BoatU.S.®
MARINE INSURANCE PROGRAM
Seaworthy
KEEPING YOU AND YOUR BOAT SAFE ON THE WATER Vol. 33 No. 4 | October 2015

Fire Away

Understanding where, when and how most fires start is the first step in reducing the risk of an onboard fire

By Beth A. Leonard

The boat above was a casualty of a neighboring boat's fire - when one boat burns, it puts at risk nearby boats, property, and people.

IT TAKES TWO things to start a fire: something that will burn and something that will start it burning. Every fire must have, in fire-investigator parlance, a fuel source and an ignition source. When BoatU.S. Marine Insurance turns a claim over to a fire investigator, his or her task is to find both. They don't always succeed – about eight percent of the time, no cause can be assigned. But it should come as no surprise that, in those cases where a cause can be determined, at least half of all boat fires originate around the motor. That's because, when it comes to boats, fuel and ignition sources are most likely to come together in the engine room or under the cowl of an outboard.

What might come as a bigger surprise is how often the boats BoatU.S. insures are casualties of *someone else's* fire. More than a quarter of the time, our insured's boat burns when something else goes up in flames: The marina, the storage facility, the house, the garage, the barn, the neighbor's house (Figure 1 on page 4). In more than 70 percent of those cases, it's the marina that burns. While the cause of those fires cannot always be assigned, based on what we do know, a high percentage start on someone else's boat. That means that every boat owner has a responsibility to prevent fires on board–not just to keep the boat safe, but also to keep anyone aboard safe, and to keep the marina where the boat is kept, and the people who work there, safe.

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Mailboat

MORE MARINE CORROSION

Thanks to Ed Sherman ("Marine Corrosion 101," July 2015) for an informative article. I have a question that has me puzzled. I have two large zincs on the shaft of my 36-foot sailboat. Normally they are a bit more than half consumed at the end of a four-month season. Last year they were totally consumed. What could be causing this? My boat is on a dock in saltwater, at my yard, near a few other boats in adjacent slips. My galvanic isolator is in working order and there have been no changes in my onboard equipment or wiring.

Joe Kosheff
York, Maine

Ed Sherman responds: *The importance of considering environmental conditions that may vary from year to year cannot be over-emphasized. Boat usage also plays into this; anode consumption will increase as boat usage does. All of these things need to be considered as part of the equation before deciding if there is a problem or not.*

I was gazing in horror at the corroded sterndrive photo in "Marine Corrosion 101" in the July 2015 issue, and then also noted that the boat is setting on cinder blocks! More horror....

Hank Zimmerman
Fort Valley, Virginia

You're right, every year we see boats damaged because someone used cinder blocks as support. The damage ranges from cracked hulls to boats falling off of cinder blocks. The American Boat & Yacht Council has blocking standards – and, in this case, it's obvious these weren't followed!

COLREGS

I was reading your article about navigation, and it reminded me of another problem I have come across here on the Chesapeake Bay. I am seeing more and more of these red and green bow "strip" LED lights. While they are very bright and easy for other boaters to see, they do not have the required arc of visibility. It's hard to tell the boat's position because it's possible to see both red and green lights when the boat is not coming directly at you.

Paul M. Gring
Aberdeen, Maryland

Dan Rutherford responds: *I too am concerned about navigation lighting configuration. This is not limited to the new LED lights. I have seen, all too often, lights improperly mounted so as to not show the correct arc (arc of the horizon 112.5 degrees from right ahead to 22.5 degrees abaft the beam on its respective side). The newer LED navigation lights have many positive attributes. They are indeed bright, they use far less power, and the LED is far less susceptible to failure. But I have not run across the LED "strip" lights yet. So, like any good investigator, I googled them. I have not personally seen them mounted, but from this photo, they do NOT appear to meet the US Coast Guard standard. Looking at the configuration, I would think that you would need quite a large shield to protect the forward end of the light from exceeding the arc of visibility aft.*

The Coast Guard needs to review, modernize, and update the requirements regarding navigation lights on all vessels and barges. In my opinion the current regulations are archaic. A single red/green/white light is barely visible under the best of conditions. The lighting requirements on barges according to the regulations is ridiculous. When was the last time lighting requirements were updated? There are more boats on our waters and more boats operating at night.

Tony Tabbacchino
Waretown, New Jersey

Dan Rutherford: *I hear you loud and clear. To be honest, though, most of the accidents I have investigated had more to do with the improper display of and/or the misuse of navigation lights as promulgated by the USCG under the current COLREGS. That said, I agree with you on the barge issue, especially when at anchor. There are just not enough lights to be visible from all approach angles. Often, barges are piled high with cargo or work equipment – cranes, pipes, etc.,—so the "all-round" light is just not visible. Also, they are frequently solar-powered or battery-powered lights that are dim at best.*

It is a difficult task to revise the COLREGS because they are an international standard to which we are but one party. I am fairly certain that if you put one hundred people in the room, you would have one hundred different takes on what changes, if any, should be made.

That said, the Coast Guard does provide a way for you to give them input on the existing COLREGS.

In the official publication, COMDTINST M16672.2D, there is a "Record of Changes" page. It is left blank so that the owner of the book can write in any changes as developed. There is the following notation in the front: "Notices of changes to the Navigation Rules and Regulations are published in the Federal Register, Local Notice to Mariners, Weekly Notice to Mariners and Commandant Notice. Comments should be addressed to Commandant (G-MOV-3)." That is the place to let the USCG know your opinion.

I hope this information is helpful. In the meantime, keep a constant vigil and a sharp lookout.

ISOLATING THE PROBLEM

In regards to the article about shorepower isolation transformers, how would this work for electricity on a pier? Would you still need GFCI on pier wiring?

Dave Baugher
Middle River, Maryland

As far as the boat goes, an isolation transformer on the boat precludes the need for an ELCI (equipment leakage circuit interrupter) on the shorepower inlet of the boat as long as the transformer is installed within 10 feet of the shorepower inlet on the boat. Because the transformer is the source of the boat's shore power, any leakage will return to it and won't flow through the water toward shore, endangering swimmers. However, a GFCI is still needed on alternating current (AC) outlets inside the boat. That said, you'd be wise to protect anyone dockside with a GFCI at the shorepower pedestal.

I don't agree with the following statement: "An isolation transformer takes your marina's often wild and unpredictable shorepower and converts it to pure clean power." A power transformer will attenuate some of the higher frequency components of noise but by no means will it "clean it." As an example: If presented with a noisy, distorted waveform input, the output will also be a noisy distorted waveform. Equipment requiring a "pure sine wave" will still malfunction.

Stas J. Andrzejewski
Buena Park, California

OVERHEAD AWARENESS

Good article on overhead wires ("Power Line Hazards", July 2015). The noise from the mast close to the high-power wires noted in the article is called the "spark gap" effect. That is, you may get a "jump" from the line to your boat's mast if the distance is small enough. Thus, to be sure you'll be safe passing under overhead wires (either in the boat out on the water or with the boat on a trailer), you need to know the voltage of the lines by contacting the authority that manages them.

Minimum Power Line Clearance Distance	
<50 kV	10 feet
<200 kV	15 feet
<350 kV	20 feet
<500 kV	25 feet
<750 kV	35 feet
<1000 kV	45 feet

Source: OSHA

C. Henry Depew
Tallahassee, Florida

MORE THAN JUST THE MANIFOLD

The July 2015 Alert on manifold life was excellent. However, it failed to mention one of the most critical components of all engine plumbing – the watertight joints between components – particularly in saltwater. Failure of the manifold gasket by corrosion, incorrect type, or installation can often be the cause of manifold failure. My costly experience came after only two years with a factory-rebuilt marine 350 V8 engine that used a non-stainless overhead gasket – a serious no-no. When the major US company who did the rebuild was confronted, after many emails, (including sending one gasket to prove my case), their comment was, "…on occasion our suppliers don't supply stainless gaskets." Cost to me: $3,000. Rebuilt engine buyers – beware!

Neal Bastable
Brunswick, Georgia

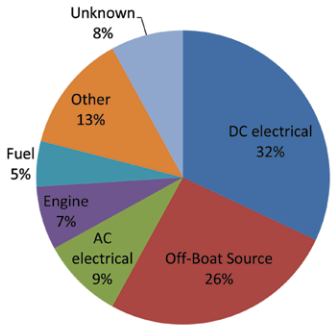
SEAWORTHY PDFs

I usually download and save a PDF copy of *Seaworthy*. How can I download and save this issue? I don't see a link to download as PDF – was that option removed? Please provide a method to download a copy so I can save it locally.

Kevin Lyon
Wake Forest, North Carolina

You can download a PDF from the Seaworthy *email by clicking on the front cover in the upper right-hand corner of the email or by going to the* Seaworthy *homepage and clicking on the link to "Archives" and then "PDF Version" in the left navigation pane. Issues from July 2011 through the current issue are available for download there.*

Figure 1. Causes of Fire On Recreational Boats, 2009-2013

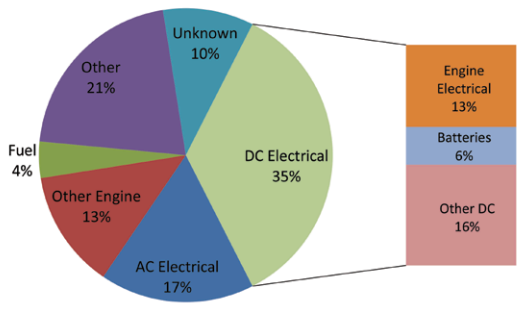


Source: BoatU.S. Marine Insurance Claim Files

So what can you do to protect your boat from fire? The *Seaworthy* editors analyzed five years of BoatU.S. Marine Insurance claim files to understand the major causes of fires aboard boats to determine what owners can do to minimize the chances of a fire. Understanding the causes of fires aboard begins by understanding where exactly in the boat the fire originated. We found that the places where fires originated, and the specific causes as to how they started, depend upon whether your boat has an outboard or an inboard engine. In this article, we'll focus on fires on inboard and inboard/outboard (I/O or sterndrive) boats. We'll take a look at outboard boats in our next issue.

Inboard boats tend to be larger than outboards, and the areas around the engine, where most of the action takes place, are not visible and accessible in the way that an outboard engine is. These larger boats are also more likely to be stored at marinas, which makes them more vulnerable to the marina fires that are a major source of BoatU.S.'s total fire losses. Whether underway or tied up to a dock with no one aboard, it's easier for a fire that gets started on a larger, inboard boat to gain some serious momentum before somebody notices it. Because, as can be seen in Figure 2, most of the fires can be traced back to maintenance issues in the DC electrical system, the AC electrical system, and the engine

Figure 2. Causes of Fire On Inboards and I/Os Excluding Off-Boat Sources, 2009-2013



Source: BoatU.S. Marine Insurance Claim Files

(particularly the engine cooling system), a regular maintenance schedule combined with attention to critical components in each of these systems can have a huge impact on reducing the incidence of fire aboard inboard boats. So what exactly causes the fires in these different areas?

DC ELECTRICAL FIRES

Thirty-five percent of the fires that originated on a BoatU.S.-insured boat were caused by problems in the 12-volt DC electrical system (Figure 2). But the fire that starts in the wiring under the headliner or behind a panel in the galley is the exception, not the rule. More than half of DC electrical fires, or 19 percent of all fires originating on BoatU.S. inboard-powered boats, were associated with either the engine or the batteries, both of which tend to be in the engine room. That's because there's so many things that can burn in the engine room—fuel, oil from a slow leak, or even, in the case of a gasoline engine, gas fumes—once a DC wiring problem creates some heat. In addition, starting the engine and charging the batteries generate significantly higher amperages than those in most other areas of the boat. These higher loads create more heat where there are undersized wires, loose or corroded connections, or intermittent shorts. Finally, the vibration from the engine increases the likelihood of chafe in such vulnerable areas as the wiring harness and connections to the alternator and the starter.

Preventing these fires comes down to **good electrical maintenance** on every component of the DC system associated with the engine and the batteries. Regular main-

Reconnecting battery cables incorrectly can cause all kinds of havoc in the electrical system, including a fire.

tenance – on a monthly basis during the boating season – should include ensuring all connections are tight from the batteries to the starter to the alternator, making sure wiring is supported and secured to minimize the impact of vibration, keeping battery terminals clean, and inspecting wiring for signs of chafe.

Beyond good maintenance, there are three other steps owners can take to prevent DC electrical fires on inboard boats. **Wiring harnesses and starters** account for the majority of DC electrical fires on boats 25 years old or older. If you have an older boat and the starter and wiring harness are original, consider replacing them. Another problem area has to do with hooking up the batteries at the beginning of the season. Every year, we see cases where the **battery cables were reversed** or the batteries were hooked up in parallel instead of in series. See Alerts for some suggestions on ways to avoid this slap-yourself-in-the-head mistake.

Outside of the engine room, there is no single area where most of the remaining DC electrical fires originate. Locations are pretty much equally spread across electrical panels, instrument panel gauges, bilge pumps, lights, and equipment of various types, including air conditioners, windlasses, and winches. Most of these fires could have been prevented if adequately sized, marine-grade wiring had been used and loose or corroded connections had been located and addressed.

AC ELECTRICAL FIRES

To have 120-volt, alternating current (AC) to run our air conditioners, our refrigerators, and our water heaters aboard, we usually have to plug in to shore power. Even if you don't have any of these luxuries on your boat, you quite likely still plug in to charge the batteries. In the marine environment, **the plugs and inlets/outlets in the shorepower system** are vulnerable to dirt, corrosion, and moisture, any of which can cause arcing that damages the contacts and eventually leads to increasing resistance and heat buildup. *Seaworthy* has explored the hazards of shorepower electrical connections before (see "When Your Shorepower Loses Its Cool," July 2010). In addition to the cord itself, the data pinpointed a particularly vulnerable link in the shorepower chain: the shorepower inlet on the boat. And not the entire inlet, but the **terminals at the back of the inlet** where the boat's wiring is connected. These inlets are particularly vulnerable to water intrusion, and the connections are subject to vibration and corrosion and are often surrounded by material that ignites easily. They should be pulled out and inspected at least every five years. If there's any sign of corrosion, replace them.

Electric heaters, another hazard *Seaworthy* has addressed before (see *The Boater's Guide to Winterizing* at www.BoatUS/Seaworthy/winter), continue to be a major source of AC electrical fires aboard. While safer heaters have been developed that are less prone to being tipped over or to igniting anything combustible that falls on them, they still draw a great deal of power, and any corrosion in the shorepower system (or worse, household extension cords powering heaters) will tend to build up heat somewhere that can result in a fire. BoatU.S. continues to recommend not using heaters in lieu of winterizing, and never to leave a heater running if there is no one aboard.

Finally, **battery chargers** are much like heaters, but in addition to the demands they make on the shorepower cords and connections, using an automotive battery charger instead of a proper marine battery charger can easily lead to fires aboard. High-quality marine battery chargers are not only designed for the marine environment with potted components that resist water intrusion, but they also use multi-stage charging regimes and temperature sensors to make sure the batteries get just the right amount of current at each stage of the charging cycle.

OTHER ENGINE-RELATED FIRES

Fifty-six percent of non-electrical engine fires result from failures in the cooling system, while problems in the exhaust system account for another 20 percent. Engines overheat when not enough water circulates to keep the engine at its proper operating temperature. Reduced water flow usually happens for one of three reasons: debris blocks the water intake or sediment enters the cooling system, scale or marine growth restricts water flow in the heat exchanger or hoses, or the water pump ceases to circulate adequate water, most often due to an impeller failure. Impeller failure can result from sediment in the raw water, so it pays to replace your impeller if you know you were running in particularly

Overheated exhaust systems are usually caused by lack of cooling water — another reason to replace impellers every two years.

dirty water. Otherwise, replacing impellers every other year and flushing cooling systems every season will help to prevent these kinds of fires. If the engine ever overheats, before getting underway again, take the time to check the engine room to make sure the engine is at operating temperature and everything is normal.

Exhaust-system fires almost always result when something flammable comes into contact with something hot on the exhaust. That can happen when the cooling system fails so that no water is available to cool the hot engine gases. But they can also occur when cooling water is still circulating, such as when a backfire displaces the flame arrestor, or where the water-cooling injection system in the exhaust fails. Inspecting the exhaust system regularly and replacing the exhaust manifold every five years will help you avoid most of these fires.

OTHER CAUSES OF FIRE

As Figure 2 shows, of the fires that originated on a BoatU.S.-insured boat in the claim files, no cause was assigned to 10 percent of our total fires. A quarter of the fires in Figure 2 fall into the categories of fuel and other. While no single cause stands out in these categories, there are a few takeaways:

Automotive-style battery chargers don't have the safeguards to protect your boat while the battery is charging, especially long-term.

ONLINE EXTRA

For more information about fire extinguishers, visit http://www.boatus.org/findings/46/

- **Fuel.** The majority of fuel fires come from fuel leaks due to failures of hoses or hose clamps. Wiping down hoses with a rag and smelling it can alert you to a slow leak that hasn't yet caused a serious problem. If the rag smells of gasoline or diesel, either you have a leak or the hose is old enough that it is becoming porous and needs to be replaced.
- **Stoves.** The incidence of fires due to stoves has decreased with the gradual replacement of alcohol stoves with propane stoves and electric ranges. Two percent of fires were caused by stoves, more than half resulting from problems with lighting alcohol stoves. Given how few alcohol stoves there are on boats these days, they are significantly more dangerous than those that use other fuel sources. If you still have an alcohol stove on board, you may want to consider upgrading. Most people agree that they don't heat very well, anyway.
- **Shrinkwrapping.** BoatU.S. gets a few fires every year associated with installing shrinkwrapping. These can be particularly problematic because the fires can spread quickly from boat to boat in a crowded marina hardstand area. This is a job that we'd prefer you leave to professionals.

TEN TAKEAWAYS

Fire prevention comes down, above all, to maintenance. Here are 10 things you can do to reduce your risk of fire aboard your inboard boat:

1) Inspect all electrical connections associated with the engine-starting and charging systems at least once a month during the boating season. Tighten loose connections, replace corroded wire ends and terminals, secure and support all wiring to protect it from chafe and vibration, and replace battery switches that are more than 15 years old.
2) Inspect battery wiring, switches, and terminals at least once a month during the boating season. Clean terminals and connectors at the beginning and end of the season.
3) If your boat is more than 25 years old and the wiring harness and starter are original, replace both, if possible.
4) Inspect shorepower cords, and replace them if pitting or corrosion is visible on the plug's blades or if the cord itself shows any signs of wear, including kinked or pinched areas. Replace cords that are over

10 years old. Black electrical tape is no substitute for intact insulation!

5) Inspect your boat's shorepower inlet every five years, and address any corrosion in the terminal or the wires that attach to it. Replace the inlet every 10 years.
6) Never use an electric heater when no one is aboard.
7) Use only high-quality marine battery chargers on your boat.
8) Flush your cooling system annually.
9) Change your impeller every other year or anytime the engine has ingested debris.
10) Replace your exhaust manifold every five years or at the first sign of pinhole corrosion.

If every inboard-powered boat owner checked off every item on this list, not only would the risk of fire on any given boat decrease by more than half, but every boat that spends time in a marina would be safer.

DETECTION AND SUPPRESSION

Preventing fires is just one leg of a three-legged stool that can minimize fire damage. Professionals label these three legs prevention, detection, and suppression. If prevention fails, you need to know that a fire has started and then you need to be able to put it out as quickly as possible. As the statistics from the BoatU.S. claim files show, fires that spread are a huge hazard to other boats. Even more, a fire that gets out of control in a marina can easily endanger lives, including those of the firefighters called to put the fire out.

Detection: Smoke detectors on larger boats with living quarters can provide the kind of early warning that could save a boat and possibly a marina. However, a detector that goes off in the engine room isn't enough because the chances are it will not be heard if you're in the cockpit underway or if the boat is closed up at the dock with no one aboard. Connecting a smoke detector to an alarm and a light at the helm station will alert you if you are underway. In the marina, the smoke detector can be hooked up to an alarm on deck. Or, if you're into gadgets, you can buy a security system that will send an alarm to your phone. These require some kind of connectivity to work and may not function if shore power is cut, so they're not as reliable as something that depends only on ship's power.

Table 1. Fire extinguisher sizes

Type	Foam (gallons)	CO^2 (pounds)	Dry Chemical (pounds)
B-I (Type B, Size I)	1.75	4	2
B-II (Type B, Size II)	2.5	15	10

Source: *A Boater's Guide to the Federal Requirements for Recreational Boats,* United States Coast Guard

Table 2. Fire extinguisher minimum carriage requirements

Vessel Length	No Fixed System	With Approved Fixed System
Less than 26 feet	1 B-I	0
26 Feet to Less Than 40 Feet	2 B-I or 1 B-II	1-BI
40 Feet or 65 Feet	3 BI or 1 B-I and 1-B-II	2 B-I or 1 B-II

Source: *A Boater's Guide to the Federal Requirements for Recreational Boats,* United States Coast Guard

Suppression: If prevention fails, you don't just want to be alerted to the fire; you need to have a way to put it out. The Coast Guard requires that you carry a certain number and size Type B extinguishers aboard, depending upon the length of your boat (Tables 1 and 2). Type B extinguishers are designed to put out fuel-based fires, while A are for non-fuel combustibles (paper, wood), and C are for electrical fires. However, by choosing a Type ABC extinguisher, you won't have to think about what type of fire it is when you pick it up — you can just point and shoot.

When it comes to fire, you don't want to carry just the minimum size or quantity, especially on a larger boat. A B-I extinguisher will last for only about 10 to 15 seconds before you'll be left holding an empty canister. You'll want an extinguisher within reach in the engine room, in the galley, and near a diesel or propane heater if you have one aboard. We'd also recommend having one in each sleeping compartment so you can escape if a fire breaks out in the main cabin. A fire blanket for a stove can also be an effective way to put out a small fire without having to spray corrosive powder all over the galley.

Given the high incidence of fires in the engine area, the engine compartment should be fitted with a fire port so that you can suppress the fire without having to open the compartment, introducing more oxygen and further feeding the fire. Larger boats with real engine rooms should be equipped with automatic fire-suppression systems.

Watch Your Wake!

Whether you're in a no-wake zone or not, you are responsible for any injury or damage caused by your wake

By Raúl J. Chacón Jr. and John C. Scarborough, Jr.

LET'S FACE IT, pretty much all powerboats create a wake. Especially on inland waters, where primarily small craft operate, wakes can be dangerous. Common courtesy toward other boaters demands that we control our wakes. However, the consequences of failing to do so go far beyond rude gestures and horn blasts. Because here's the one thing you really have to know about wakes: under the law, damage caused by your wake is treated exactly the same way as damage caused by a physical, fiberglass-crunching collision.

Imagine the following scene: After a long no-wake zone and an even longer wait for a drawbridge to open, a motoryacht is just passing through the opening. In a stroke of luck, a behind-schedule, in-a-hurry sportfish arrives at the drawbridge already open for the yacht ahead. After clearing the drawbridge, both vessels pick up speed, creating significant wakes.

Ahead of the yacht, just outside the channel, a fisherman is poling a small jon boat on the flats, searching for redfish. Perhaps the operators of both the yacht and the sportfish do not realize how their wakes can combine into a veritable tsunami, or they are just more interested in making it back to the dock than in reducing speed. Regardless, the combined wake of the yacht and sportfish violently rolls the jon boat, causing serious injuries to its passengers. The passengers sue both vessels and their owners for their injuries as well as pain and suffering. It's important to remember that the incident took place outside of any no-wake zone, so neither captain was likely overly concerned about their wakes nor realized the extent of their liability.

Here's an interesting point: Nowhere in the Inland Rules of Navigation will you find any mention of a duty for recreational vessels to control their wakes. Still, our two hypothetical vessels are not saved by the lack of an explicit rule.

Courts applying the General Maritime Law are entitled to interpret the rules of the road to reflect their understanding of the norms of maritime navigation. That means the rules are not necessarily what they say, but what courts think they mean. Courts have used at least two of the navigational rules to hold operators liable for the damage caused by their wakes.

First, courts have ruled that when a vessel's wake collides with another vessel and causes damage, Rule (6) of the Inland Rules applies. This rule provides that each vessel "shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision." The courts read the word "collision" to include both a collision with a vessel's hull and a collision with its wake. Applied to our motor yacht and sportfish, both failed to proceed at a safe enough speed to prevent their wake from colliding with the jon boat, so they are presumed negligent. The only defense available is for the operators to prove conclusively that their wakes did not cause the injuries to the jon boat passengers, an impossible burden.

Second, courts have used the catch-all rule, Rule 2(b) of the Inland rules, to hold operators liable for their wake. Rule 2(b) provides that "due regard shall be had to all dangers of navigation and collision and to any special circumstances ... which may make a departure from these Rules necessary to avoid immediate danger." As courts read this rule, an operator of a vessel is required to do anything and everything to prevent a collision (including a collision with a vessel's wake). Applied to our motor yacht and sportfish, no defense to liability exists. Neither took any action to prevent a collision between their wakes and the jon boat. Both are equally responsible for all the damage to the jon boat and its passengers.

If you haven't already figured it out, this narrative is based on a true story that resulted in an unhappy ending for those aboard the motoryacht, the sportfish, and the jon boat. If that does not scare you enough, remember that if the owner was operating the vessel, the injured person can come after the owner for any damages in excess of the value of the vessel, and prosecutors can bring criminal charges.

The moral of the story is: Watch your wake!

Raúl J. Chacón Jr. is the managing partner at The Chartwell Law Offices, LLP in Miami, Florida. His practice focuses on Admiralty/Maritime law, Products Liability, Property & Casualty, Insurance Defense and Commercial Litigation.

Winterizing Basics

Unless you're in the sunny South or Hawaii, you'll almost certainly have to do at least some winterizing

By Charles Fort

THE BAD news about winterizing your boat is that if you forget something critical or you do something incorrectly, you may be faced with expensive repair bills and a long delay to get back on the water next spring. The good news is that most winterizing chores are not that hard, and we can show you how to avoid the vast majority of problems in a single page (though you'll want to download our free 16-page wintering guide for a much more in-depth look – see below). In a nutshell, winterizing means storing your boat properly, making sure engines and drives are protected, and making the plumbing freeze-proof.

STORAGE

The best place to store your boat is on land – winter storms or a failed thru-hull can't sink a boat that's not in the water. Cradles, jackstands, dry-stack storage, and trailers are your choices. Larger boats are usually stored ashore on jackstands. Make sure that the stands sit on plywood so they can't sink and that they are chained together so they can't slip away from the boat. If you store your boat on a trailer, you'll extend the life of the tires if you take the load off of them with blocks. It also makes it harder to steal your boat.

If you decide to store in the water, your job is to prevent thru-hulls from allowing water in (close all but cockpit drains), be certain your bilge pump works well (test it by putting some water in the bilge and letting the float switch actuate), and make sure your boat is tied so strong winds can't bang it against the dock (use long spring lines and have chafe guards on every line). Whether ashore or in the water, a well-fitting cover will prevent the cockpit from filling with water or ice during winter storms.

GETTING THE WATER OUT

Fun fact: When water freezes, it expands by almost 10 percent. Not-so-fun fact: If your raw-water cooling system holds, say, 10 quarts of water, when it freezes, there will suddenly be an extra quart inside under great pressure, with nowhere to go. It's enough pressure to destroy a manifold, wreck a refrigerator, and even crack an engine block like an eggshell. The key, then, is to get water out of places where it will cause damage when it freezes.

Nearly all engines use raw water for at least some parts of the cooling system, and this water must either be drained or replaced with antifreeze. Mistakes in this step lead to the vast majority of the freeze claims in the BoatU.S. Marine Insurance files. Outboards can usually be drained easily simply by tilting the engine all the way down, but for inboards and I/Os the preferred method is to circulate antifreeze throughout the cooling system. Typically, a bucketful of antifreeze is sucked into the engine's raw-water intake, replacing the water. Sea strainers need to be drained or filled with antifreeze too, because ice can crack them open and sink the boat during a thaw.

Other areas that have a risk of freezing water and need draining or antifreeze include the potable water system, air conditioning and refrigeration systems, marine heads and holding tanks, and bilge-pumps systems (if your boat is stored out of the water).

OTHER WINTERIZING TIPS:

- Change the oil in the engine and sterndrive or lower unit before laying up – this prevents old, acidic oil from damaging internal parts.
- Fog gasoline engines to protect against internal rust.
- Fill gasoline tank and treat the fuel with stabilizer, or completely drain to ward off ethanol-induced issues and stale gas next spring.
- Flush outboards and store in lowest position to prevent water from remaining inside and freezing.
- Remove expensive electronics and fishing gear, and store at home to prevent damage or theft over winter.
- DON'T use a heater to winterize your boat. Not only will it prove useless right when you need it most (during a winter-storm power outage), there is a very real risk of fire.
- Visit your boat frequently to head off potential issues before they become serious.

For the most complete, up-to-date boat winterizing information available, get our online, printable 16-page *Boater's Guide to Winterizing* here: http://www.boatus.com/seaworthy/winter

Lubricants Roundup

What to use, and where to use it

By John Tiger

THE ARRAY OF ENGINE AND drive lubricants, oils, sprays, and fuel treatments at your local marine parts store or dealer can be intimidating. Here's a primer on what to use and where to use it.

All photos: John Tiger

Engine Oil. Obviously for four-stroke engines or inboards, this goes in the engine crankcase to lubricate the inner workings (crankshaft, pistons, rings, bearings, and camshaft). In a two-stroke outboard, it's either poured into the oil injection tank or for older engines, mixed directly with the fuel. Synthetics are typically better and can help your engine last longer, but they're more expensive. What's important:

- Buy the right oil for your engine; there are oils specially formulated for inboards and sterndrives (essentially car engines in boats), PWC, and four stroke outboards. There's also specially formulated oils for two stroke engines, depending on whether the oil is mixed in the fuel or injected from a separate tank. This may be especially important if your engine's under warranty. Use the manufacturer's recommended oil if possible.

- Don't skimp on oil quality. Buy name-brand oils only; look for the TC-W3 rating on outboard oils. You may save a few bucks on the oil, but if it damages your engine, that cost far outweighs any savings.

Grease. Waterproof, synthetic extreme-duty grease is best for lubricating engine steering and trim/tilt pivot points as well as trailer bearings. Keep a spare grease gun and a few cartridges handy in your tow vehicle in case of emergency or just to top off. Don't mix different types of greases, especially waterproof with non-waterproof, and synthetic with non-synthetic. Buy good quality grease, correct for your application, and stick with it.

Fuel Treatment. Very important stuff – this can save a lot of headaches caused by high ethanol content in fuel, or injector/carburetor gumming and contamination problems caused by long layups (longer than a couple months). If you can, use it at every fill up, or at least every other, and especially if you know you're not going to use your boat for a while. It's inexpensive and really does help keep your boat's fuel system clean.

Gearcase/drive lubricant. As with engine oil, buy the right stuff for your drive. Synthetics are better and can help the gears and bearings in your drive/gearcase last longer, but are more expensive. Ask your dealer if you are in doubt.

Engine Tuner, Decarbonizer. Affectionately called "engine tune-up in a can" this solvent helps keep piston rings and pistons in both two-stroke and four-stroke engines from "coking" with hard carbon deposits, which can lead to loss of compression (and resulting loss of power), and end in engine failure. Apply liberally once per season and your engine will last longer with more power.

Electrical Protectant. This is typically available at marinas and auto-parts stores. Spraying this on the engine's electrical parts (coils, spark plug

wires, etc.) can help provide a "film" to inhibit corrosion, brittleness, and other signs of aging. It's particularly helpful in saltwater.

Power Trim/Tilt and Power/Hydraulic Steering Fluid. Be especially careful here. For sure, buy only what your unit's manual and your dealer recommend, and don't mix types, brands or purposes. Don't use power trim fluid in the hydraulic steering system, for example. Keep an extra bottle handy in your boat's storage area (in a leakproof storage container), and in your garage or shop to top off if necessary.

Fogging Oil. Used mainly for winterization and long layup periods, fogging oil is typically sprayed into a gasoline engine's intake (carburetor or EFI) while the engine is running; as a last resort it can be added to the fuel supply or sprayed into the spark plug holes (while rotating the flywheel slowly by hand). The object is to coat the moving parts (crankshaft, connecting rods and bearings, pistons and cylinders, etc.) with this rust-preventing lubricant for the long winter's nap.

Marvel Mystery Oil. This stuff really does work wonders, especially for those of us who like to work on old engines. An engine that's "stuck" (i.e. frozen piston/cylinder due to rust, etc.) will eventually work it's way free by tipping it up, removing the spark plugs and adding some Marvel oil into the cylinders. It may take days or even weeks, but eventually this stuff will work its way into the rusted rings, bearings and other rotating parts and free them up.

Liquid Lubricants. Such lubricants as silicone spray, WD-40, and similar products can be sprayed just about anywhere moving parts work together. Especiallly in saltwater environments, these products keep parts from corroding, rusting or sticking together. Great for throttle shafts, tilt levers, engine cowling/cover latches and levers, and of course anywhere on a trailer (winch, tongue jack, lights, etc.)

Never Seez. Used for decades to keep nuts and bolts from binding and galling, Never Seez is great for wheel lug nuts and other similar fasteners you will want to loosen at some future point.

PETROLEUM-BASED VS. SYNTHETIC LUBES

While petroleum-based lubricants and greases are cheaper than their synthetic counterparts, synthetic oils and greases have a lower coefficient of friction, and higher lubricity. These qualities will help your engine rotating assembly, gearcase, trailer wheel bearings, and other areas that need lubrication work easier and last longer.

Rust Penetrants. These lubricants are used to loosen stuck bolts, screws and nuts. It's best to spray them on a stuck part, then wait a bit to allow the penetrant to soak in between the two parts.

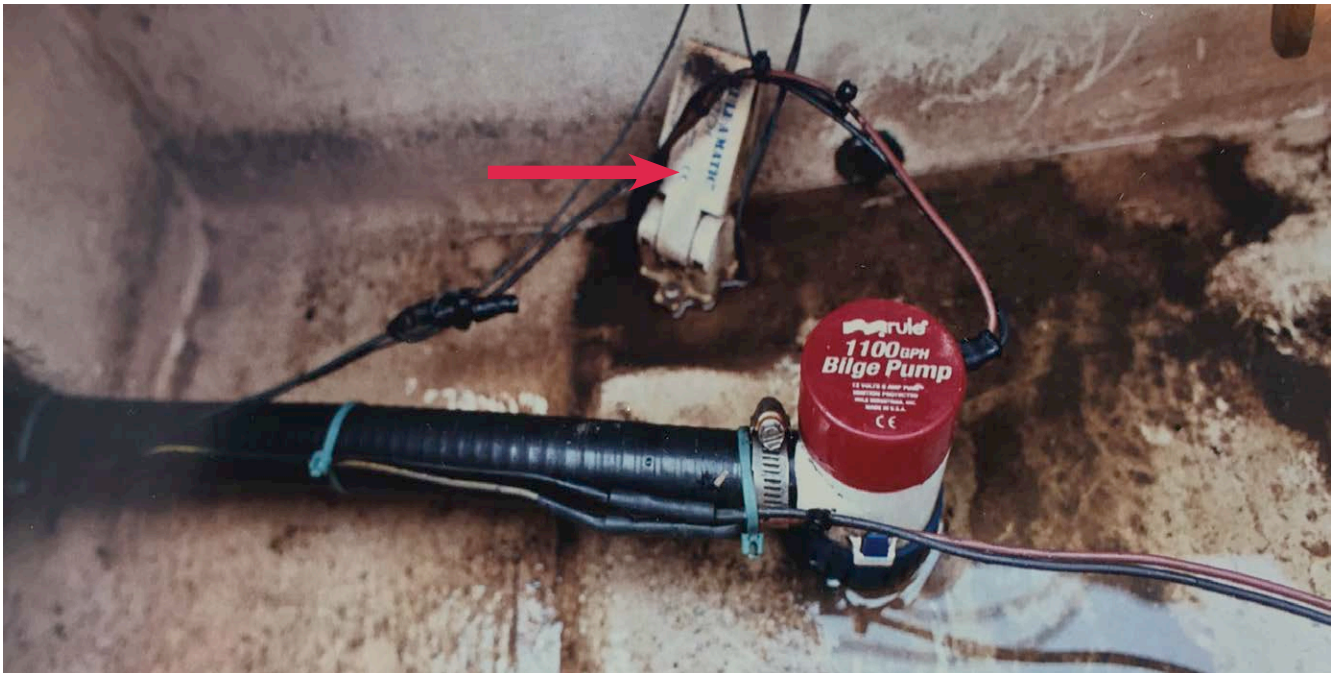
Boat owners worth their salt will have these and more in their arsenal of boat and engine maintenance products. Keeping them new is also a must; after a few years of sitting in a locker, they won't be as effective as when new, so replace as needed.

John Tiger is a Master Technician for Johnson/Evinrude and Mercury outboards who specializes in high performance engines and setups, powerboat racing, and engine building.

Alert

REVERSING CHARGES

Every spring, we see claims involving electrical fires and damage to sensitive electronics that are the direct result of owner error: The battery cables were reconnected backwards, with the negative wire connected to the positive post and visa versa. Sounds like something too basic to mess up, but rewiring the batteries can be particularly complex if you have to remember whether your batteries are wired in series or in parallel and which wire goes where. These claims are entirely preventable, and our goal is not to have any next spring. So if you're going to remove the boat's batteries this fall to trickle-charge them over the winter, take precautions now. Before you remove the battery cables, take a picture with your phone and send it to yourself or store it somewhere on the phone where you'll be able to find it again. Then, clearly mark which cable goes where. Write a + or – (and the number of the battery) on a piece of tape attached to the cable or use black and red electrical tape to distinguish them. A dab of red fingernail polish on the positive lug of the battery and black on the negative will also help you keep things straight.



A PUMP THAT WON'T PUMP

We've said it before, but it bears repeating: Bilge-pump failures don't sink boats, leaks sink boats. In most cases, a bilge pump is designed to remove nuisance water from a boat, not a steady stream. If you leave your boat in the water this winter, a bilge pump might buy your boat some time if it begins leaking (especially if there is also a high-water alarm that might alert someone that there's a problem). But if your bilge pump can't function due to poor wiring connections, loose clamps or leaking hoses – or worse like this stuck switch – you might get a call this winter that starts something like: "We've got some bad news…"

BLOWING OFF STEAM

There doesn't seem to be much that can go wrong with a lowly water heater – after all, there are no moving parts. But water heater controls can fail, and when they do, it's possible that the heating elements won't turn off and the tank can build pressure. Too much pressure, and it can explode. That's why water heaters have over-pressure valves that "blow off steam" before the tank can rupture. In boat installations, sometimes the piping from the over-pressure valve leads to the bilge or somewhere else where escaping scalding hot water won't hurt anything. But there should never be valve on the escape piping, as in the picture at right. What's even worse is that valve is closed, effectively rendering the safety device inoperative.

INSPECTING DRIVE BELTS

Losing a drive belt can ruin a day on the water. A worn belt is subject to failure at any time, which can lead to losing your alternator or your power steering or to an overheated engine. When you're laying up your boat this season, check each belt. Look for cracks or obvious worn spots like the one in the picture above. If you see black dust near the belt, it probably means it's not wearing right and needs adjusting. A belt that is too loose will slip – and usually squeal to let you know. One that's too tight will wear too fast and may even damage the bearings on whatever it's turning. A properly tensioned belt should deflect about a half-inch per 12-inch span when pushed hard in the center. Keep a spare of each belt onboard, as well as the tools necessary to replace it it. It's usually not a hard job, and it can save you from being stranded. Some boats have a single, long serpentine belt that drives everything, but these tend to be a bit more complicated to change.

SECURING SAILS

Name one sailing area that doesn't sometimes have a lot of wind during the winter months. Not easy, because over the winter there are almost always thunderstorms, nor'easters, or just plain winter storms that can produce damaging winds. Sailors love wind, of course, but too much can be a bad thing, especially when the boat's fending for itself on the hard, on a mooring, or in its slip. Wind has a way of finding a little opening and making it bigger. A loose jib is just asking for storm winds to unfurl it, which will almost certainly damage the sail and possibly the rig. If the boat's in a slip, a loose jib can damage the boat next to you. Removing the furling jib should be a standard part of winterizing any sailboat. But if you decide not to take our advice, at least make certain that the furling sail is secure and can't come undone. Lock or tie the furler drum so it can't move, and truss up the sail with the sheets until it is well secured and can't get loose. While you're at it, take that mainsail home with you as well. This is a perfect time to see to all those little broken stitches and chafed areas so your sails will be ready to fly come spring.

AH, THE LIVEABOARD LIFE-style! The freedom of living on a boat, awesome views, interesting neighbors, and … not a lot of space. Over the years, your *Seaworthy* editors have spent a lot of time living on their boats, and one of the benefits we've found is having no yard – no mowing or raking leaves. Unfortunately, it also means no gardening, and that's the part we missed. But boaters tend to be pretty innovative, and one liveaboard couple on a 38-foot sailboat in Hampton, Virginia, found an ingenious way to have a portable garden. This clever "lifeline" garden can even be brought below when things get a little dicey. Fresh tomatoes, anyone?

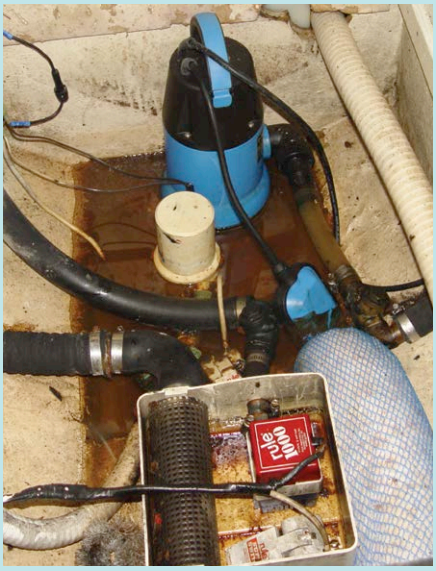
MOST OF THE TIME fortunately), insurance claims at BoatU.S. are pretty routine – a banged up hull from a docking mishap, or a bent prop from an unexpectedly shallow bottom, for example. But once in a while, things get a little more exciting. Last summer, William Buell and his wife Sheryl Moller, along with their two dogs, were enjoying a nice sail on their Soverel 36 into Glen Cove Harbor off Long Island Sound, when it was time to start the engine to head home.

William, who's been insured with BoatU.S. for 16 years, said the diesel fired right up, but almost instantly quit in a way that didn't sound right – never a good sign. He went below to see what was wrong and discovered two things: A rod that held up spare lines in the engine compartment had fallen, allowing one of the lines to strangle the spinning propshaft to a stop – the reason for the sudden silence. But worse, water was now gushing into the boat at an alarming rate from a split stuffing-box hose. Faced with a substantial leak and no engine, Buell called for assistance on the VHF. Within minutes, the US Coast Guard and TowBoatUS, City Island, arrived and quickly got the boat to a local marina where it was immediately hauled. Lesson learned: Anything stowed near machinery needs to be well secured, and lines should be stored elsewhere.

SO THERE YOU ARE ON A Friday afternoon, trying to decide if you'll go camping or boating this weekend. One company in Germany wants to make that decision easier by letting you do both with one rig. The maker of the aptly-named

Sealander Swimming Caravan says the boat/camper comes equipped with a sunroof, bed, and sink and has the "aesthetics of boat-building combined with the flexibility of a mobile home." Maybe so, but we wonder if people – landlubbers and boaters alike – might be tempted to call rescue services when they see this bobbing on a local lake.

ANSWERS TO LAST ISSUE'S *WHAT COULD POSSIBLY GO WRONG?*



Alison Mazon

1. The bilge-pump discharge hose has been teed into the shower sump-pump discharge hose; unfortunately, each can backflow into the other, rendering both useless. The surveyor who provided this picture remarked: "If one back-flows into the other, you just set up a pumping loop that does nothing except aerate the bilge water and make the bilge creatures happy."

2. To try to get around item 1, the installer added a check valve to each hose, which is not recommended by ABYC, partly because check valves can get stuck closed – which is exactly what happened to both valves. Neither pump worked.

3. If both pumps are on, the output is funneled into a single discharge hose that is too small – like too many cars on a narrow street.

4. There is an AC-powered home sump pump in the bilge probably because the DC bilge-pump system could not be relied upon to handle all of the above. Surveyor's comments: "The presence of a major AC bilge pump implies that there are very likely deeper problems."

ANYONE WHO'S BEEN IN a marina at night lately has probably seen the water lit up by underwater hull lights. They can be useful for night fishing, and some boaters think they look pretty cool and can even help you safely board your boat in the dark. But just because you can put an underwater light on your boat doesn't mean you should. Surveyor Steve Mason recently sent this photo of an underwater stern light to *Seaworthy*, which looks like an accident waiting to happen. If the boat strikes something in the water, goodbye underwater light, hello underwater hole.

AS BOATERS, WE'RE becoming used to having information at our fingertips (thank you, smartphones). And now boaters have the free "United States Coast Guard" app that can provide all this: State boating information; a safety equipment checklist; free boating safety check requests; navigation rules; float plans; and calling features to report pollution or suspicious activity. When location services are enabled, users can receive the latest weather reports from the closest National Oceanic and Atmospheric Administration weather buoys as well as report the location of a hazard on the water. The app also features an Emergency Assistance button, which, with locations services enabled, will call the closest Coast Guard command center. The Coast Guard is careful to point out that the app was not designed to replace your VHF radio.

Speaking of clever apps, if you want to call TowBoatUS, the best way is our towing app: boatus.com/towing/app.

HERE'S A SOBERING statistic: Almost half of all reported boating accidents involve alcohol. Most states – Michigan being the newest – have standards for intoxication that match their state highway laws for operating a motor vehicle, which is typically a blood alcohol concentration (BAC) of 0.08 percent or greater. Some states may revoke your boating privilege and charge points on your driver's license if you're arrested for boating under the influence. And while there is no "safe" BAC on the water, it's now easy to find out someone's level of intoxication if you have a smartphone. The Alcohoot ($99, www.alcohoot.com), snaps into your smartphone's headphone jack and works by blowing into the device for about four seconds, after which time, a reading pops up displaying your BAC – a fun party trick at home. Keep in mind, though: If you're a skipper, anything over 0.00 percent is too much.

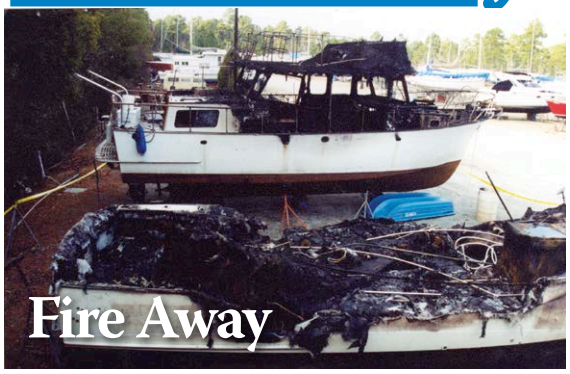
WHAT COULD POSSIBLY GO WRONG?

HERE'S OUR NEWEST PHOTO to challenge you to find out what could possibly go wrong. They may be American Boat & Yacht Council (ABYC) standards violations, USCG violations, or just things that make you say, "Really?"

We'll post the answer in the next issue, along with a new challenge. For those who can't possibly wait for the next issue, we'll also post the answer on the *Seaworthy* magazine website.

Photo: Alison Mazon

BoatU.S. MARINE INSURANCE PROGRAM
Seaworthy



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BoatU.S.
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Alexandria, VA 22304

The Afterdeck: The BoatU.S. CAT Team Is Standing By

THREE YEARS AGO this month, when hurricane season was supposed to be over and done with, Superstorm Sandy slammed into the New Jersey coast with a storm surge that topped out at more than 12 feet in New York City and surrounding areas.

The first BoatU.S. Catastrophe (CAT) Team members hit the ground 24 hours after the storm – the day before Halloween – and began sorting through the debris in search of the boats we insured. More than 100 surveyors and salvors worked with our adjusters in the Alexandria, Virginia, office to resolve thousands of claims.

The following June, the CAT Team and the management of BoatU.S. came together to determine what lessons we could learn from the storm. There were many things that had worked well, but there were also things we had expected to work that hadn't. Connectivity by phone or wifi had proven much more difficult than anticipated, forcing us to rely on overnight mail services and fax to move documents between the field and our headquarters. Since then, we've been working on implementing a variety of changes to make our CAT Team even more effective.

Those changes have been rolling out over the past two years. But in June of this year, we brought together the new CAT Team and unveiled all of the improvements we have made. We expanded our roster of team members and created new ways to work with them in the field. While we've been lucky so far this season, we're only halfway through and - as Sandy proves - it only takes one storm to make for a bad season. As always, we stand ready to respond if a hurricane finds its way ashore. No one ever wants to have to use their insurance, and no one wants to have to deal with a hurricane. But we're in this together. We rely on you to prepare your boat for the storm, and, if worse comes to worst, you can rely on us to take care of your boat afterwards.

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PUBLISHER Michael Pellerin
EDITOR Beth A. Leonard
ASSOCIATE EDITOR Charles D. Fort
GRAPHIC DESIGN Marcus Floro
PROOFREADER Tim Murphy
CIRCULATION Nelo Karimi, Kristin Loyd

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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