

Seaworthy

KEEPING YOU AND YOUR BOAT SAFE ON THE WATER

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Courtesy David Wiggim

Everyday Moorings

A quiet evolution over the past two decades has improved two key elements of the mooring system. Have you given your mooring a makeover yet?

by **Beth A. Leonard**

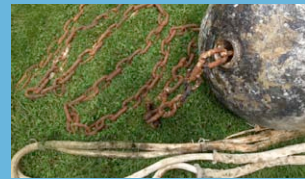
MOORING SYSTEMS ARE a lot like that old song about the thigh bone connected to the knee bone. Most moorings consist of a dozen separate pieces including whatever's on the bottom, two or more swivels, a half-dozen shackles, and a couple of lengths of both chain and line. For your boat to stay where you left it, every part has to be up to the task, and the whole will only be as strong as the weakest link. While most of the losses of boats on moorings during hurricanes in the BoatU.S. Marine Insurance claims files have to do with failure at the pendant, the part of the mooring lying between the surface of the water and the boat, "everyday" losses – where the boat doesn't stay put in conditions up through gale force – are just about equally divided between dragged moorings, failed pendants, and problems somewhere between.

But the files show that mooring and pendant failures can be reduced – and maybe even eliminated – with new technologies and techniques that first began to find their way into public mooring fields in the wake of Hurricane Bob in 1992. These new technologies – and annual maintenance on all the pieces in between – make it far less likely your boat will go wandering when the wind kicks up.

BoatU.S. claim files show that dragging deadweight or mushroom anchors account for roughly one-third of mooring failures

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SEAWORTHY TOP 10

Just got my *Seaworthy* magazine ... Top 10 ... that's my boat in #3! We had just purchased her in August, moved to that marina at Lake of the Ozarks ... and wham! We met [CAT Team Member] Dave Wiggin and [TowBoatU.S. Captain] Charlie Meyer that weekend and really understood why BoatU.S. insurance is far superior to others.



We still have this 36 Carver Aft Cabin and enjoy it almost every weekend. We almost lost her.

Bob May, Bob's No Wake Zone Radio
Clinton, MO

I enjoyed reading about your Top 10 claims in the October edition. I have a suggestion that would reduce or eliminate all but one of those causes – sail a steel boat. Because of the “Faraday cage” principle, lightning goes around a steel boat, not through it. Theft is less of a problem because steel boats are unique and stand out from the crowd. With steel being many times stronger and less brittle than fiberglass, steel boats protect their crew while shrugging off collisions, allisions, and bumps against underwater objects. While steel boats ground just like fiberglass boats, pounding against the bottom or shore rarely causes extensive damage. Of course the interior of steel boats will burn, but not the hull and deck.

This could be critical if the fire occurs at sea. My steel boat in Beaufort, North Carolina has been hit 11 times by hurricanes; the last time, my boat came through without a single scratch. I do have to concede that steel boats will sink just like fiberglass boats, maybe even faster.

Lee Huddleston
Beaufort, NC

Having read your article on Top 10 claims, I note that you suggest that we make sure we have proper fire extinguishers. The advice includes the word “working.” This has always left me wondering how to determine if a fire extinguisher is working properly. One establishment advised that I either bring the extinguisher in so that it could be recharged or simply replace it after a year or two. I also have a halon system on my boat and I have learned the only way to check the extinguisher itself is to weigh it. That, however, does not assure me of the functionality of the automatic setup. I would be interested to know if there are other ways to make sure fire extinguishers are OK. Even though the gauge shows in the green, I am suspect of its accuracy.

Wayne Russell
Daytona Beach, FL

After checking with some fire extinguisher manufacturers, we thought the answers were useful enough to share with everyone. See Alert on page 12.

WINTER AND HEATERS

I enjoyed your article on electric heaters and winterizing. This area is all too often ignored by boat owners as well as marina owners. The National Fire Protection Association (NFPA) writes many standards that are adopted as laws in many states and municipalities. Some of these fire codes contain chapters that apply to

marinas and boatyards. Portable heaters are covered in NFPA 302 (Pleasure and Commercial Watercraft), NFPA 303 (Marinas and Boatyards), and NFPA 1 (Uniform Fire Code). NFPA 1 has been adopted by 20 states and many other jurisdictions.

NFPA 1 states:

“28.1.7.2.1.1 Heaters.

28.1.7.2.1.1.1 The use of portable heaters in boat storage areas shall be prohibited except where necessary to accomplish repairs. [303:7.2.1.1.1] 28.1.7.2.1.1.2 Portable heaters used in accordance with 28.1.7.2.1.1.1 shall be used only when personnel are in attendance. [303:7.2.1.1.2]”

All three sections of the code state that portable heaters should only be used on a boat when the boat and heater are attended.

Captain John McDevitt, NFPA 302
Watercraft Chair
Grasonville, MD

WINTER AND ETHANOL

I have a 90-hp, 4-stroke Mercury on my pontoon boat. I only get to use it about once a month and was wondering if I should disconnect the fuel line after each use and run the gas out of the motor. I use only ethanol-free gas and I try to keep the tank topped up.

Steve Smolcich
Fort Walton Beach, FL

You're lucky that you can find non-ethanol fuel. No, there's no need to run the engine dry after each use. If you do store it for longer than normal, though, it still needs to be treated with a fuel stabilizer — any gas will deteriorate after a few months.

Thanks for the article as it has happened to me – ethanol affected the high-pressure fuel gas pump internal to my four-stroke Honda 130. I heard from an engine mechanic who works on fuel-

injected four-strokes that disconnecting the fuel line and running the engine out of gas until it stops is bad for fuel-injected engines. Any comment about this?

Richard J. Montaner
Arlington, VA

We've spoken to several industry and manufacturer experts and they all say that while disconnecting the fuel line while the engine is running could potentially damage the fuel pump, it would take more than a few times before it became a problem. After all, people run out of gas sometimes. Running the engine with the fuel line disconnected once a year is not likely to hurt anything. Call Honda's tech service department if you want to be sure this advice holds for your engine.

WINTER AND OUTBOARDS

In your article, "Long Winter's Nap", in the section on draining all the water, you first say tilt the engine up to running position. Next sentence you say tilt down to running position. Which is it – up or down?

Dave Evans
Shelter Island, NY

Sorry for the confusion. First we said to "tilt to the upright running position,"

and then to "store it in the running (tilted down) position." What we meant to tell you is to drain or store in the running position (tilted down/engine upright). The reason we specified keeping it in the running position during storage is that if it's tilted up and water gets inside through the hub somehow, it can freeze and crack the lower unit housing.

ANCHOR CHAIN ANGST

I have owned a 185 Scout Sportfish for a number of years. The boat was equipped at the dealer with a coated anchor chain. Great concept in that the chain never scuffed the fiberglass around the chain locker hatch. Bad idea, though.

I recently had the boat anchored on the backside of one of our remote barrier islands for a day of fishing. At the end of the day, when I went to pull the anchor, I pulled nothing but a piece of chain, NO ANCHOR. The chain had completely parted from the anchor due to extensive corrosion that could not be seen because of the factory coating on the chain. Thankfully the chain failed when the full strength of the anchor, chain, and anchor line was not required. Had I been faced with an emergency that required my anchor, I

would have been in deep trouble.

If you have an anchor chain, have a chain that can be easily inspected. Your anchor equipment is only as good as the weakest link.

Herb Aton
Charleston, SC

ROAD WARRIORS

The most important advice I always tell my clients when shipping a boat any highway distance is this one: Be sure to drain exhaust systems including mufflers/lift mufflers before hitting the road. Boats being shipped long distances and over mountainous roads go uphill then downhill. Any water left in the exhaust finds its way back into the engine's cooling system and into the cylinders.

Also, save big money by listening to what a good marine surveyor tells you when you prep your boat.

**Norm LeBlanc Accredited
Marine Surveyor, SAMS**
Danvers, MA

Another good reason to drain the exhaust: If a boat is going to be traveling through below-freezing weather, the trapped water could freeze and damage the exhaust. That's also why it's so important to winterize the boat before travel.

HITCHED AGAIN

In response to the letter in Mailboat in the October 2013 issue, concerning the writer's desire to require others to remove their hitches, I must say that it took me at least half a day and about \$100 to add a hitch to any of my four current vehicles. After removing bumper covers and drilling holes in the vehicle structure, I am NOT going to remove a hitch. Perhaps the writer meant to say hitch receiver.

Ed Wagman
Ocean View, DE



Courtesy Herb Anton

ON THE BOTTOM

Until recently, mushrooms and deadweight mooring anchors – which can include anything from an engine block to rough-hewn slabs of granite a yard or more across – have been the only mooring options.

But both have serious issues. While a deadweight anchor may gain some advantage from suction in a mud bottom, in most cases its holding power is completely dependent on its weight, or, more exactly, on its submerged weight. Cast iron weighs about 12.5 percent less in the water than out; concrete loses nearly half of its weight underwater. The reduced weight and lack of shape to help the anchor dig in to the bottom mean that it takes a very large and heavy deadweight anchor to hold a boat in place in gale-force winds. As you would expect, in various tests deadweight concrete moorings



Mushroom anchors can drag if the chain wraps around the shank.

had a holding power of right around half their dry weight (Table 1).

Theoretically, mushroom anchors can provide substantial holding power – up to 10 times their submerged weight – if they are sufficiently buried in mud. In most harbors, though, a mushroom anchor doesn't sink more than a foot or so into the bottom, and it is most often oriented pointing away from the prevailing winds. A storm that swings the boat into a different direction will first pull the mushroom anchor upright, and it may not reset when it gets pulled back down in the

new direction. In a storm with a couple of wind shifts, the chain can also wrap around the shank of the mushroom anchor, shortening effective scope and decreasing the chance of it resetting. Mushrooms tend to drag through silt and bump along without digging in to denser bottoms like clay or hard-packed sand. In tests, the holding power of mushroom moorings has varied from 2.4 to 5.7 times their weight.

In the last year, all of the incidents of moorings being dragged in the claim files involved either mushroom or deadweight anchors.

Weighted mushrooms are designed to overcome some of these issues. A weight at the top of the shank is meant to tip them back on their side when they come upright, and the sharper edge on the bell-shaped bottom helps them to dig in. We don't have enough data to evaluate their holding power, though.

In the last two decades, two alternatives have come into increasing use and the evidence has been mounting that these are substantially better at staying in one place than the traditional solutions. While all the other mooring anchor types rely on weight or weight and embedment for their holding power, helical screw anchors are screwed directly into the seabed. They have long, high-tensile steel shafts with large screw threads on the bottom and an attachment eye at the top. A barge-mounted hydraulic device is used to install them, and they work in most bottoms.

Comparing the holding power of a helix anchor to that of a traditional mushroom or deadweight anchor is like comparing a wood screw to a thumbtack or paperweight. As Table 1 shows, helical moorings offer an order of magnitude more holding power than any of the alternatives. They're also significantly less sensitive to scope to maintain their holding power, which means more boats can be fit into a smaller area. Helical screw anchors are not completely failure proof, though. They must be installed properly, and

▶ ONLINE EXTRA

For links to moorings and pendants, see this article on *Seaworthy* online.

they need sufficient scope to allow for storm surge and waves.

Dor-Mor anchors look like upside down pyramids with a point at the bottom and a short shank on the flat top. The mooring lands point down and buries deeply in mud, clay, or sand bottoms. The high center of gravity tips the sharp edge down so that it digs in. When the boat swings, the mooring may shift, but it doesn't come upright like a mushroom. While nothing can compare to the holding power of a helix anchor, in tests, Dor-Mors had almost twice the holding power for their weight as the average of the mushrooms. Dor-Mors now account for 75 percent of the moorings at Woods Hole, an anchorage known for a difficult bottom and strong currents. The Coast Guard has been using Dor-Mors for Aids to Navigation in areas subject to currents. Dor-Mors are more expensive than mushrooms, but their installed cost is similar to helix anchors.

AT THE BOAT

When the wind starts to kick up, in all but the most sheltered mooring fields, waves will soon follow. The cycling loads from waves on the mooring pendant can generate forces anywhere from two to 10 times the static load. If the wave period is four seconds, the mooring pendant will be subject to those shock loads over 20,000 times per day.

In these conditions, the mooring pendant provides elasticity to limit the shock loading that could destroy the boat's hardware or jerk the mooring anchor from the bottom. But that same elasticity results in chafe and may cause the pendant to part if the line passes over any hard spot as it lengthens and shortens. Normal chafe protection can allow heat to build up in the nylon strands, leading to a failure when the internal stresses cause

the fibers to melt. There are many of these failures in the claim files. What's needed is a mooring pendant that provides a great deal of elasticity without chafe – a seemingly impossible combination.

After Irene, *Seaworthy* reported on a new mooring pendant designed to separate the pendant into two lines, one with high elasticity and one with, for all practical purposes, no elasticity and very high chafe resistance. Nantucket Moorings, in conjunction with MIT, developed Cyclone Mooring Pendants, a two-part pendant with the upper part made from New England Ropes STS-12 line coupled to a standard nylon double-braid lower. STS-12 is made from Dyneema fibers, which are incredibly strong, abrasion resistant, and UV resistant. Soft eyes are spliced into each of the two lines, and they're then connected together. A second, longer Dyneema line can be added to make a bridle and act as a backup if the first Dyneema line were to fail.

Dennis Metcalfe, manager of Nantucket Moorings, told us that in the three years Nantucket Moorings had



This pendant uses chafe-resistant Dyneema on the boat, coupled with standard stretchy nylon line at the mooring.

been using Dyneema, he had never seen any signs of chafe. You can buy a pre-made pendant or make your own.

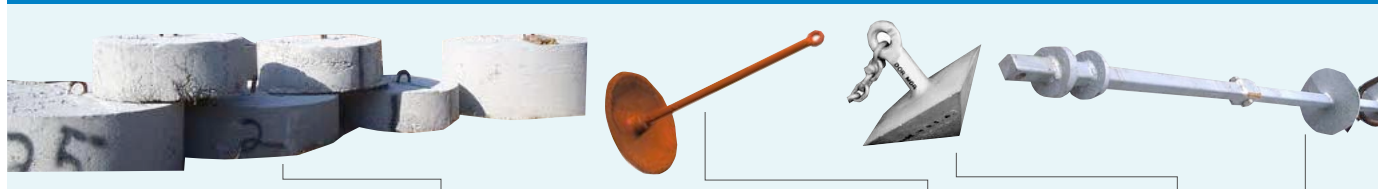
WHAT LIES BETWEEN

The anchor mooring and the pendant are only two pieces in the mooring system that makes up the mooring. Traditional systems use heavy chain on the mooring to ensure that the pull on the mooring remains at an appropriate angle even in strong winds, and lighter chain above to reduce the weight on the mooring pendant. Eye-to-eye swivels and shackles are used to connect the two chains. The entire system needs adequate scope for the type of mooring

anchor. Failures between the traditional mooring and the pendant almost all have to do with corrosion. The key to preventing failures is a comprehensive maintenance program that includes an annual inspection of every element in the mooring system.

Unfortunately, it's not enough to make sure your mooring is perfect. Your boat's safety also depends on the condition of every mooring upwind of you. A professionally managed mooring field with an annual maintenance schedule and specific standards with regard to the mooring anchor, pendant, and everything in between will reduce the chances another boat will ruin your day. ⚓

TABLE 1. COMPARISON OF BREAKOUT FORCE FOR MOORING ANCHORS



Test	CONCRETE BLOCKS					MUSHROOMS			DOR-MOR	HELICALS
	BoatU.S.	Vineyard Haven	Vineyard Haven	BoatU.S.	Sarasota Sailing Squadron	BoatU.S.	Vineyard Haven	Vineyard Haven	BoatU.S.	BoatU.S. Vineyard Haven Sarasota Sailing Squadron
Anchor dry weight	8,000 lbs.	6,000 lbs.	3,000 lbs.	2,000 lbs.	1,500 lbs.	500 lbs.	500 lbs.	350 lbs.	650 lbs.	Various sizes
Breakout force	4,000 lbs.	3,200 lbs.	2,100 lbs.	800 lbs.	800 lbs.	1,200 lbs.	1,700 lbs.	2,000 lbs.	4,500 lbs.	10,000 - 20,800 lbs.
Holding Power*	0.5	0.5	0.7	0.4	0.5	2.4	3.4	5.7	6.9	

BoatU.S. – 1995 BoatU.S. Insurance pull-test conducted by BoatU.S., MIT, and *Crushing World* in Newport, RI

Vineyard Haven – Test performed at Vineyard Haven, MA by Helix Moorings with harbor masters, marine writers, and BoatU.S. in attendance

Sarasota Sailing Squadron – 2007 *Practical Sailor* test conducted at the Sarasota Sailing Squadron

*Holding power is defined as breakout force/anchor dry weight and represents the pounds of force the mooring can hold per pound of anchor dry weight

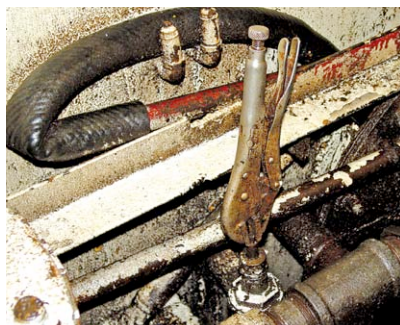
Capt. Frank's Sea Chest of Horrors

Don't let the sleeping dogs lie aboard your boat this winter

by Frank Lanier

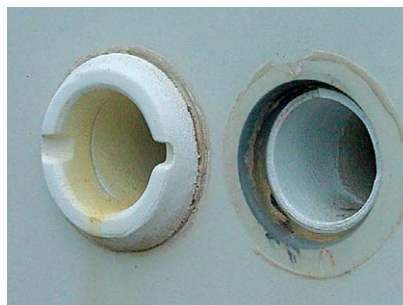
WHILE THE OLD axiom "Let sleeping dogs lie," may be sage advice when dealing with rottweilers, as a marine surveyor I can tell you it's definitely not the attitude to have with regard to boat maintenance. The various systems aboard your boat won't continue working flawlessly without proper upkeep, and an "out of sight, out of mind" maintenance philosophy will quickly transform the feng shui of your floating Shangri-la into a black hole of frustration and financial woe.

Most all boats have sleeping dogs and winter is the perfect time to inspect your vessel before they have a chance to wake up and take a bite out of the captain's quarters. To visually assist in your mission to identify and head off potential problems, hop on board, buckle in, and keep your arms and legs inside the car at all times as we take a ride through the cavalcade of maritime perversions I like to call "Capt. Frank's Sea Chest of Horrors." All the more shocking because they're true!



1 HERE, SAILOR'S INGENUITY has once again reared its hoary old head in an effort to sink yet another vessel. The handle of the gate valve controlling the bilge manifold has broken off and been

replaced with that venerable standby, locking pliers. Aside from the damage this inflicts to the valve's stem, chances are the pliers will be "borrowed" by a crewmember for some other important task and never returned – a fact most likely discovered when the valve needs to be closed in a hurry. Gate valves are not recommended for use onboard, particularly in below-the-waterline applications. Their internal mechanisms are prone to corrosion-induced failures and they give no visual indication of whether they're open or closed as does a true seacock. Worse still, the valve can fail to completely close if they become jammed with trash or debris, allowing water to enter the vessel even after the owner thinks the valve is closed.



2 CRACKED PLASTIC THRU-HULL fittings are a common problem, as a walk through pretty much any boatyard will bear out. Ultraviolet light is the main

culprit and while different brands vary widely in their susceptibility to UV damage, some are so poorly made they can fail within the first year. Plastic thru-hulls typically fail where the body of the fitting joins the outer flange, resulting first in a crack and eventually in the outer flange breaking away completely (both shown in the accompanying photo). Once the flange shears off, there's nothing left to keep the thru-hull in place, meaning it'll eventually be pulled inboard, leaving a gaping hole in its place. If located near the waterline, such a hole can reduce the vessel's effective freeboard from feet to inches, meaning a boat needs only to settle slightly before it begins to take on water and sink. Plastic fittings should be inspected at least annually. If you find one fitting that's bad and the others are of the same vintage, play it safe and replace them all.

3 IT TOOK ME a few moments to figure out just what it was about this thru-hull installation that gave me the willies. Do you see it – or rather, what don't you see? At first I thought it was the gate valve (which I'm not overly fond of to begin with, especially in below-the-waterline applications such as this). Then it hit me – there are no hose clamps! The only thing holding the thru-hull, seacock, and hose together are a few pieces of foam PVC pipe insulation and a prayer.





switch to pressurize the line. Note the pressure gauge reading, then close the tank valve – the gauge reading should remain constant for at least three minutes. If the pressure drops, you have a leak (or leaks), which must be found and corrected prior to use. Leaks will typically be found at fittings and connections, although they can occur anywhere in the system due to chafe or physical damage to supply lines or other system components. Use leak detection fluid or a detergent solution to locate leaks. Don't use solutions containing ammonia (it attacks brass fittings) and unless you want top billing at the Darwin Awards website, never use a lighter to check for leaks.

5 BACKUP BILGE PUMPS are always a good idea; however, there are a few installation points to consider to ensure they work properly when needed. Backup pumps should be mounted and configured to turn on when the bilge-water level reaches around four to six inches above the turn-on point for the primary pump. This prevents the backup pump from resting in the normal accumulation of bilge water, where it can become clogged with sludge and debris and seize from disuse. Unlike the installation shown, a better option would be to mount the backup pump just below or at the same level as its float switch (shown by the arrow).



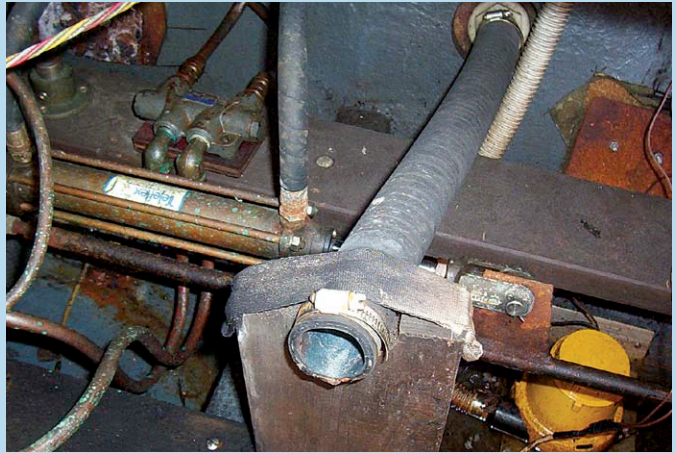
4 CAN YOU SPOT the problems with this LPG installation? They include an unsecured cylinder, no shut-off valve operable from the vicinity of the LPG appliance, and no pressure gauge. Without a pressure gauge, you cannot conduct leak-down tests, a simple way to check the "health" of your LPG system that should be done on a regular basis (at least monthly). To conduct a leak-down test, make sure the tank valve is open and turn on the solenoid

6 WHAT, I HEAR you say, can possibly go wrong with cockpit drains? The water disappears and everybody's happy, right? Let's say your boat was manufactured in 1980, a realistic example as there are still plenty of vessels from that era out and about. If the cockpit drain hoses are original (and there's a good chance they are), it means the safety of you and your vessel hinges on a 33-year-old piece of hose. All hose has a finite lifespan and should be inspected and replaced on a regularly scheduled basis (as per manufacturer recommendations) regardless of appearance. Recommended replacement time frames vary between hose manufacturers, but 10 years is commonly quoted.

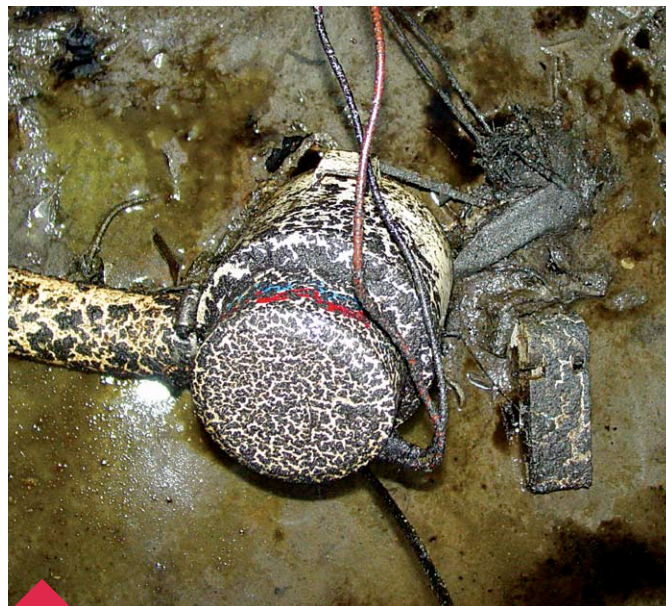




7 SWIVELS ARE INSTALLED between anchor and rode to prevent twisting (particularly with all chain rodes); however, many boaters are unaware they can be installed incorrectly. The jaw fitting of the swivel must be attached to the chain, not the anchor shank, with the swivel eye attached to the anchor shank, utilizing an anchor shackle. When the jaw fitting is attached to the anchor shank, as shown here, it will bind and could fail as the vessel sheers at anchor. The swivel itself should be drop forged (not screwed, riveted, or welded together), and the largest size that fits the chain link without binding should be used.




9 THIS PHOTO SHOWS the exhaust outlet for a generator that, according to the owner, had failed a number of years before and been removed. Rather than properly capping or removing the now unused thru-hull, the owner chose to simply do nothing, effectively reducing the vessel's freeboard (and safety margin against sinking) from roughly three feet to three inches.



8 NO AMOUNT OF pumps can overcome a bilge choked with trash and debris. Periodic bilge cleaning is a fact of life with older vessels, but even new boats can be littered with wood shavings, bits of fiberglass, globs of adhesives, and other construction trash that can plug up a pump. Oil in the bilge is just as bad; it combines with dirt to form sludge, a thick gooey material that can clog pumps and prevent automatic float switches from operating properly. And, of course, discharging that oil overboard is bad for the environment and the hefty fines are bad for your wallet.



10 HERE WE HAVE a cracked and severely corroded exhaust riser for a small diesel engine on a 30-foot sailboat. If it's this bad on the outside, just imagine what the inside looks like — that swollen and corroded fuel shut off control line resting against the riser isn't looking too good, either. Engine manifolds and exhaust risers should be periodically removed, pressure tested, and fully inspected for corrosion and clogging, as failure here can easily damage the engine or, if water gets into the cylinders, destroy the engine completely. This should be considered standard maintenance, particularly with boats used in saltwater. How often depends on vessel location and use; however, four years is typically quoted (more frequently depending on riser age).

Frank Lanier is a SAMS Accredited Marine Surveyor with over 30 years of experience in the marine and diving industry. He holds a 100GT master's license, and has captained and maintained many different types of vessels. 



CELL PHONE

THE PROS Your cell phone is, without question, one of the easiest and most effective search and rescue (SAR) devices of modern times.

With it you can speak directly to SAR personnel, give them position and situational information, and receive instructions. Modern smartphones can also provide you with GPS data and backup navigational abilities. And if you need your hands free to keep your boat afloat or render medical assistance to a passenger, you can activate an application like the SARApp or ICE. And don't forget the BoatU.S. towing app, which sends your position directly to the BoatU.S. dispatch center (www.BoatUS.com/towing/app).

THE CONS Unfortunately, cell phones remain one of the least reliable forms of communications on the water. Range is obviously limited. Even if you always boat within sight of land, they simply can't be depended upon to get a signal, especially in life-or-death situations. Their batteries always seem to run out when we need them the most. On top of that, the Coast Guard specifically requests that SAR contacts not be made via email, which is how some of the cell phone emergency apps are set up to work. Finally, consider how vulnerable cell phones are to water damage. And unlike on a VHF radio, there's no way to put out a general call to anyone within hearing range. Even though it may be the first thing you reach for in case of emergency, you simply must never rely upon a cell phone as your primary form of signaling for help.

Continued on page 10

Emergency Signaling Options

When you need to make a call for help, you want to be 100 percent certain that call will go through

by Lenny Rudow

IN THE MIDDLE of the summer of 1899, the barkentine *Priscilla* foundered on the shoals off North Carolina's Outer Banks. With no way to call for help, the 10 men onboard were in imminent danger, but luckily, a beach patrol on horseback from the Gull Shoal Lifesaving Station spotted the wreck – and all hands were saved. Flash forward to the winter of 2012. The 48-foot sailboat *Wolfhound* loses all power and spins out of control in 50-knot winds and 20-foot seas. But this takes place a solid 680 miles east of where the *Priscilla* met her fate, and there's zero chance of a lucky encounter with horseback-riding rescuers. Someone onboard the *Wolfhound* presses a button. Moments later the Coast Guard Fifth District Command Center in Portsmouth, Virginia, receives the signal from an emergency position-indicating radio beacon (EPIRB). Within hours an HC-130 Hercules based in Elizabeth City, North Carolina, is circling above the stricken sailboat. As with the *Priscilla*, all of the people onboard are saved.

Separated by 115 years of technology, the only things these two cases share in common is that both vessels were in imminent danger, and both crew were successfully rescued. One thanks to sheer luck, and the other thanks to modern electronics.

The EPIRB is not, of course, a completely new development. In fact, EPIRBs have over 22,000 rescues to their credit. Having been in use for over three decades, however, today's EPIRBs are significantly advanced over those of yesteryear. And just as

importantly, the concept of sending a signal through the air to call for help has been thoroughly expanded upon. Now, you can send out an SOS with a wide variety of devices including cell and satellite phones, satellite text messengers, and PLBs (personal locator beacons). With choice comes the need for informed decision-making. And correctly deciding which of these systems is best for you is only possible with all the facts in hand. Here are your choices, and the pros and cons of each.

VHF RADIO WITH DSC



THE PROS The VHF radio is just about the most common form of emergency marine communications around, and with good reason: It's simple to operate, communications go both ways, and, with a properly installed DSC (digital selective calling) radio, when you hit the panic button, the USCG will automatically get your exact GPS position, they'll know you're sending a distress call, and they'll know who you are. DSC radios retransmit any emergency signals they receive, so as long as another boat with a DSC-equipped VHF receives your transmission, the effective range of a distress call can be many times greater than your VHF range. VHF's are also relatively inexpensive, easy to install, and virtually all of the models on the market today are rugged and reliable.

THE CONS The biggest downfall of VHF with DSC is the same as it is for all VHF radios: Your range is limited by the curvature of the Earth. Antenna height plays a big role here, as can atmospheric conditions. With an average fixed-mounted antenna on an average pleasure boat, you can't expect a range much over 20 miles. Also, the fixed-mounted VHF on your boat probably depends upon your boat's electrical system for power. If you're adrift with dead batteries, the radio won't help one iota. Carrying a backup handheld unit with its own power source is always a good idea, but these units have even less range, sometimes as little as a mile or two. Finally, if you have a DSC-capable VHF, you need

to make sure it's properly interfaced with your GPS to give position data – something the Coast Guard estimates eight out of 10 boaters fail to do – and it needs to be registered with a Maritime Mobile Service Identity (MMSI) number. MMSIs for domestic use can be obtained from BoatU.S. at www.BoatUS.com/mmsi

EPIRB

THE PROS Thanks to a proven track record of high reliability, EPIRBs remain a top choice for sending out an emergency signal to SAR personnel today. Since EPIRBs interface with Cospas-Sarsat international SAR (search and rescue) satellites that calculate your position via GPS, triangulation, or a combination of the two, they are essentially unlimited in range. EPIRBs are also equipped with a strobe light for quick visual acquisition, can be activated either manually or automatically, are required to float and be completely waterproof, and can be mounted with hydrostatic releases.

THE CONS Despite excellent reliability and a long history of saving lives, if the EPIRB were perfect, it wouldn't have all of this competition. First, consider expense. Bottom-of-the-line models cost over \$500, and high-end units cost over \$1,000. And it's not a one-time cost, since EPIRB batteries usually need to be serviced by the manufacturer as they age, about every five years. Less expensive units commonly aren't GPS-equipped, which expands the effective search radius from a few hundred feet to two nautical miles. And EPIRBs cannot be taken from vessel to vessel. They must be registered to a specific vessel, so



▶ ONLINE EXTRA

To find out how to interface your radio and GPS see <http://www.boatus.com/magazine/dsc>

you can't legitimately use one unit for multiple boats. But an EPIRB's biggest downfall may be its limited communication ability; it can send out a cry for help with your location information and vessel data, but that's it. They don't receive any form of communications, and they don't have the flexibility to transmit any additional data. You can't discuss emergency repairs procedures, medical treatment, or any of the other matters that could make the difference between life and death in an emergency situation.

PLB

THE PROS A personal locator beacon (PLB) is much like an EPIRB, in that it sends out an automated distress signal to the Cospas-Sarsat satellites with an essentially unlimited range; GPS, triangulation, or both are used to nail down your position. They're also smaller than EPIRBs, less expensive (some can be purchased for less than \$300), and completely portable. They are small enough to be carried by crewmembers at all times, and they have been used to locate crew in overboard situations.

THE CONS On the surface it may seem that a PLB is a better choice than an EPIRB until you consider the downsides of depending on these units. For starters, they have half the guaranteed battery life. Not all units have strobes (though many do) and all require manual activation. Finally, not only do they suffer from the same limited-data constraints of the EPIRB, they actually transmit even less data, since they don't include vessel information.



SATELLITE MESSENGERS



THE PROS Satellite Messengers are a relatively new development, with the first (the SPOT) being introduced about five years ago. But they've developed rapidly since then, with expanded capabilities. Text messengers use satellite com-

munications to bounce a short text message to an individual party or, in times of need, to emergency responders. When you hit the SOS button, these transmissions include your exact GPS position in the data feed. These units are extremely small (the size of a cell phone or smaller), inexpensive (some can be had for as little as \$120), rugged and waterproof, and are easy to operate. Some allow for two-way communications via an integrated keyboard, some use Bluetooth to pair with a cell phone and allow two-way texting, and some allow only one-way texting of pre-typed messages. They run on either store-bought lithium or rechargeable internal batteries, and while operating times vary, can generally send out their messages for days at a time.

THE CONS Satellite Messengers use commercial networks rather than the Cospas-Sarsat system, so they charge for airtime and are sold with a monthly or yearly service contract (ranging from about \$100 to \$500 per year depending on service level). Your SOS transmission does not go directly to the USCG but to the GEOS Emergency Response Coordination Center, which then ascertains the proper SAR agency to contact. The GEOS track record is good – they've assisted in the rescue of over 3,500 people in the past five years – but this does add another step into the emergency-response process. Also, the different units' capabili-

ties vary widely depending on the type of unit and service you choose. While some allow for two-way communications, others can only transmit, not receive. And in some cases, they can only transmit a distress signal.

HF RADIO



THE PROS For those planning to spend a lot of time out of cell phone and VHF range, HF (High Frequency) radios – single sideband (SSB) or ham – provide two-way, long-distance communications and can be used to contact rescuers directly. HF signals can be transmitted for hundreds of miles, and in the right conditions can span entire oceans. Newer DSC-equipped models offer the same push-button emergency signaling and retransmission of distress signals from radio to radio as DSC VHF's. HF radios are like party lines — which means that someone will hear you in an emergency even if it's not the party you were attempting to reach, and they can then relay the message to rescuers.

THE CONS Ham radios cost about \$800, but they are dependent upon good antenna systems and ground planes to perform well so the installed cost will easily be double that. A license is required to operate a ham radio. No license is required to operate an SSB, but marine SSBs are much more expensive, starting around \$1,500 with an installed cost of \$3,000 or more. Transmission quality is dependent on atmospheric conditions, and there may be times when it is all but impossible to get clear communications with the desired party. Finally, these radios consume a fair amount of power so if your ship's batteries go down, the radio goes down with them.

SATELLITE PHONE

THE PROS For fast two-way communications without any limitations on the information that can be conveyed between rescuer and rescuee, a sat phone is going to be tough to beat. It allows you to speak firsthand with SAR personnel, continually, from virtually any place on the planet. As well as relaying location and emergency information, you can communicate medical situations (and receive instructions from special-knowledge responders) and any other pertinent info. You can contact parties outside the SAR system. Marine models are rugged and waterproof. Both portable and fixed-mount units are available, as are extra batteries. That means you could take the portable with you if you have to abandon ship.



THE CONS Unfortunately, satellite phones are not cheap. Most brands start at around \$1,000 (though at least one model new to the market this year has an MSRP of \$500) and can cost several thousand dollars. Worse, they get a lot more expensive if you actually use them. You may have to buy a monthly plan and with many of them, you'll also have to pay \$1 or more per minute of use. Plus, the Coast Guard doesn't have a 1-800-RESCUE-ME number to call. Different areas are covered by different regional Rescue Coordination Centers, each of which has its own emergency line. It's not hard to find these numbers and pre-program them into the phone but in any case a sat phone doesn't create an idiot-proof direct link of units like EPIRBs and PLBs. Finally, most portable sat phones have a fairly limited battery life and talk time, which may span just a few hours. ⚓

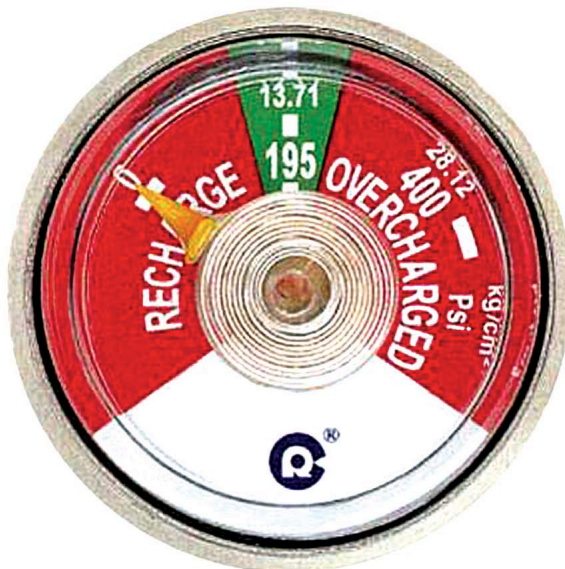
Our BoatU.S. Magazine electronics editor, Lenny Rudow, is also an editor for BoatUS.com.



EXTINGUISHING DOUBT

The time to know if your fire extinguishers work is not when you are about to use them. This winter, make sure your extinguishers are up to snuff.

Most portable fire extinguishers are nonrechargeable and contain powder that may compact over time, which can make them useless in an emergency. Once or twice a year, remove your extinguishers from their brackets and vigorously shake them to break up the powder. If it's been a while, you may need to hold them upside down and strike the bottom with a rubber mallet (don't use a hammer because it might chip the paint and allow the canister to corrode). If you can't feel loose powder inside the canister, it's time to replace it. Mounting the extinguisher horizontally will often delay the chemical from packing, but they still need to be shaken.



Most portable extinguishers have a pressure gauge that should also be checked at least twice a year – the reading should be in the green zone. If it's not, less expensive fire extinguishers will need to be replaced. Some more expensive portable fire extinguishers can be recharged if the pressure gauge is no longer in the green. Those types should be serviced annually by a qualified extinguisher company, who will tag them with the date of service. Also check for dents and corrosion, and make sure the nozzle hasn't gotten damaged. Non-rechargeable fire extinguishers don't last forever and have expiration dates, usually 12 years from the date of manufacture.

Fixed engine room systems that contain halon or FE 241, should be inspected twice a year, and the canisters should be weighed annually to see if they've lost any of their charge. If so, they need to be serviced and recharged.

CAUSE OF FIRE: BILGE PUMP

You put a bilge pump aboard to protect your boat, and for the most part, that's exactly what it does. But every year *Seaworthy* gets reports of bilge pumps smoking, melting, and even starting fires. The problem is caused by a combination of incorrect fuse size and something called rotor lock, a condition in which the bilge pump rotor can no longer spin because it's jammed with debris or bilge scum, or the bearings are seized.

Here's what happens: A locked rotor causes the 12-volt wires to heat up, which should blow the fuse. But a fuse rated for more current than what the manufacturer calls for may not blow even if the wires get hot. The hot wires create even more resistance, which decreases the current flow in the wires, preventing the fuse from ever blowing. Because electricity is still flowing, the wires start to smoke and eventually glow red-hot, at which point they could ignite anything flammable nearby.

Many small bilge pumps call for a 3-amp fuse, but some-



times installers substitute a 5-amp fuse because they're more likely to have one lying around. It's critical to install the exact fuse size manufacturers recommend for use with their bilge pumps – a fuse rated even one amp higher could lead to a fire if the rotor locks. Also, make sure the wire size to the pump is correct – too small of a wire can also overheat without the fuse blowing.

FIBERGLASS AND ETHANOL DON'T MIX

Or rather, they do mix, too well. Gerry Peckham shared this photo of the fiberglass fuel tanks from his 28 Bertram FB. After having multiple fuel filter and fuel pickup tube clogs, he decided it was time to replace the fiberglass tank with a new aluminum tank. Upon cutting open the old tank, the damage E10 (gasoline with 10 percent ethanol) was causing to the internal surfaces was obvious.

Independent laboratory tests sponsored by BoatU.S. Marine Insurance in 2006 confirmed that the resins used in some fiberglass tanks were leaching from the tank walls, weakening the tanks. The resin makes its way through the fuel system where it sticks to valves and other internal engine parts. The buildup of this sticky black substance has bent pushrods, clogged intake valves, and ruined some engines. Affected engines may run rough, stall, or bog down under load.

Courtesy Garry Peckham



The majority of gas tanks on boats are made from either aluminum or plastic. However, some older boats, mostly high-end sportfishers, were built with fiberglass gas tanks. On newer boats, some smaller, portable, and under-the-seat gas tanks are also made from fiberglass. Though custom and semi-custom yachts may also have fiberglass tanks, these typically use diesel rather than gasoline, and so are not affected.

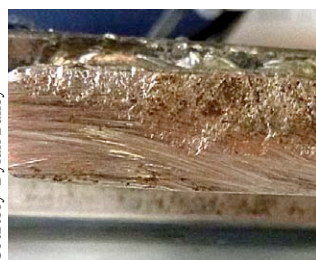
Anyone who owns a gasoline-powered boat and runs on E10 should inspect the fuel system regularly to head off E10-related problems. And if that boat has fiberglass tanks, consider it a prime candidate for tank replacement.

HIDDEN CHAINPLATE DANGERS

Seaworthy has often warned of the dangers of crevice corrosion on stainless steel chainplates, especially where they pass through the deck and cannot be inspected. As a boat ages, it is almost impossible to prevent saltwater from leaking down through the chainplate cover. If it becomes trapped against the chainplate in an area with little or no oxygen, it can lead to crevice corrosion that will eventually cause the chainplate to fail. Most riggers recommend inspecting the parts of the chainplates that can be seen annually and pulling them from the boat for a complete inspection and possible replacement every 10 to 12 years.

This kind of corrosion cannot occur if stainless steel in oxygen-starved areas stays dry. In the '70s and '80s, a number of sailboat manufacturers began completely encapsulating the chainplates in fiberglass to prevent water from intruding and causing corrosion. Some

older boats, like Ericson and Irwin, as well as many of the Taiwanese-built boats, have encapsulated chainplates. As these boats age, the chance of water leaking into the encapsulated area and coming into contact with the chainplates increases. The chainplates can



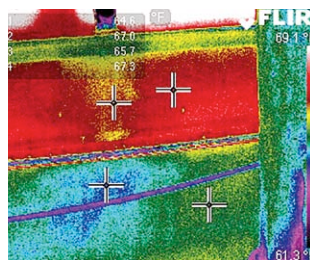
Courtesy Dylan Bailey

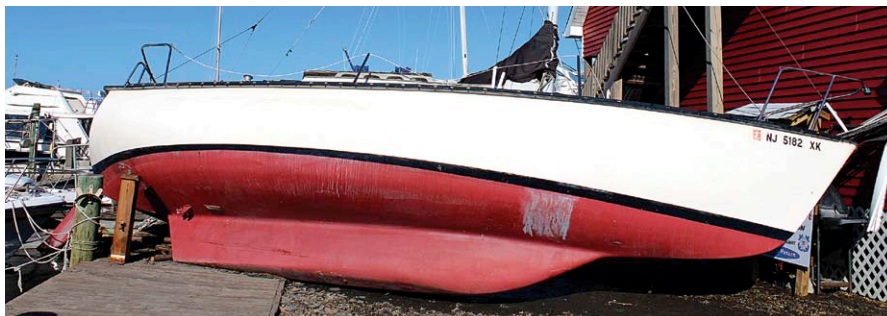
neither be inspected nor pulled without destroying a great deal of fiberglass. Some builders still use encapsulated chainplates, though most have drainage holes designed to keep water from being trapped against the metal.

As a quick search on the Internet will show, failure of these chainplates is far from uncommon. The chainplate above came from a 1987 Irwin — crevice corrosion had succeeded in

penetrating halfway through the plate. Luckily it was replaced before it failed. Thermal imaging offers a window into these hidden areas and may assist boaters in determining whether or not water has become trapped around chainplates. The cooler blue color at the bottom of the image at the right shows lower temperature below the base of the chainplate that likely indicates moisture.

If you're in the market for an older sailboat, find out whether or not the chainplates are encapsulated and weigh that into your buying decision. If you already own a boat with encapsulated chainplates, you may want to consider thermal imaging to see if they need to be replaced. But if the boat's in its third or fourth decade, you're probably better off just replacing them — as painful and time-consuming as that can be. You'll find lots of descriptions of how others have gone about it on the owner's forum of whichever boat you own.





WITH THE 2013 hurricane season officially behind us, we here at BoatU.S. have stopped holding our collective breath. In May, when we were still sorting out claims from Superstorm Sandy, NOAA forecast an “active or extremely active” season with a “70 percent likelihood of 13 to 20 named storms (winds of 39 mph or higher), of which 7 to 11 could become hurricanes (winds of 74 mph or higher), including 3 to 6 major hurricanes (Category 3, 4 or 5; winds of 111 mph or higher).” That compares to an average year with a total of 12 named storms, of which 6.7 are hurricanes including 2.7 major hurricanes. When Tropical Storm Andrea formed in the Gulf of Mexico a few days after the official start of the 2013 hurricane season and made landfall in Florida on June 6, it looked as if the season was, indeed, going to be a doozy.

In fact, the 2013 hurricane season proved to be among the quietest on record, with 12 named storms including two hurricanes, neither of which had wind speeds over 85 mph. Only one other named storm made landfall on the continental U.S. this season, and Karen came ashore as a tropical storm, not a hurricane as forecast. So how did forecasters get it so wrong?

The original forecast released in May was based on conditions that looked perfect for hurricane formation. “These conditions include weaker wind shear, warmer Atlantic waters

and conducive wind patterns coming from Africa,” Gerry Bell, Ph.D., the lead seasonal hurricane forecaster with NOAA’s Climate Prediction Center, said at the time.

But actual conditions were almost the opposite of what had been expected. The area where Atlantic tropical waves most frequently form had some of the driest air since reliable records began in 1970, effectively discouraging hurricane formation.

The fact is that early seasonal hurricane forecasts are not very accurate. In 2012, Dr. Jeff Masters looked at “statistical skill” in forecasting Atlantic hurricanes. His results, published on Weather Underground, found that NOAA’s and Colorado State University’s December hurricane forecasts from 2002 to 2011 would have done better had they simply forecast the historical average. The August forecast, on the other hand, when seasonal conditions have pretty much been established, is more accurate than the historical average 60 to 70 percent of the time. Forecasters were particularly unskillful at predicting how many major hurricanes would occur in a given year. The bottom line is that hurricane forecasting remains at least as much black art as science.

The quiet 2013 season extended for another year a record-long streak without a major hurricane making landfall in the U.S. It has now been more than eight years since Hurricane Wilma slammed into Florida on

October 24, 2005. Researchers call it a “hurricane drought” and worry that “hurricane amnesia” may keep people from responding to hurricane warnings or evacuating coastal areas. We at BoatU.S. and, we suspect, those who live in the northeast, are not suffering from hurricane amnesia. As Sandy demonstrated, it only takes one, and that one doesn’t need to pack Category 3 winds to wreak devastation over a wide area. After Sandy, we were really hoping the major hurricane drought would not come to an end in 2013. Now we’re all breathing again – until next year.

SPEAKING OF SANDY, a year ago we received a letter from a policyholder in Connecticut. John Milnes Baker wrote, “My Cape Dory 25, *Howkola II*, was picked up off its jackstands by the storm surge at Rowayton, Connecticut and deposited about 50 yards away across the road on a neighbor’s front stoop. Fortunately my boat was solidly built and withstood the battering with only superficial damage.” Baker immediately called BoatU.S. and was told that someone would get back to him shortly. “I was dubious, to say the least. I shouldn’t have been. CAT Team member George Mansfield called me and you’d think I was BoatU.S.’s most valued customer ... With all he had to deal with, he still made me feel that I was number one on his list ... The claims office was so efficient, I received a check within a couple of weeks.”

That was one of hundreds of letters we received in the months following Sandy, letters that encouraged our teams to maintain our high standards of professionalism and responsiveness in the face of a seemingly endless number of claims. We appreciated every one.

That’s almost always the last we



Courtesy John Milnes Baker

hear about the boats that will live to float another day. We're all too familiar with the end of the sad stories, the ones where the boat gets totaled and we turn it over to liquidators – the fate of way too many of Sandy's victims. So it was especially meaningful when Baker wrote in again in September and sent us some more photos. "I thought you might like to know that my boat is back at its mooring and in fact looks better than ever," he wrote. He may have missed some of the 2013 sailing season, but we're glad to know he, and many others like him, will be back on the water in 2014 – despite Sandy.

SO THERE YOU are, cruising along in your \$80 million motoryacht in the Med, working on your perfect tan on the aft deck. You've given orders that you will dine in the Royal Malta Yacht Club in Grand Harbour at 2100 and left the crew in charge. Two hours later, your captain comes to find you, clearly nervous. "Malta should be visible over the bow by now," he says. "But it isn't. And there's a suspicious-looking boat approaching that's trying to hail us." Just then, you hear the rotary beat of a helicopter and see its insect-like profile approaching fast.

You could be the victim of GPS spoofing, and you could be in trouble.

Your GPS works by receiving signals from multiple satellites giving each satellite's location and the time the signal was sent. Using that information, a sphere can be calculated around each satellite somewhere upon which the GPS must be located. The GPS uses trilateration to determine the intersection of the spheres from at least four satellites and find its position. But the high-frequency signals coming from the satellites are not very strong. The GPS can be tricked, or spoofed, by stronger signals from a transmitter designed to mimic the satellite signal. Weak counterfeit signals can be synchronized with the genuine signals and then gradually strengthened and diverted from the actual signals, so that the GPS is deceived into thinking it is someplace that it is not. This is called a "carry-off attack," and it can be used to take a vessel far off its course. Unlike GPS signal blocking or jamming, spoofing triggers no alarms on the ship's navigation equipment.


In June 2013, a team of University of Texas at Austin graduate students led by Assistant Professor Todd Humphreys successfully spoofed the GPS aboard the \$80 million, 213-foot superyacht, *White Rose*, by broadcasting a faint ensemble of civil GPS signals from their spoofing device – a blue box about the size of a briefcase – toward the ship's two GPS antennas. The team's counterfeit signals slowly overpowered the authentic GPS signals. "The ship actually turned and we could all feel it, but the chart display and the crew saw only a straight line," Humphreys said. Spoofing the yacht cost less than \$3,000.

At least so far, it looks as if spoofing is very target-specific — other GPSs in the vicinity would experience a sudden, suspicious position shift that would

give the game away. So, while spoofing would work on any civilian GPS, you probably don't need to worry about anyone trying to trick yours — unless you happen to have an \$80 million superyacht.



ANYONE WHO GREW up navigating with paper charts, taking compass bearings or sights, and using dividers or parallel rules to find their position can't help but feel saddened by the announcement last October that, as of this April, the government will be getting out of the business of printing traditional charts. But before getting too maudlin, reflect on your own chart usage and how it has changed. "The demand for traditional paper charts has fallen more than 90 percent in the last 30 years," said Susan Shingledecker, vice president of the BoatU.S. Foundation and a member of the NOAA Hydrographic Services Review Panel.

But the end of lithographic charts doesn't mean you can't still navigate the old-fashioned way. NOAA is beefing up its Print-on-Demand charts, available through private vendors; the NOAA Booklet Charts, which cover 95,000 miles of U.S. coastline including the Great Lakes, are available for free download directly off its website (nauticalcharts.noaa.gov). In addition, private vendors are bound to jump in with innovative products that combine the best of paper and electronic charting. 

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In The Beginning...

I'M GUESSING YOU DON'T know who Bill Oakerson is. Yes, if you've been insured with us for a while, you might have noticed his name as publisher on *Seaworthy's* masthead year after year. Perhaps you've seen him mentioned as CEO of BoatU.S. somewhere, sometime. The fact is, there's no reason for you to know who he is, and that's the way Bill likes it. But if you find your insurance policy easy to understand, if you enjoy *Seaworthy*, if you've ever been helped by our Catastrophe (CAT) Teams, if you've received exceptional service on a claim, if you've called TowBoatU.S. to get a tow, then you know Bill Oakerson.

Bill wasn't even 30 years old when he came to BoatU.S. in 1977 as an underwriter from Connecticut General. He knew insurance, but he loved boats. In just three years, Bill had been promoted to Director of the Insurance Division, a lofty title that put him in charge of half a dozen people. But he didn't care about titles or the number of reports. He was too busy shaping the future.

It was Bill who worked relentlessly to strip our policy language of every bit of legalese possible. He put in place our claims handling policy and procedures and wrote our underwriting guidelines, and designed both to be tough but fair while giving the benefit of the doubt to the policyholder. And as he began to understand the treasure trove of information lurking in our claim files, he also realized that knowing what went wrong on boats would benefit boaters.

In 1983, Bill set up the Damage Avoidance Department and



put Ernie Braatz in charge of mining those claims and sharing the results. The first issue of *Seaworthy* went out that spring. That same year, when Hurricane Alicia struck Galveston, Texas, Bill (at left in picture) could not sit in Alexandria, Virginia while our policyholders struggled to figure out where their boats were. He took Ernie Braatz (at right in picture) and a master salvor, Mike McCook, and they flew down to Galveston to help any way they

could. Ernie would be killed in a car accident a few years later, and Bill would put Bob Adriance in charge of *Seaworthy*. Mike would become a key member of our CAT teams, and Bill would become CEO of BoatU.S. And the CAT teams and *Seaworthy* would become two of the cornerstones of the BoatU.S. Marine Insurance program.

If you asked Bill, he'd give credit for all of this to others because that's the way he's made. But Bill has left his imprint on every part of BoatU.S. By the time you read this, he will be retired. But he will still be part of us. Because the biggest thing Bill did was to instill an absolute dedication to our members in the very heart and soul of BoatU.S. He taught every employee that each member is special, each member deserves the very best service we can provide. And he didn't let us forget to have fun along the way. If you've ever finished a call with BoatU.S. and been left with the sense that we truly care about you, you've spoken to Bill – even if you didn't know who he was.

Seaworthy

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THE BOATU.S. DAMAGE AVOIDANCE PROGRAM IS DEDICATED TO HELPING YOU ENJOY ACCIDENT-FREE BOATING. *Seaworthy* looks at real claims and how they might have been avoided. For permission to reprint articles, email Seaworthy@BoatUS.com

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