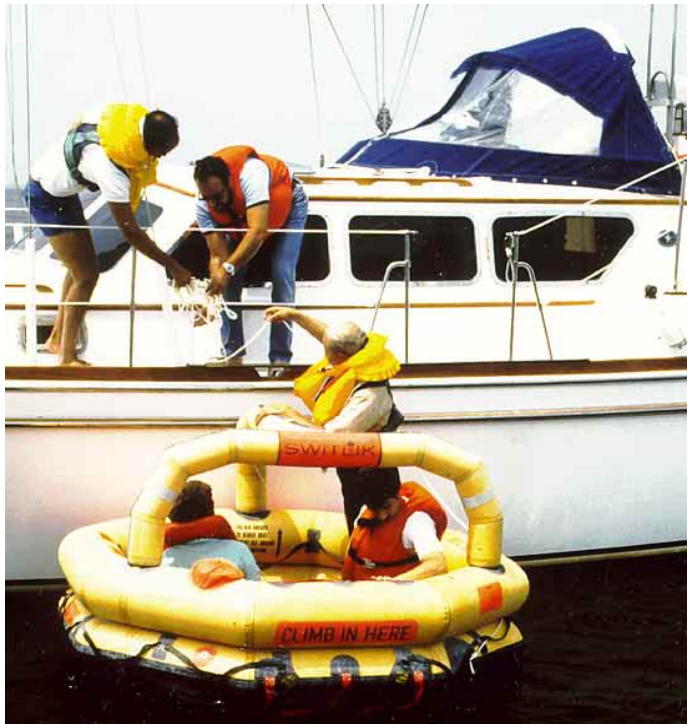

The Switlik Search-and-Rescue Liferaft is an inexpensive (compared to a full life raft) approach to temporary emergency needs. However, its single-tube construction and lack of ballast chambers makes it suitable only for protected waters where help is likely to arrive within a few hours (Switlik photos).

ments, purchased nickel cadmium batteries and new flashlights, and sealed the various small items inside the pack in separate plastic containers.

After two years of use on *Sundeer* we took our Givens raft in for service. It had gotten wet at some point and the inside was a mess. Part of the problem probably arose because the raft was stowed inside a locker in the transom where it might have had difficulty in "breathing."

Had we needed to use the raft it would have inflated. But all the supplies were ruined. This lesson convinced us to store our rafts on deck, with a cover over the exposed portions to protect the canister gaskets from rain and spray.

The issue of life-raft service is a difficult one. Your life may depend on how well the job has been done, yet you may not see the work or know if the raft has been correctly repacked.

If a professional service is doing the job it is a good idea to check their credentials. Talk to some other cruisers for whom they've done work. Make sure they are approved to repack your style of raft (there are differences between rafts, and each require a slightly different repack arrangement). If you are using a USCG-approved raft, contact the Coast Guard in Washington, D.C. to confirm that your service provider is indeed authorized to do the work. (When a USCG raft is repacked, the work is done under the scrutiny of a USCG surveyor).

Canister Cover

Assuming your raft is stored on deck, you'll want a canister cover as mentioned above. There is some debate as to whether it should be watertight PVC or breathable woven fabric. We prefer a breathable material.

Handling on Deck

I got a real surprise the first time I tried to maneuver our well-packed raft. With molded handholds of minimal value, I had a hard time getting the raft back where it was supposed to go. How I would handle the reverse chore, perhaps on my own under adverse conditions, was open to speculation. We felt that protruding handles attached to a reinforced spot on the cover would be a real help. So would separating the extra material packed into the raft to reduce the bulk and weight to a more manageable size.

Stowage Provisions

If the life raft is stowed on the pushpit, it's much easier to deploy. Pull the safety line and it's floating — no lifting or shoving is necessary. Standard kits are now available to mount right on the stern railing for this purpose. If the raft is stowed vertically in the pushpit, be sure to have the painter facing down, so that opening in the raft canister through which the painter deploys isn't

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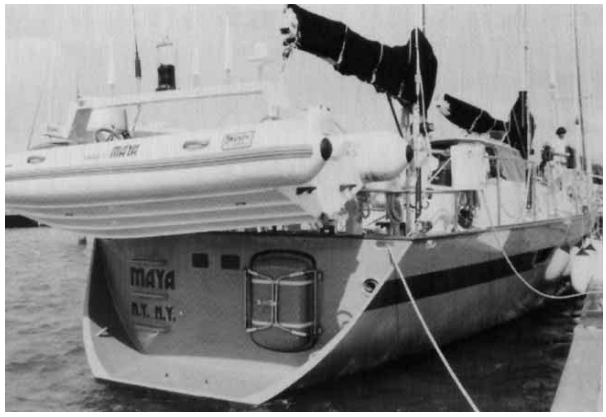
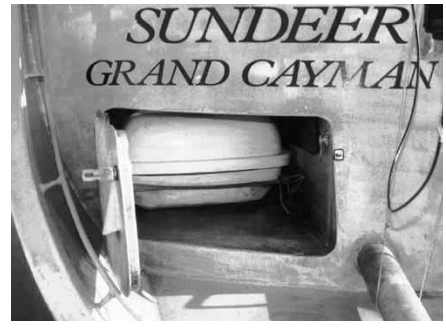


Finding the right spot for life-raft storage is always difficult. A location should be relatively dry at sea, easy to reach, secure from theft in port, and from which it is easy to launch. The best spot on most yachts is the pushpit, stowed vertically. If you take this approach, check with your life-raft manufacture about drainage. Most rafts have drain holes (for condensation) in the bottom of their cases. These no longer work as drains when stowed vertically (and in fact will let moisture in.) You should also have the raft-painter-opening facing down.

One idea that simply does not work is in the transom storage we tried for *Sundeer*. It was simply too wet for the raft's seals.

subject to getting wet. If you're stowing horizontally, be sure these holes stay dry as well. That's one of the reasons carrying a raft amidships or forward isn't a very good idea.

Most rafts come with small holes drilled in the bottom of their canisters, letting condensation drain out. If your raft has these holes, be sure to protect them if the raft is stowed vertically.



Rapid Deployment

I've always assumed that there were two scenarios in which we headed into a raft. The first is a collision, and the second is fire. Both of these require fast action. If the raft is tied down with all sorts of line, how fast can you cut it loose? Is there a sharp knife nearby? We sew a knife pocket into the raft cover, so the knife is always handy.

You can purchases hydrostatic releases that automatically let go at a preset depth, typically 15 feet (4.6 m), just in case you don't get to the knife in time.

Using the Inflatable as a Raft

Before leaving on our circumnavigation I met George Siegler of Survival and Safety Designs. George and his partner had a different philosophy from the standard raft people. They felt you had to be self-sufficient for long periods, and needed to be able to make progress toward a destination.

George and his partner had enough courage in their convictions to take a 12-foot (3.7m) Zodiac,

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The whole issue of boarding a raft in adverse conditions needs to be given some thought. You will probably want to have polypropylene lanyards tied onto your abandon-ship bags. (West Marine photo)

Another view of a six-man Switlik raft with canopy partially furled. (West Marine photo)

One thing you need to give the folks at West Marine credit for...they test the products they sell! How many other marine-store employees do you think you'll find climbing into life rafts on San Francisco Bay? (West Marine photo)

equipped with a sail and survival gear, on a 2,400-mile passage from San Francisco to Hawaii, a 58-day trip.

Years later, I still feel George Siegler's original ideas to be the most valid system for an *offshore* cruising vessel. Equipping a good inflatable dinghy with awnings, a small rudder, and a sail would allow movement of 30 to 50 miles a day in the direction of salvation. Considering the constant abuse these inflatables take day in and day out, they would certainly stand up to a long-term voyage better than any standard life raft.

The key is proper preparation. You must have a means of staying dry and, more important, of keeping out of the sun. This can be accomplished with an awning or tent attached to the edges of the inflatable and supported by aluminum struts. The sailing rig and rudder can be easily made. On the Italian Whitbread round-the-world racer *R and B*, they worked out a pair of leeboards so they could sail upwind in their Zodiac life raft.

One big problem is inflation time. The safest procedure is to leave the inflatable partially filled with air, with floorboards in place, lashed down to the deck. A scuba tank, with an air nozzle preceded by a regulator, will take care of the rest of the work in a matter of minutes. Spare supplies must be carried in a sealed container, either in the raft or at some convenient spot nearby. We've met people who use their everyday inflatable dink in this manner. If the dinghy is kept in good shape and covered, there is no reason why it won't do double-duty. But toward the end of its lifespan, consider replacing such a raft a bit earlier than would be necessary if the only need were for shoreboating.

From a cost standpoint there are advantages as well. As a general rule an inflatable dinghy is going to cost 20 to 25 percent less than a comparable life raft.

A negative aspect is stability in heavy weather. It can be argued that without ballast pockets a standard inflatable is more subject to being rolled over than a stabilized raft is. Without an inflated center support tube to the canopy, the inflatable type of dink will be more difficult to right once upside down. True, but the excellent turned-up bow shape and natural buoyancy of these designs, coupled with a good sea anchor, should do much to offset the risk.

Using the Hard Dinghy

As mentioned briefly in the section on hard dinks, a hard dink can be made into an emergency craft. The first issue is capsize resistance and buoyancy. Both of these factors can be aug-

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mented by tying inflatable fenders along the gunwale (tie both top and bottom). We've always done this with a single large fender to a side with our dinks. Try it with your own hard dink and you will be amazed at how much added capsize resistance a couple of fenders make. There are now available inflatable collars which take this approach one step further. If the hard dink is to be your primary life vessel, then you need to have the right gear aboard. Just as with the inflatable, you will want shelter from the elements (sun and cold) a large-sized sea anchor, and the usual abandon-ship bag filled with supplies, water, etc.

Life-Raft Radio Gear

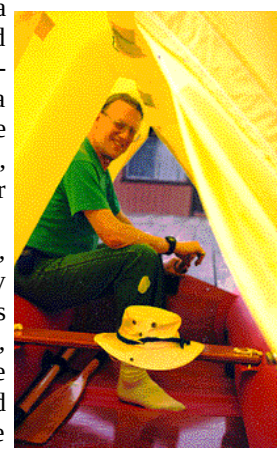
For short-range work and talking to ships that may be passing on the horizon, a portable VHF in a watertight bag makes sense. Even better, watertight models are now available. Since you will want to keep this charged on board, and it will see duty in the dinghy, it should be a part of the pre-departure check to make sure it is placed in the abandon-ship bag. Herb Johnson, the man who pioneered 12V ham radios with the Atlas company, has developed a new, solar-powered, self-contained (in a waterproof case) SSB radio. This may be the ultimate in raft safety gear.

Ralph Naranjo had a very clever piece of gear in his survival kit: He built a 5-watt Heathkit Morse code transmitter that ran off dry cells and would work on the ham-radio bands. Five watts of code may not sound like much, but you can be sure that somewhere, someone with a powerful directional antenna will pick up the signal. It's inexpensive to build, and the necessary code is easy to learn.

Stay Aboard!

Before we leave the subject of life rafts, a word needs to be said about staying aboard your mother ship. The vast majority of situations in which people leave their yacht for a life raft involves heavy weather. There may be damage involved, perhaps the boat is leaking, or maybe the crew is just tired of caring for their craft.

They then leave the situation they are in, with its perceived dangers, for the illusory security of a life raft. Days later their yacht is found in relatively good condition. In fact, there have been many instances where those in the life raft have lost their lives or suffered dearly, while their much larger and more secure yacht floated along fine.



The Tinker inflatable is an entirely different approach to a life raft. Usable as a dinghy under more favorable conditions, they come with a sailing rig and canopy and partial or full inflation systems. However, floor space for even two occupants is extremely limited.

The canopy has so much buoyancy that you can roll the life boat back right-side-up without leaving the confines of the interior. The canopies can be purchased separately for use with other dinghies. (West Marine photos)

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Unless you are really going down fast, or a fire is pushing you off the boat, it is almost always better to stay with the larger vessel and fight a battle to save it, than to take to the much smaller life raft.

Radar Transponders

If you want to go the whole route on rescue gear, consider a Search-and-Rescue Radar Transponder (SART). When switched on, these units look for an X-band radar signal. When they hear it, they reply with a special signal that paints 12 dots on the radar's screen.

These 12 dots are the international radar distress signal and show up in a line emanating from your location. This is the ultimate close-in locating device.They have recently been added to the list of required gear on ships approved to SOLAS classification, and costs are coming down.

EPIRBs

You will want to have an EPIRB (Emergency Position-Indicating Radio Beacon) aboard. However, instead of packing it directly in the raft, it may be a better idea to place it near the companionway. It's easier to service in this manner and is available without opening the raft in case an onboard emergency requires its use. The 406 megahertz EPIRBs are far superior to the older models in that they allow accuracy to plus or minus 1/8 to 1/4 of a mile. In order to have your 406 EPIRB effective, be sure to mail your registration card to the authorities. Otherwise, if the unit is triggered and there's no registration on hand, you may be written off.

There are a variety of flares that you may require. Handheld smoke flares, red and white rockets, and dye markers are included in the Survival Tech kit. On *Sundeer* we kept a dozen 25mm parachute flares on board and another dozen stowed in the raft.

Flares

Flares serve two purposes. One is to summon help; the other is to alert another vessel to your presence, averting a potential collision in the process.

When you walk into the marine store you'll see a wide array of flare packages: pencil flares, small hand-launched units, even flares shot from "guns" using a 12-gauge cartridge. However, for offshore work, where your life may depend on successful observation of your flare, the only real option is a hand-launched parachute flare. These are typically available in SOLAS and USCG-approved configurations. Of the two, the SOLAS tend to be brighter.

Flares come with a date stamp and are supposed to be thrown out after the specified period, especially for use in the life raft. However, we've found that even two or three years out of date, they always seem to work (we typically test one flare on New Year's Eve).

For distress, a red parachute flare is used. For bringing another vessel's attention to your position, use a white flare.

SOLAS parachute flares are required to reach a height of 1,000 feet (300 m) in altitude. They must have a descent rate of not more than 16 feet per second (5 meters per second) and must maintain their burn for at least 30 seconds.

Remember, the launched flare will drift with the wind, and the wind aloft will be stronger than on deck. So, if you want to mark your position with some degree of accuracy, it is best to aim the flare slightly to windward. Also, if there is low cloud about, you'll want to depress your firing angle even more so that the flare burns below the cloud layer.

Smoke and Die Markers

With the problem of being seen by rescuers when you're in a raft or worse, floating in a life jacket is important. Where the typical raft has a moderate physical presence to those close by, a swimmer is almost impossible to see, which is why some form of man-overboard marking device is neces-

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sary. At night, in a raft, parachute flares are visible for miles. But during daylight hours, while they can still be seen, they are not nearly as effective.

Practical Sailor recently tested various smokes, dyes, and flares. They found that from the air, the dye packets were by far the best source of indicating your location (during daylight). Second best from the air, but best from water level, were the SOLAS-class smoke signals.

Abandon-Ship Bag

What you put into your abandon-ship bag(s) depends on how long you expect to be stuck in the raft before help arrives and what is packed with the raft.

There are two schools of thought as to whether it is better to pack as much directly with the raft or leave most things in the bag. On one hand, if it is in the raft you know it will be there when you launch the raft. On the other hand, you will not know the condition of the items. My instinct is to keep the extra survival gear in abandon-ship bags, have it stowed where it is easy to grab in a few seconds, and then practice occasionally with abandon-ship drills.

What do you take? A 406 EPIRB goes without saying. Then augmented freshwater supply. This could be in the form of a small hand watermaker (like the PUR Survivor) or a jug or two of fresh water (remember to only fill about 80 percent of the way to allow for some buoyancy to float the container; test your container in the water). We typically carry two 5-gallon (18.9 liter) jugs on deck, right next to the raft, with long floating painters on each jug with which they can be attached to the raft or dinghy. Next are additional flares, a battery-powered VHF radio, and spare AA batteries. At $150 there's some logic to carrying a portable GPS so that you can broadcast your position over the GPS and know where you are drifting.

We have space blankets in our kit, along with a small fishing spear, lines, and hooks. Food supplements, a general chart, vitamins, and a notebook are a good idea. The list can go on even further, but these are the basic items.

What To Choose

There are obviously lots of choices to be factored — budget, space, your personal concerns, and cruising plans. A lot of people have sailed many miles with minimal safety equipment. And there's the problem of investing "freedom chips" and storage space in gear that will, in all probability, never be used.

If you want help in deciding what makes the best sense for your own requirements, visit the folks at Survival Technologies. They have devoted their energies to developing safety gear and to finding products that make sense for the cruising sailor. They hold safety seminars and give demonstrations of many of the pieces of gear mentioned in the preceding section. I think they deserve all the support that sailors can give them. I want to see their product development continue.

SurvivalTech has developed this flotation-lined abandon-ship bag.

Above: Cascade Design makes a variety of watertight and waterproof bags for camping and canoeing that are ideal for abandon ship bags. (Cascade Design photo).

Below: If you're going to be spending any significant time in a raft, the single biggest issue will be fresh water. This hand-operated RO unit sells for less than $500. (Recovery Engineering photo).

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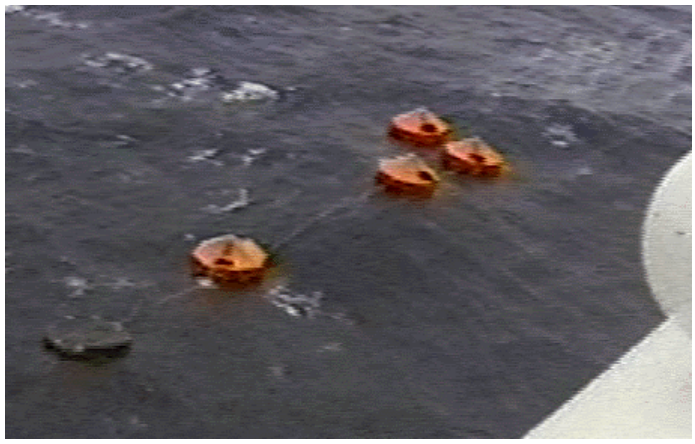
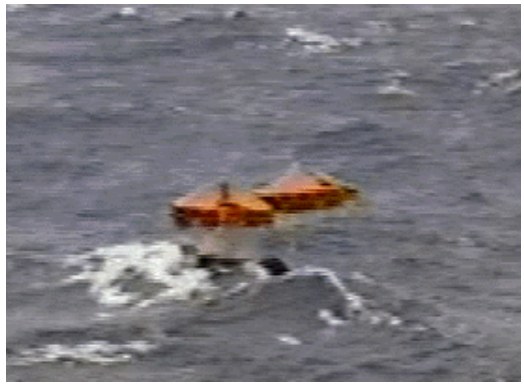
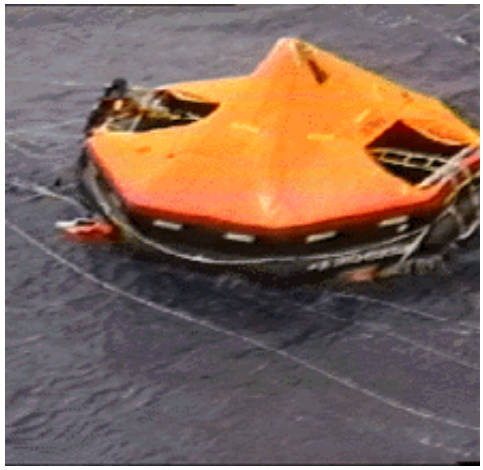


These images were taken from a Coast Guard chopper going to the aid of the crew of a sinking cargo ship. Conditions were moderate. Note the capsized raft in the foreground. What is interesting is how much impact the small seas are having on the rafts. (USCG video)





A good look at the ballast bags (or lack thereof) on the underside of the capsized raft (photo above).

A Coast Guard swimmer checks one of the rafts (lower left) for missing crew. It is very difficult to board a double-tube raft from the water. It usually takes help from someone inside. Yet if the raft capsizes the crew must exit in order to re-right the raft. The first occupant who goes back in the raft is going to need to be in good shape.

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YACHTSAVER

Having looked at what you would do if you had to abandon ship, let's now take a look at an innovative means of saving your vessel so that a life raft is not required. The Yachtsaver system is a series of buoyancy bags placed throughout the interior of your boat. If you begin to sink, pulling a rip cord discharges a carbon-dioxide cylinder, which in turn inflates these bags like a life raft. If enough buoyancy is provided, your boat will float with some degree of freeboard.

Staying With the Boat

There are a number of obvious advantages to this approach. First, you have a much larger and more visible platform from which to be rescued. This platform is going to be a lot more stable than a life raft, with more room for the crew and the ability to go "shopping" for supplies down below as necessary.

Next, even though the hull may be pretty much submerged, it will have a drift rate in a controllable direction, and speed can be augmented with small sails.

Time To Do Repairs

Even more important, however, is that by keeping the boat afloat with buoyancy bags you have time to find the problem and make repairs. Many sinkings are the results of relatively small breaches in the hull or of plumbing failures that could be repaired, but which require time.

Reefs

It is not unusual for boats that hit reefs to go through the experience more or less unscathed. Then, in the process of being dragged off they are holed and sink. It's nice to know that if you plant your cruising home on *terra firma*, there's a pretty good chance of getting it back afloat.

Abandon-Ship Psychology

The most important advantage of this system, however, is psychological. Knowing that your vessel will not sink under you should add an enormous amount of security to your cruising. And, heaven forbid, if you ever find yourself in a situation where a life raft might otherwise seem inviting, knowing that you have these buoyancy bags may keep you with the boat.

Consider this against the fact that the vast majority of boats that are abandoned are usually found afloat at a later date, in reasonable condition. In almost all cases the crew that abandoned their boat would have been better off staying with the boat than they were in taking to a raft. In the infamous 1979 Fastnet race, almost all those who died after abandoning ship would have been saved had they stayed with their vessels.

This production boat found itself on a New England reef. When the tide receded, it was holed and then flooded on the next tide. It was impossible to get salvage equipment out to the boat, so the owners called on Lifesaver to try to refloat the vessel. (Yachtsaver photo)

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A series of iflatable bags were stuffed into the aft quarterberths and main saloon, and then inflated. (Yachtsaver photos)

Protection from the Elements

Let's assume the worst. Your hull is breached through collision with a shipping container. The boat rapidly fills with water. You pull your inflation lanyard and the bags inflate. In the meantime the EPIRB is triggered, and you try to send off a Mayday signal on the SSB and/or VHF. Within a few minutes the boat has settled into the water as far as the buoyancy bags allow, and you now take stock of the situation. The crew is on deck, their safety harnesses attached to handrails or padeyes. With the boat in a partially sunken state, the odds are a running sea will break over the deck. The crew will need protection from the elements. If you are in high latitudes, this means survival suits. In temperate climates or the tropics, an insulated jump suit with wrist and ankle closures will do the job.

In the tropics, protection from the sun will also be critical. Since you are still aboard you will eventually be able to find your awnings or a sail to rig to provide shade.

Below you have food supplies, perhaps a couple of pre-packed waterproof emergency bags, a hull-repair kit containing underwater epoxy, light plywood for a patch, a collision patch, through-hull bunks, and a variety of tools. If the proper plumbing precautions have been taken with the freshwater system, you will still be able to use the ship's freshwater supplies.

Compared to what you find in the raft this is like living in the lap of luxury.

Freeboard

Obviously a critical issue in all of this is how your vessel reacts to the seastate. This is a function of freeboard and the angle of the boat to the seas. The angle can be controlled to some degree by drogues or a parachute-style sea anchor. Freeboard is a function of the amount of buoyancy you have, *and where it is located relative the center of gravity of your hull.*

The boat was then towed off on the next tide and brought to a local yard, where she was hauled. Note the bow-down attitude.This is the result of much of the buoyancy in the bags being aft of the hull's center of gravity. (Yachtsaver photo)

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Calculating Buoyancy Requirements

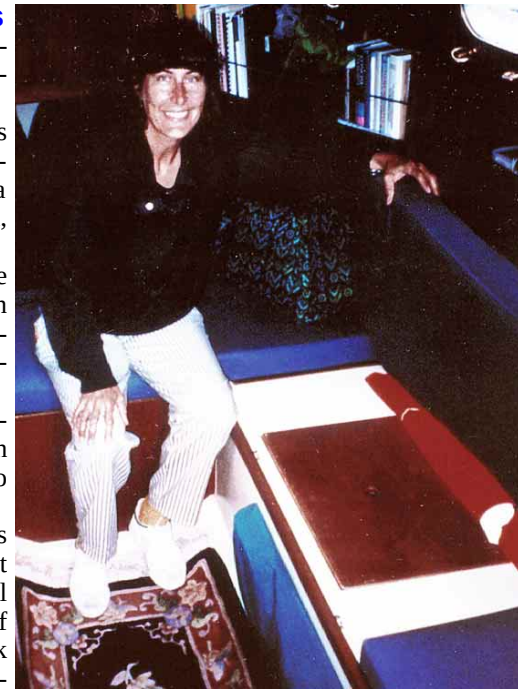
Buoyancy requirements are a function of displacement, the type of construction and its inherent buoyancy, and how high you want to float.

There are two ways to look at this. On a gross basis, Yachtsaver suggests allowing for 60 percent of the *fully loaded* displacement of a wooden yacht, 70 percent for a fiberglass vessel, and 80 percent for metal.

On a more detailed basis you can calculate the weight of all of the non-self-supporting items in the boat. This would include machinery rig, rigging and deck hardware, ballast, electrical system, ground tackle, and non-buoyant supplies.

Most structures on modern yachts is self supporting. Cored fiberglass and metal sprayed with insulation will usually float (it is not difficult to calculate these factors).

If you get the buoyancy just even, your decks will be awash. This is better than swimming, but not much, as exposure (unless you have survival suits) will gradually wear you down. However, if you add additional buoyancy to support the deck and some of the topsides, you can then have a relatively dry deck to sit on (assuming the seas aren't breaking over the boat).



Yachtsaver buoyancy bags installed under the saloon seat in a 20-foot (6.15m) Flicka cruising design. (Yachtsaver photo)

Run through these numbers and you will find that as a percentage of the total buoyancy required the additional needed to float a couple of feet of topsides is going to represent a small amount.

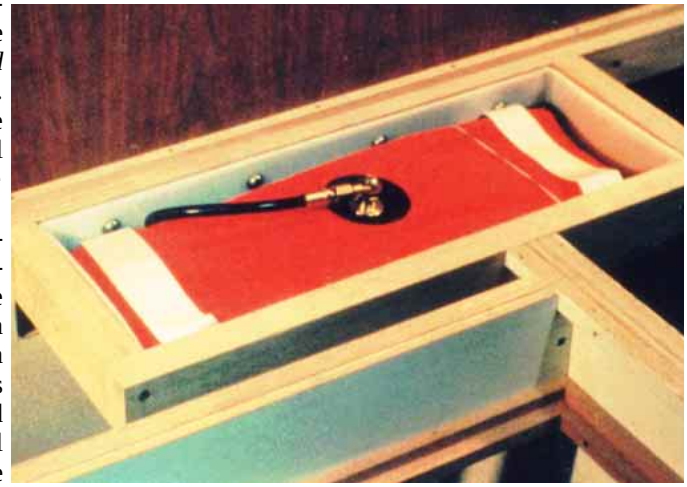
Consider also the displacement-to-hull volume ratio of your boat. Older, heavier designs will find it hard to float with much freeboard. On the other hand, modern, lighter weight vessels will have a lot more interior volume for a given amount of displacement.

Installing a System

The buoyancy bags vary in size but a typical bag will have a deflated dimension of 22-inches x 11-inches x 10-inches (560mm x 279mm x 250mm). When inflated this bag measures 5-feet x 4-feet x 3-feet (1.53m x 1.23m x 0.92m) and provides a ton (1,000 kg) of buoyancy.

In order to get the most freeboard from a given system, the *buoyancy bags need to be held as low as possible in the boat*. Otherwise, they will rise to the deck head, and, while you'll still be afloat, the decks will be awash.

There are two ways of accomplishing this task. One is by finding constrained areas in the interior into which the bags can be blown up. A quarterberth is an ideal location. The cockpit seats keep the top of the bag low, and the sides are held in place by hull and the inboard edge of the berth. Enclosed heads are another good bet for constraint.



An installation beneath the sole. (Yachtsaver photo)

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This installation is on an Alden 50. CO_2 tanks are installed beneath floorboards, while the deflated bags are stowed into pockets below the saloon seats. (Yachtsaver photo)

Apogee 52: Bag in floor of main cabin. (Yachtsaver photo)

Straps on the bags girdle them and fasten them to the hull. These typically have two attachment points, which are located within the deflated bag dimensions. If you are using a bag with the dimensions just given, with a ton of buoyancy, each one of these straps will need an anchor point capable of taking 1,100 pounds (500 kg) of lift, with something left over for a factor of safety. If these bags are mounted under bunks or the floorboards, you will need to be sure that the structure to which they are fastened can carry the load to the hull.

The other major installation issue is dealing with chafe points. The bags are built from polyeurethane-coated nylon and are doubled up for reliability. This material will withstand chafe from furniture, but the prick of a wood screw, sharp fiberglass edge, or sharp metal fixture will eventually cause a leak. So you need to carefully police the area into which the bag will inflate.

Make an allowance for plumbing runs and for the CO_2 cylinder (a typical cylinder is 27 inches x 7 inches (686 mm x 178 mm).

Storage bags are made to order and can be sewn from the same material as interior cushions. The bags can be stored under bunks, made into sea cushion backs, used as hull pads outboard of bunks, or fastened to the front of saloon settees. Or they can be installed under seats, bunks, or floorboards.

Cost Issues

If you consider the cost of a good-quality offshore raft, add in the extra supplies required to stock it, and an expensive raft survey every couple of years, the Yachtsaver system quickly begins to make financial sense. The smaller the boat, the more sense it makes (a small boat has the same expense as a large vessel for raft and related gear, but a smaller buoyancy system at lower cost will get the job done). If you add into this equation the issue of raft storage and security, the Yachtsaver alternative begins to look even more interesting.

Fire Risks

The one area where this system won't help is if your boat is lost to fire. Obviously you will take normal precautions to avoid this, but if you are going to use the Yacht-

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saver approach in lieu of a raft, everything possible must be done to minimize the risk of fire.

Fires at sea resulting in boat loss are pretty rare. I can think of only one instance (although there are sure to be others), and this resulted from an overheated generator on a timber yacht during a race from California to Mexico.

Most fires seem to happen in the galley, usually with alcohol or kerosene stoves (being started with alcohol), while the boat in question is at anchor. They are typically extinguished without loss of the vessel.

Built-in system installed in recesses of bunk fronts on a J/29. (Yachtsaver photo)

More rare, but potentially far more dangerous are electrical fires. You can avoid this risk by making sure that every individual circuit on your boat has a fuse or circuit breaker. This includes main leads off the batteries and from the alternators.

Much rarer are diesel-engine fires. These usually involve a fuel leak and an exhaust manifold or turbo. Careful maintenance, fire alarms, and fire-suppression systems (with auto engine shutdown) should minimize this risk.

Finally, you need a good selection of fire-fighting gear, including smoke hoods to allow you to battle a blaze long after smoke would have forced you out of the boat.

Decisions

It's not easy to decide what to do. There's a certain amount of security to the concept of a totally separate life boat/raft from the mother ship (no matter how illusory this is). In addition, although Yachtsaver has sold lots of systems, they have no real-world stories to tell about saved boats or lives in a cruising context (and we hope they keep it that way). Still, the logic of the system makes sense to me. I think if I had the space to fit in one of these systems and the budget to do this as an alternative to a quality life raft, I'd go this route with several caveats. First, the system has to be properly installed, with careful attention paid to freeboard, chafe, and long-term storage (keeping the system clean and dry). Second, some form of survival suit or insulated jump suits need to be aboard and handy to the companionway, with safety harnesses ready to go.

A final word on this subject. I was discussing these trade-off issues with Ralph Naranjo recently. Along with having circumnavigated, run a boat yard, and taught at the U.S. Naval Academy, Ralph is also *Cruising World*'s technical editor. Over the years he has held a series of safety-at-sea seminars during which various life rafts are demonstrated. Obviously this is a forum wherein a life-raft manufacturer would want to show off the best he has to offer.

On three separate occasions rafts have failed to inflate when their trigger lines were pulled. These included rafts from Avon, Switlik, and Winslow. Food for thought.

DECK HATCH RISKS

Before we leave the subject of safety gear, we need to talk about one more real risk aboard. The plastic that glazes your deck hatches is extremely slippery. When stepping on wet hatches, you will find traction nonexistent. Throw in some heel angle and sea motion, and they can be quite dangerous. A simple solution is to place nonskid tapes (3M seems to work quite well) around the edges and over the mid-span reinforcement bars. This provides your feet with some areas of traction, but doesn't affect what you see from below.

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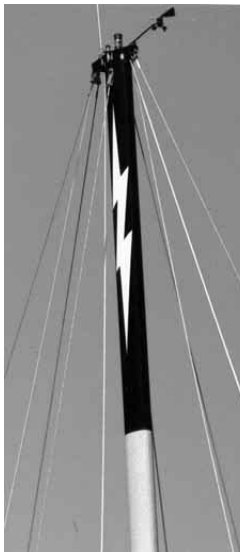
INCREASING VISIBILITY



This masthead graphic design enhances offshore visibility. A rescue-orange color scheme would be even more effective.

We all know that it is our job to see the other guy first, especially if he is bigger than us (like a ship for instance). But in case you miss, what are your chances of being seen? From the deck of a ship (if anyone's looking), it turns out that the odds are not very good. If there is a sea running with a few whitecaps, the odds are that your white sails and white hull will be lost against the horizon and foam.

Colored Sails

One way to help your visibility is by using brightly colored sails or the tops of the sails. Sailcloth is available in "rescue orange," and this is often a good choice for storm sails because of their increased visibility. It also makes sense to consider a colored panel or two at the top of your mainsail.

Spar Paint Schemes

Another way to increase visibility is by using a bright color on the upper section of your mainmast. Color combined with a paint scheme can do nothing but help.

Masthead Tricolor

Most cruising yachts today have a masthead tricolor to better project their lights at night. We've used these for years ourselves; and in clear conditions they are visible for 5 miles or more. This is a big improvement over deck-level running lights, especially with a sea running!

The problem, of course, comes with power consumption. If you are using a 25-watt bulb and it is left on for 10 or so hours, you have a huge increase in total power consumption.

So people tend to go dark and save the power. Of course, then you are relying on your own watch-keeping, fate, or the good fairy to keep you out of harm's way.

Over the years we've spotted a number of cruisers on radar during the evening hours that were sailing without lights. We'd adjust course to have a closer look, giving them a call on the VHF. Rarely has that call been returned, nor did they illuminate themselves as we passed close by. It seemed that nobody was awake.

All-Around White Light

On our last visit to Tonga we discussed the issue of visibility and watch-keeping with Jim Dilley, a P & O container-ship captain was cruising on his own 25-footer. What Jim had to say about watchkeeping and visibility was a bit disconcerting. While P & O (and most British ships) keep a careful deck watch, they are the exception in this day and age. And even with their watch, a small yacht during the day is difficult at best to see, Jim told me.

At night he favors an all-around white light, as bright as you can handle. When I asked Jim about the tricolor, he said he felt white was better because it was brighter.

"The red and green plastic lenses cut down the available light, and why give anything up?" was his reply.

When I asked about the issue of the ship discerning which way the yacht was headed, Jim indicated that "they give all white lights a wide berth."

Strobe Lights

Another ship captain, Bob Canto, who runs a supertanker from Saudi Arabia around the Horn, favors a strobe light. This is far brighter than a conventional white light and takes less power. The problem, however, is that strobe lights are so bright that they ruin the night vision of anyone within a mile or so. They have two additional problems. First, there is no depth perception with a strobe, so it is difficult for another vessel to tell how far away it is. Second, the strobe is typically thought of as an emergency signal; as such it is likely to invite unwanted attention. We installed a strobe aboard *Intermezzo* when we first went cruising, but after learning about the problems they cause we stopped using it.

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Running Lights

At some point you will enter a local traffic pattern. And while masthead tricolor lights are legal for running lights on vessels up to 65 feet (20 meters), they don't do a good job of letting other traffic know where you are when they are close to you. For work in traffic, hull-level running lights are the best.

Passive Radar Reflectors

To a ship with its radar antenna mounted a hundred or more feet above the water, a small yacht is little more than a tiny blip among many other small blips that represent sea-clutter.

It goes without saying that you cannot count on them seeing you. But you can improve your radar visibility with a radar reflector. These can be as simple as a small octagon or as complex as one of the tubular models.

When looking at radar reflectors, remember two things. The target presented by the reflector goes up with the cube of the increase in size, so a slightly larger unit will be far more visible than a smaller unit. Second, the higher the reflector is mounted, the better its visibility, especially in a running sea.

In a variety of tests, simple radar reflectors like the one above have proven highly effective. The higher it's mounted, the better its echo when a heavy sea is running. Even with the best reflector, however, you need to keep your eyes open.

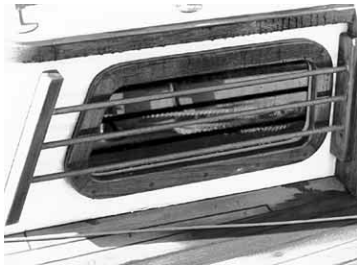
Electronic Radar Reflectors

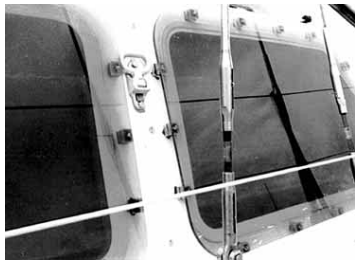
All commercial aircraft carry radar transponders that "paint" a signal on the air traffic controller's radar screen. Why not the same technology for seamen? We've discussed this issue with a number of electronics companies and I am happy to report that a variety of efforts are underway toward just such an end. The biggest hurdle, it seems, are the bureaucrats in various government agencies.

In the meantime, the folks at McMurdo Marine have been working on a device that takes an incoming radar signal, magnifies it electronically, then shoots it back to the vessel that originated the signal. According to the initial data on this device (called an "Ocean Sentry") it will provide a target enhancement eight times better than a passive reflector. Pricing was not firmed up at the time we went to press, but they are shooting for something under U.S. $700. In adverse conditions this could be a great safety enhancer. Of course, nothing beats a good lookout!

STORM SHUTTERS

For most production boats and heavily built custom vessels venturing in the higher latitudes, storm shutters are a good idea. Storm shutters can be as simple as heavy marine plywood, or more sophisticated thick plastic.





The horizontal bars in the photo at upper far left will protect the windows from flailing gear and will break the sea somewhat. Plywood overlays slip inside in heavy weather. The owners of *Arion III*, a Cal 2-46 (lower far left), used 1/2-inch (12.7mm) plexiglass to protect its windows, but made no attempt to seal them. To clean these they would run a hose between the two surfaces. The straps are a clever, easy-to-use means of holding plywood shutters in place. Another approach (near left) is to use quick-release straps. However, the ends of the storm shutters will need to be tied together to keep them from slipping out.

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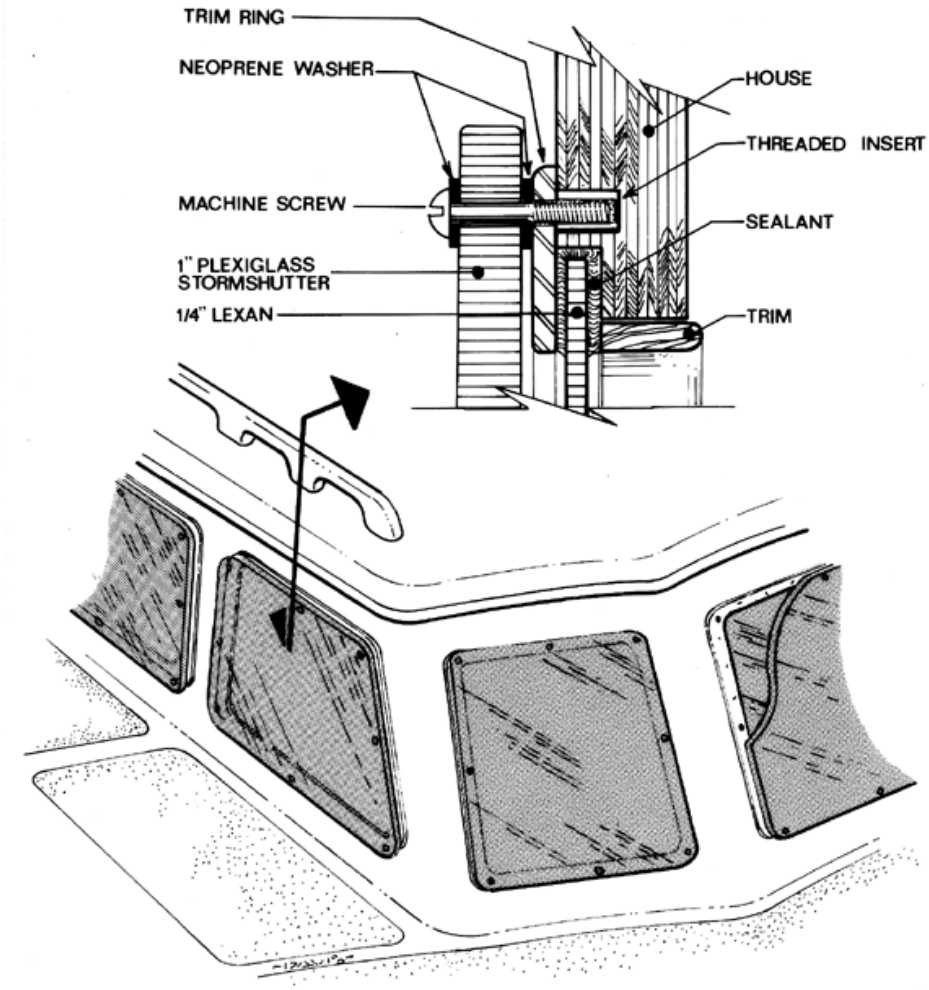

Here's a detailed drawing of one approach to semi-permanent storm shutters. The heavy Acrylic (Plexiglas) shutters are held off the window, protected by a thick spacer. The storm shutter is held in place with a simple threaded insert.

A teak or plastic washer can be used to maintain a space between the shutter and window. This gives you the option of squirting a hose between the two to clean some of the salt buildup.

The most basic question is usage. If your storm shutters are stowed under a bunk (where they are difficult to get at), the odds are by the time you think you need them you won't want to go on deck to put them in place. This is exactly what happened to us on *Intermezzo*. She had large, vulnerable dog-house windows that would not have withstood a fall off of a wave face. I had 3/4-inch (19mm) plywood shutters that tied easily in place. However, when we finally got into a blow where they were needed, the last thing I wanted to do was go on deck dragging these unwieldy shutters and put them in place. As a result, we installed permanent 1-inch (25mm) thick plastic shutters in New Zealand.

Although plastic is more expensive than plywood, it does allow you to see out and are more prone to be being used. I prefer to have permanent storm shutters, or a system that is so easy to use that as a matter of course the shutters are installed before each passage.

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COLLISION PATCHES

What do you do if you get a hole in the hull? A collision patch can make a hell of a difference. While this can be as simple as a sail feathered over the damaged area there's a lot of validity in the concept of a dedicated collision patch. Ideally, the patch should be triangular or round, at least 25 square feet (2.4 square meters) in size, with grommets all the way around the edge. A sandwich of heavy denier-trap material with hard but flexible foam inside will work best (the foam will help the fabric contour to the hole better).

As with all safety gear, try out your collision patch in calm conditions so you get a feel for how it can be rigged over the bow and along the topsides.

A triangular collision patch being tried out aboard John Neal's *Mahina Tiare*. Small patches are easier to keep in place against wave action. However, one this small would only work for a very small breach.

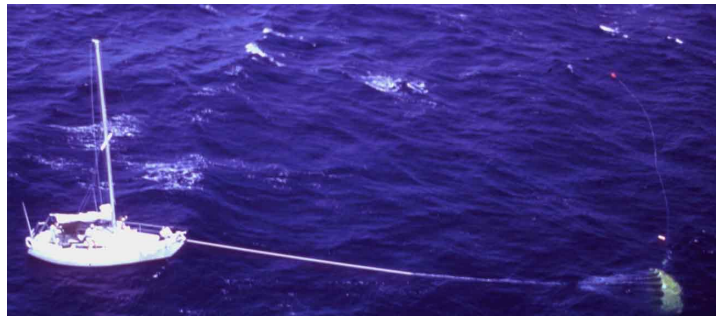
PARACHUTE ANCHORS

The whole issue of sea anchors and drogues is loaded with controversy. It goes right to the heart of heavy-weather tactics, a lengthy subject which we'll avoid for the moment. However, there are lots of reasons other than heavy weather to carry a sea anchor, primarily because it is a good way of holding station. Under normal circumstances you would heave-to. But what if you've lost your rig? In this case motion becomes intolerable in any sort of a sea. It takes much less force to capsize a de-sparred vessel, so a parachute anchor will help you hold station as well as improve capsize resistance and comfort.

If you are stuck in gale-force conditions, don't want to run off, and find there's too much breeze for heaving-to, again, a parachute anchor may look inviting.

If you carry such a system, be sure to test it in moderate conditions so you'll know how to set and retrieve it in heavier weather. Rigging and deploying can be tricky.

The parachute sea anchor is an effective means of holding station in moderately severe weather. However, most vessels are better running off at speed (assuming they have sea room) in truly severe conditions. (Paratech photo)



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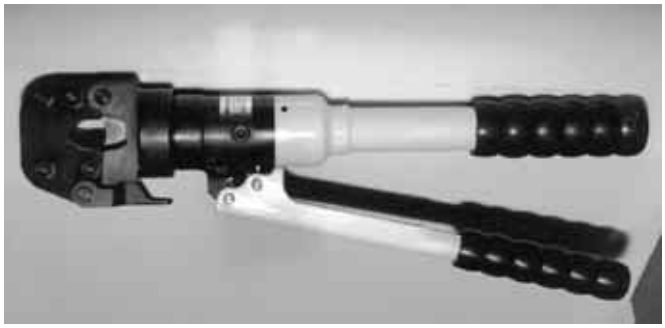
With 1x19 wire up to 3/8-inch(9.5 mm) size, a conventional wire cutter (Felco c-16 shown here-top left photo) can be used. There's a definite trick to cutting the wire, however. Place one cutter handle on the deck and give a hard jerk down to start. Practice in port. You might have to do this some day on a heaving deck (and if you're dismasted your deck is really going to move violently!).

For rod rigging and larger wire, there are several hydraulic cutters (lower left) on the market. In this case, the cutter is locked around the piece of rigging, then the handle is pumped until enough pressure is developed to make the cut. Little force is required on the pump handle. This unit shown is sold by Norsemen. You can also buy similar products from electrical wholesalers. (They're used for cutting heavy electrical cables.)



Deck knives are an everyday help, and essential when you have to act fast in an emergency. We typically carry one knife lashed to the main vang, one at the helm, and a third in a pocket on the life-raft cover. Inexpensive stainless fish-filleting knives with plastic sheathes work well.

RIGGING EMERGENCIES

The best way to avoid rigging emergencies is to periodically check the entire rig top to bottom. We always go aloft before each passage and look at tangs, wire terminals, spreader roots, and chafe gear and to make sure halyard sheaves are lubed and smooth running.

We check the bottom end of the rig — turnbuckles, wire terminals, goosenecks, etc. — before, as well as during, a passage.

Still, problems can occur. It will most likely be with a wire terminal, especially if it is a swage (although we've never had a swage fail on any of our yachts over the years). The best way to deal with a failed terminal is to replace it with Norsemen or StaLok terminal, which can be installed at sea.

It also makes sense to carry spare wire or wires, so that a shroud that begins to strand can be replaced. There's some logic to increasing wire sizes in the rig to reduce the amount of spare wire that has to be carried. Of course, this means you will have some extra weight aloft — not a particularly good idea.

Along with the Norsemen/StaLok fittings, traditional rigging clamps are also useful, especially if you have some heavy 7 x 19 wire to use them with for short periods of time.

A selection of large "D" shackles made from high-strength steel alloy (not stainless, which is weaker) with clevis pins that match turnbuckle pins may also be of use some day. If you use these shackles on the wire end and at the chainplate, repeated windings of light line can generate enough total strength to hold the rig in place until a failed turnbuckle can be replaced. Finally, some form of wire cutters need to be aboard to clear away a rig that has gone over the side.

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