Picture got your attention, didn’t it? But when it comes to boating injuries, the truth is that accidents like the collision that caused the damage above are the exception. Boating is surprisingly safe compared to many other activities we engage in – and getting safer. As we reported in our October 2014 issue, fatalities have dropped to 4.7 per 100,000 registered recreational boats (2013 USCG Recreational Boating Statistics), more than 80 percent below the all-time high of 27.7 deaths per 100,000 registered boats in 1973. Collision and crew-overboard incidences account for most of the fatalities.

Injuries occur more frequently – somewhere around 100 per 100,000 registered boats. While collision is also the leading cause of injury, the majority of boating accidents leading to injury are more mundane than life-threatening: a sprained ankle from jumping off the boat to the dock, a broken rib from falling down the companionway, a back injury from being thrown from the seat by a wave. These smaller accidents can still wreck your day, your week, your month, and possibly your year. Proper boat-handling practices and a few minor modifications to your boat can go a long way toward reducing the chances of an injury.

Boating Safety Overview
Lessons learned from a review of boating accident statistics
By Beth A. Leonard

Collisions are responsible for more fatalities and injuries while boating than any other type of accident.
I have been building and/or repairing boats, as well as cruising extensively on the three multihulls that I built for myself, for the largest part of the last 45 years. In the “Striking Lightning Facts” article in the January 2015 issue, you refer to “multihulls” as if catamarans and trimarans are the same. They are not. Catamarans have a very difficult time achieving the same level of lightning protection as trimarans or monohulls can, partly because they do not lend themselves to having as direct (straight) a route to ground. The problem is that lightning seldom makes a 90-degree turn to follow a catamaran’s necessarily bent ground wires. A relatively straight, relatively vertical run of a AWG 00-gauge ground wire is preferred. Hard to achieve on cats, easy on monohulls and tris.

Mark Johnson
New Bern, NC

In searching for an explanation for the apparent attractiveness of multihulls, are there any data which relate strikes to the size of the vessels struck? We see beach cats everywhere, parked in the open with masts rigged, but hardly any monohull dinghies left the same way.

Robin Leigh
Jacksonville, FL

Unfortunately, even with 10 years of data, we’re limited by the number of claims in our ability to parse the data beyond monohull/multihull or size category for all boats. We’re talking very small frequencies here, and we’ve gone as far as we can while keeping our results statistically significant. With respect to trimarans, we do have what look to be a significant number that have had lightning claims, but we cannot say that their frequency is more or less than that of catamarans. Similarly, while size clearly matters when looking at all types of boats, we lack the data to say that size matters to multihulls specifically because the sample sizes get too small.

The article on lightning reminded me of helping a friend move his Catalina 34 across Lake Huron when an electrical storm came up. He had me get the jumper cables out. I connected them to the shroud and let them run down to the water, just as a precaution. We were glad that it was never “tested.” Probably like putting a forest fire out with a glass of water.

Hugh Nielsen
Pearl Beach, MI

Regarding what to do if you are caught out on the water: Thunderstorms normally bring high winds. What should you do on your sailboat if you cannot go below, and must stay in the cockpit to maintain some steerage? My sailboat has a wheel, and I have often wondered what I would do in that situation.

Staying in port is always the best course of action, but we all know Mother Nature has a mind of her own.

Bill Doleski
Sicklerville, NJ

You absolutely do not want to be holding onto a metal wheel during the storm. What you should do depends a great deal on where you are, what the wave and wind conditions are, and how long the storm is likely to last. If you have an autopilot, taking most of the sails down and just working your way slowly to windward with the autopilot is a good option. If you don’t, I’d suggest heaving to and lashing the wheel until the storm passes. On an inland lake with a fairly stable cruising boat, striking the sails and lashing the helm so you lie beam to the wind and waves is fine. But you don’t want to do that if the waves might reach a height of half the beam of the boat, because you could risk getting capsized.

Hugh Nielsen
Pearl Beach, MI

We’ve heard of this solution (or doing the same with chain) often among our sailing friends who swear it has prevented lightning strikes. We wish we could say we have some hard-and-fast evidence to support this approach. But there’s no way to tell with statistical accuracy if the boats where this approach was used have been struck less frequently or had less damage than on boats where it was not used. The recreational boating industry doesn’t have the funding to get properly controlled, experimental data on lightning strikes.

We will be interviewing a number of lightning experts from other lightning-vulnerable businesses — aviation, airports, agriculture (there is a huge lightning problem with grain silos) — and this is one of the things we will ask about. Stay tuned.

Len Berman
Fairhaven, MA

Top-notch article on bilge pumps in the January 2015 issue! One question: does each bilge pump need its own discharge line and port or can they be ganged together?

Captain Lanier: ABYC H-22 Electric Bilge Pump Systems (22.8.8) states that if discharges are manifolded together, one pump cannot back-feed into or reduce the pumping capacity of another.

Unfortunately, even with 10 years of data, we’re limited by the number of claims in our ability to parse the data beyond monohull/multihull or size
That means you can't just use a T or Y to connect them to the manifold, and the discharge manifold must be of the same size or larger than the output size of each pump combined. In other words if you have two 1-inch-diameter pumps, the size of the discharge manifold must be at least 2 inches. With multiple pumps, the required diameter of the discharge manifold can "grow" pretty quickly. My personal preference is for each pump to have its own discharge outlet whenever possible. I think it makes for a simpler installation in the long run, and I like the redundancy it provides (separate, complete systems instead of bilge pump systems with a common potential point of failure).

Regarding bilge pumps, it isn’t only while you are afloat that you need them. Last winter, a friend had his boat stored on land. It rained hard, and the bilge overflowed with water ruining his teak-and-holly floors.

I store my boat with the mast up. I know water can run down the mast and collect in the bilge. I leave my three AGM batteries installed and aboard the boat. The bilge pump is wired directly to the batteries through a three-way, on-off, manual switch with fuse. I leave the switch on during the winter. The wire connections are at the very top under the floorboards. The bilge is always clean and debris free.

Just before Christmas, I went to check the boat and found the bilge filled with water almost to the top. The connections were fine. The flapper style automatic switch was moving freely. The pump wasn’t clogged. The three-way switch was in the on position. What was left to cause the pumps not to work?

The fuse was 18 years old and had failed on its own. Another insurance claim avoided.

**MARINA SAFETY**

I just read the article on covered moorages in the January issue. Our covered moorages are mostly free-floating, so during heavy snows we either sweep or hope that everything comes back up after the snow. With respect to fire, code in the City of Portland, Oregon, requires the plastic panels described in the article over every boat in the covered area. Curtains (partitions of metal roofing running across the covered area) are also required to keep the fire in a smaller area. These curtains are not expensive and work extremely well.

**David Grant**
Portland, OR

**AND OTHER STUFF**

Interesting piece on the USCG’s changes to life jacket classification in the January Small Stuff. I ride a PWC and am required by law to wear a Type III vest (which I do religiously). I’m looking to replace my old vest with a newer version. Curious thing is my old vest comes with a “50-mph impact rating.” I would assume this is specially designed for watersports. However, I can’t seem to find any new vests with this impact rating. Has the Coast Guard dropped this certification as well?

**Rich Kranz**
Mount Laurel, NJ

Chris Edmonston, president of the BoatUS Foundation, told Seaworthy that the impact rating has also been dropped, as it proved problematic to be consistent depending on the type of water sport, the age and size of the wearer, and other factors. Until the USCG releases its new certification guidelines, he recommends buying a life jacket similar to your old one from a reputable manufacturer.

The Alert about the powerboat autopilot being hijacked by a steel bridge which resulted in pretty significant damage to the boat reminded me of a similar experience I had several years ago. I was moving my 36-foot sailboat from Lake Charlevoix to Round Lake, heading for Lake Michigan, and was passing through a narrow channel lined with steel bulkheads. I was singlehanded and, after checking for other boat traffic, lined the course up to pass right down the center of the channel and activated the autopilot. I was putting away the docklines and looked up to find that I had veered off course and was heading towards the bulkhead. I had only seconds to react, just barely recovering from impending disaster.

Lesson learned! Magnetic compasses are adversely affected by steel objects, and that does not exclude autopilots.

**Bruce Wasilewski**
Charlevoix, MI

I’m a BoatUS member and ABYC–certified as an electrical technician. In the Alert on page 13 of the January 2015 Seaworthy magazine, you asked what’s wrong in the three pictures. The one to the left has black cables terminated on a stud. The smaller ring terminal with the yellow sleeve appears to be mounted beneath the larger cable to its right. The ABYC calls for the smaller lugs to be beneath the larger ones. This is a very important requirement to avoid overheating when lugs are stacked on terminal posts.

**Tim Quigley**
Marinewright, Ltd.
Vermilion, OH

**Stephen Lee**
Marblehead, MA
So let’s take a look at the available accident statistics to see how you can make sure that your time on the water is relaxing, fun ... and safe for you, your family, and your guests.

OVERVIEW OF FATALITIES
We would all prefer that no one died while boating, but there isn’t anything we do that doesn’t have some degree of risk associated with it. So the question becomes: How risky is boating compared to other activities? Based on an analysis of the BoatU.S. Marine Insurance claim files between January 1, 2009, and December 31, 2013, an estimated five people died per 100,000 registered boats. According to the Coast Guard 2013 Recreational Boating Statistics, 560 people died in recreational boating accidents in 2013, or 4.7 per 100,000 registered recreational vessels. In 2012, 14 people per 100,000 registered cars and 60 people per registered motorcycles died in accidents as reported by the National Highway Traffic Safety Administration (NHTSA) in Traffic Safety Facts. While it is difficult to directly compare any of these statistics, they all point in the same direction – boating does not seem that risky compared to other activities involving a vehicle.

But people do die aboard boats, most for one of two reasons: the boat hit something, or someone accidentally went overboard. As Chart 1 shows, 36 percent of fatalities in the BoatU.S. claim files involved an accident where someone went overboard, and 18 percent resulted from a collision – usually with something solid like a pier or another boat. This data mirrors the findings in the Coast Guard’s report where, in 2013, 40 percent of fatalities occurred after someone accidentally went overboard and 18 percent resulted from a collision. Since most capsize fatalities occur because someone went overboard, and grounding can be considered hitting something, collision and crew-overboard accidents combined result in more than two-thirds of boating fatalities in the BoatU.S. data.

Bottom line: If you don’t hit anything and you don’t let anyone fall overboard, the chances of someone dying on your boat – small to begin with – will be cut by more than half.

That said, the type of boat you have determines whether collisions or overboard situations are more deadly. On smaller boats like runabouts and PWCs, collision causes more fatalities than overboard situations (Table 1), but both are important. If you get into a collision on a small boat, there is very little in the way of boat structure to protect you from injury – even less on a PWC. Larger powerboats offer more protection to those aboard in a collision, so while fatalities occur from collisions, going overboard kills more people. On sailboats, with their slower speed and heavier construction, collisions are only very rarely fatal. Staying on the boat is the best way to avoid fatalities.

In future issues we will discuss ways to avoid fatalities from collision and crew-overboard accidents. You’ll find a first installment in this issue – the story on COLREGS that starts on page 7 describes several situations where not knowing or not obeying the navigation rules had tragic consequences.

OVERVIEW OF INJURIES
When it comes to calculating how often injuries happen on recreational boats, the data are harder to come by. Many accidents that should be reported to the Coast Guard are not despite the fact that reporting is mandatory for any personal injury. When someone calls BoatU.S. with a claim, we capture every injury no matter how minor, because the true severity may not be known at the time. What is reported as a bruised arm may turn out to be broken, for instance. But injuries that occur where the owner does not file a claim would still go unreported. That said, we see approximately 100 injuries per 100,000 registered vessels. That compares to 1,325 injuries per 100,000 registered cars and 1,052 per 100,000 registered motorcycles in 2012 as reported by NHTSA.
Table 2 shows the number of emergency-room visits per 100,000 participants for a variety of recreational activities. While direct comparisons are again problematic, boating looks to be relatively safe compared either to operating other types of vehicles or to other recreational activities.

As to which types of accidents result in injuries, running into something tops the list just as it does for fatalities, accounting for 16 percent of the injuries in the BoatU.S. claim files (Chart 2) and 42 percent in the Coast Guard’s accident data for 2013. The rest of the top five from the claim files are far less dramatic; four of them involve some variation of falling.

Slip-and-fall accidents include everything from slipping on the companionway steps to falling down an open hatch. People getting tossed around by a wave or large wake make up 10 percent of the injuries in the claim files. Falling while embarking/debarking – going from the dock, the land, or a dinghy to the boat – results in 9 percent of BoatU.S. injury claims. These top four categories of accidents account for almost half of all the injuries in our claim files. So, by not hitting anything and by always following the “one hand for the boat” rule, you can cut the already-low chance of an injury aboard your boat almost in half.

Accidents involving towing sports is the last of the top five, with 6 percent of injuries occurring while people are skiing, tubing, or wakeboarding. A few of these involve propeller strikes, and those are horrific. But pulls and strains from the tow rope are more typical. While collision tops the list of accidents resulting in injuries across all boat types (Table 1), injuries on smaller boats are more likely to result from wave/wake and towing sports accidents, while slip-and-fall and embarking/debarking injuries are more common on larger boats.

While most of the other accident categories are self-explanatory, a few require some explanation. The on-land accidents mostly occur when the boat is on the hard and someone falls off a ladder, the boat, or the mast. Almost all of the docking accidents involve someone putting some part of themselves between the boat and the dock. Pinch/crush accidents consist mostly of broken fingers when someone's hand gets caught in an operating winch or windlass, a falling hatch, or a closing door. Hauling/launching accidents tend to occur on the boat ramp when someone slips off the trailer while preparing the boat to launch or tidying up after hauling it out.

According to the Coast Guard data for 2013 from the Boating Accident Report Database (Chart 3, next page), more than half of recreational boating injuries (while underway) result from five primary causes: operator inattention, excessive speed, operator inexperience, improper lookout, and alcohol use. The first four are the same as in the Florida Boating Accidents Statistical Report for 2013. Note that all of these things are in the captain’s control, and all of them fall into the

Table 2. Emergency-room visits for sports injuries in 2003

<table>
<thead>
<tr>
<th>Recreational Activity</th>
<th>Emergency Room Visits per 100,000 Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving off-road vehicles</td>
<td>1,638</td>
</tr>
<tr>
<td>Gymnastics/cheering</td>
<td>1,111</td>
</tr>
<tr>
<td>Snow sports</td>
<td>998</td>
</tr>
<tr>
<td>Fighting sports</td>
<td>613</td>
</tr>
<tr>
<td>Swimming</td>
<td>347</td>
</tr>
<tr>
<td>Water sports*</td>
<td>307</td>
</tr>
<tr>
<td>Golf</td>
<td>195</td>
</tr>
<tr>
<td>Racquet/volleying sports</td>
<td>173</td>
</tr>
<tr>
<td>Shooting sports</td>
<td>122</td>
</tr>
<tr>
<td>Low impact sports</td>
<td>46</td>
</tr>
</tbody>
</table>

*Surfing, SCUBA diving, waterskiing, tubing.

Source: Consumer Protection Safety Commission (CPSC) Hazard Screening Report: Sports activities and equipment (excluding major team sports), 2005
### Preventing injuries aboard

<table>
<thead>
<tr>
<th>Boat Type</th>
<th>Accident Type</th>
<th>Actions To Reduce Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runabout/PWC</td>
<td>Towing sports</td>
<td>1) Always use a lookout; when someone falls, have the lookout point to the person to keep the operator continually aware of their location.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Instruct skiers to hold a ski out of the water after a fall to increase visibility.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Make sure guests and others new to towing sports know to release the tow line as soon as they fall.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4) Tow only in wide open areas and calm conditions; be aware of the radius of your tow.</td>
</tr>
<tr>
<td>Wave/wake</td>
<td>Slip and fall</td>
<td>1) One hand for the boat, one hand for yourself.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Install a solid handhold within reach of every seating position.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Call “wave” or “wake” early to warn passengers to prepare themselves.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4) Brief guests on the need to stay seated while underway and what to do if “wave” is called.</td>
</tr>
<tr>
<td>Other power and sail</td>
<td>Slip and fall</td>
<td>1) One hand for the boat, one hand for yourself.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Always wear proper footwear with good nonskid soles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Test your nonskid deck by pouring saltwater on it and seeing if it is slippery; if so, revitalize it, or install nonskid tiles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4) Add nonskid to hatches, ladders, the sole in the galley and the head, and other areas where passengers may be vulnerable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5) Install handholds at all transition points – from cockpit to side deck, around the companionway, along the coach roof, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6) Brief guests on the need to use handholds whenever moving around the boat.</td>
</tr>
<tr>
<td>Embark/Debark</td>
<td></td>
<td>1) One hand for your boat; one hand for yourself. (See a pattern here?)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Have a proper dock step the height of the side deck of the boat. Use the docklines to pull the boat into the dock and hold it steady while guests, children, and others who may need assistance are embarking/debarking.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3) Install proper gates in the lifelines of the boat.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4) Keep the dock and the deck of the boat free of clutter including dock lines, power cords, water-sports equipment, etc.</td>
</tr>
</tbody>
</table>

Source: BoatU.S. Marine Insurance

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**Chart 3: Causes Of Recreational Boating Accidents**

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>24%</td>
</tr>
<tr>
<td>Operator inattention</td>
<td>14%</td>
</tr>
<tr>
<td>Excessive speed</td>
<td>11%</td>
</tr>
<tr>
<td>Operator inexperience</td>
<td>10%</td>
</tr>
<tr>
<td>Improper lookout</td>
<td>9%</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>7%</td>
</tr>
<tr>
<td>Force of wave/wake</td>
<td>7%</td>
</tr>
<tr>
<td>Heavy weather</td>
<td>4%</td>
</tr>
<tr>
<td>Navigation rules violation</td>
<td>6%</td>
</tr>
<tr>
<td>Hazardous waters</td>
<td>3%</td>
</tr>
<tr>
<td>Machinery failure</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: Coast Guard Accident Report Database
COLREGS

Rules to live by

By Daniel Rutherford

LET’S FACE IT, MY FELLOW boaters, I’m a practical sort. First, I know that the second I mention COLREGS, I would normally lose part of my audience to the flashy photos of that new 45-footer or sexy chartering couple. But this is BoatU.S. and Seaworthy. You are not interested in the glitz. You are interested in safety. Right? I hope so.

What are the COLREGS? That acronym stands for Collision Regulations, or to be precise, The International Regulations for Prevention of Collision at Sea. Those who know and love them refer to the COLREGS as the Navigation Rules, or Nav Rules for short, and if everyone at all times adhered to the Nav Rules, we wouldn’t have any collisions while underway. (That would be a good thing, even though it might put me out of business). The COLREGS govern our responsibilities as vessel operators, both in inland and international waters.

The International and Inland Rules are similar. If I were to sum up the differences, I would suggest that the International Rules are more for large commercial shipping, blue water vessels. As of 2009, 37 states and territories out of a possible 57 had adopted the Inland Rules in place of specific state regulation. That said, you need to know if your state or territory falls into either category because there are some rather unique state (and even county) specific rules out there, such as speed limits.

In this article, the discussion is limited to the Inland Rules, and I am going to use some general case history (with the locations and scenarios altered for confidentiality reasons) to illustrate how the Rules come into play. I have italicized words and phrases to add emphasis for a better understanding of the Rules.

Several years ago there was a terrible accident in Galveston Bay, Texas. A larger motor yacht (V1) was headed in a westerly direction at about 20 knots in the late afternoon. The weather was good and visibility was unlimited. Then tragedy struck when V1 struck a smaller boat (V2) drift fishing in the bay. V1 rode over the entire length of V2, exiting the deck on the port bow. Two out of three people on the smaller vessel were killed. In the court battle that ensued, V1 was assigned the majority of fault for failure to keep a proper lookout (Rule 5), failure to take action to avoid collision (Rule 8), as well as a Subpart II, Rule 13 violation for overtaking.
About 40 percent of the blame was attributed to V2 for violating several of the same Rules.

Let’s look at which rules were violated.

**Rule 3 (i).** As defined in this Rule, both boats were “underway.” A vessel is deemed to be underway when she is “not at anchor, or made fast to shore, or aground.” So if you are drift fishing, motor off, music blaring, and not paying attention to your surroundings, then you are in violation of the Rules because you are a “vessel” and you are “underway” and don’t have a proper lookout.

Incidentally, the rules specify what a“vessel” is, and a paddle board or PWC is defined as a “vessel” just as much as a 50-foot cruiser.

**Rule 3 (k)** states “Vessels shall be deemed to be in sight of one another only when one can be observed visually from the other.” Notice the rule states “can be observed.” In the above case, the owner of the larger vessel argued that the smaller vessel could not have been seen because of glare. Testing showed that the glare off of the water did compromise his forward vision, but because there was an issue with visibility forward, V1 should have reduced speed to compensate. It is important at this point to note that the Rules apply to both vessels equally. V2, in this case, should have had no limitations on seeing V1 approaching, with a bone in her teeth and taken appropriate action (see below).

**Rule 5 - Lookout.** This Rule states that “Every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances so as to make a full appraisal of the situation and of the risk of collision.” If all mariners abided by this one simple Rule over all others, then perhaps all of the other Rules wouldn’t be necessary. Essentially, it is your responsibility to understand what is around you all the time and act, pursuant to the Rules, once you have deemed that a “risk of collision” exists. (See Rule 7) “All available means appropriate” include using radar, AIS, binoculars, etc., if they are on board and “available.” In this case, V2 did not comply with this rule. Arguably, V1 was also not in compliance because V2 could have been seen if the proper measures had been taken, or the radar had been on.

**Rule 6 – Safe Speed.** “Every vessel shall at all times proceed at a safe speed …” and here is the important part “so that she can take proper and effective action to avoid collision …” In this rule, the state of visibility, how many boats are in close proximity (traffic density), how quickly your boat (or the other boat) can turn or stop, and what the weather conditions are would be just some of the considerations to take into account to determine if a vessel was proceeding at a “safe speed.” So in this case, V1 may have been in violation of Rule 6 if it can be demonstrated that the glare affected visibility forward.

**Rule 7 – Risk of Collision.** This one is fairly straightforward, or so you would think, given the following language. “Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt, such risk shall be deemed to exist.” To keep it simple, if you think that there is a possibility that you might cross paths with another vessel, then assume that you
will, and act accordingly. Both boats failed miserably here.

If you think you might be on a collision course, what do you do?

**Rule 8 - Action to Avoid Collision.** I don’t care if you think you have the right of way, or the other guy is an idiot; you must take action. The Rule states, “Any action taken to avoid collision shall if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship.”

Let’s see it from the position of V2 in the above situation. Why should I “take action” when I am the “Stand-on Vessel”? Because the Rules say you should.

**Rule 8 (f) (iii) states:** “A vessel, the passage of which is not to be impeded (is the stand-on vessel) remains fully obliged to comply with the rules of this part … ”

**Rule 17 - Action by Stand-on Vessel.** This rule states that even if you are the vessel required to “keep her course and speed,” the stand-on vessel “may, however, take action to avoid collision by her maneuver alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action … ,” Rule 17 (b) goes even further and requires the stand-on vessel to “take such action as will best aid to avoid collision” when she finds herself so close that a maneuver by the give-way vessel alone will not do the trick. This old poem says it best: “Here lies the body of Johnny O’Day who died preserving his right of way. He was right, dead right, as he sailed along … but he’s just as dead as if he’d been wrong.”

In the end, how could this tragedy have been avoided? V1 should have had a better lookout and if there was glare that limited visibility, and they should have reduced speed. V1 had operational radar and they should have used it. V2 was a vessel underway and, even drifting with motor off, they were responsible to keep a proper lookout. V2 should have recognized the risk of collision and acted accordingly (started the motor and moved out of the way and/or sounded five short and rapid blasts – danger – with their horn). In failing to do so, they became liable for a portion of the damages.

Let’s look at another case. In this case we have two powerboats traveling on a river early in the morning. They are about to start a fishing tournament and they are both heading in the same direction. V1 passes under a bridge and proceeds up the river at a speed of about 35 mph. V2, not far behind, decides to pass V1. He throttles up and starts to pass on the port side of V1 but seconds later, as they begin to enter a turn in the river, V2 pulls the throttle back and goes dead in the water. V1 ramps up over the other boat, killing the operator. Tragic.

**Rule 16 - Action by a Give-way Vessel and Rule 17 - Action by Stand-on Vessel.** Here we use the terms “give-way” and “stand-on” where the give-way vessel “… shall so far as possible, take early and substantial action to keep well clear.” The stand-on vessel “shall keep her course and speed.” (But don’t forget that bit about the stand-on vessel also being required to take action to avoid collision when the give-way vessel fails to do so.)

**Rule 13 - Overtaking.** If you are an overtaking vessel, then you are required to “keep out of the way of the vessel being overtaken”. Here is the important part for this particular case. You are not finished “overtaking” until you are “finally past and clear.” How do you know? Had the risk of collision passed? The answer in this case was no.

**Rule 14 - Head-on Situation.** What about a head-on or meeting situation? I think this one is fairly simple; each vessel “shall alter her course to starboard.” But this is where it gets difficult. “Head-on” is basically defined as meeting on “reciprocal or nearly reciprocal courses.” There are no double yellow lines out there, no skid marks for us to see. By day, if you see the bow or mostly the bow of an oncoming boat or at night if you can only see the sidelights with a masthead light directly above them, then you are meeting head-on. In a head-on situation, both boats should alter course to starboard, passing port to port. But what if both boats are not quite head-on and turning to starboard puts you directly in the path of the other vessel? In a head-on situation, both vessels are required to alter course to starboard unless otherwise agreed to in advance.

**Rule 15 - Crossing Situation.** Last one for now, I promise. “When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her starboard side shall keep out of the way … ” Instead of speeding up to pass ahead of the other boat, you should pass behind them (yes, that is in the Rules). I like to keep it simple and think of it like a traffic light. Using the colors of your side lights (green to starboard and red to port), if you are to port of another boat, then you would see a red light which should signal “stop” or at least caution. If another boat is to your port side, then you would see their green light, which means you can proceed safely (but cautiously) ahead. Failure to yield in crossing situations can be deadly.

I often get asked how percentages of responsibility are determined. The answer is by judges, juries, and attorneys. The take-away message is that in a two-vessel collision, unless your boat was unattended and made fast to a legal mooring in a designated harbor, you are probably partially at fault. As an accident investigator, I have the privilege of 20:20 hindsight. I hope to impart some foresight so I don’t have to use my hindsight. It would be my pleasure for you to put me out of business.

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A LOT GOES ON inside your engine. Pistons race up and down, valves snap open and closed, gears spin – and everything’s working at breakneck speed to produce the power you need to propel your boat. Because all of this happens deep in the hidden bowels of your engine, you may never know if a problem is developing until one day it just quits. Having your engine or transmission oil professionally analyzed can tell you what’s really going on inside and alert you to potentially serious problems.

HOW IT WORKS
An oil sample analysis (OSA) evaluates the levels and types of metals and the presence of such contaminants as abrasives, soot, water, fuel, and engine coolant in the oil of gas and diesel engines. A lab report will flag any suspected anomalies, state possible causes, and offer some plain-English recommendations. Typical conditions that can be found by analysis include abnormal wear of metals, fuel dilution, dirt or water contamination, coolant contamination, and incorrect lubricant. Discovering any out-of-range condition early can prevent expensive repairs later on. For instance, fuel dilution will accelerate cylinder and bearing wear. High levels of solids will cause wear on bearings, pistons, cylinders, and the valve train. Excessive soot in a diesel engine can be caused by dirty injectors, weak ignition, low compression, or restricted intake or exhaust, among other things. Simply servicing a dirty injector can save an engine rebuild if caught in time.

Most OSAs will include the following:
- **Spectral Exam:** A spectrometer is used to find the quantity of various metals and additives in the sample - useful for finding excessive wear in bearings, pistons, rings, cylinders, valve train, and gears. It also determines the composition of any oil additives.
- **Viscosity Test:** The thickness of the oil at a specific temperature is tested - useful for finding fuel dilution, the breakdown of viscosity enhancers, or other contamination.
- **Flash Point:** Tests the temperature at which vapor from the oil ignites - contamination can cause a specific grade oil to flash higher or lower than the design flash point.
- **Insolubles Test:** Insolubles are typically abrasive solids - high readings are usually byproducts of incomplete combustion.

OSA is more useful as a tool to monitor a specific engine and/or transmission over time rather than as a one-time evaluation. Small changes, which may not look significant in a single analysis, will stand out if there are prior samples on record. For example, a higher lead or tin level than in past reports, while still within normal ranges, could alert you to accelerated plain bearing wear. That’s not to say that OSA on a one-time basis isn’t useful. A single sample (often performed in the course of a pre-purchase survey) will indicate a serious condition that deserves further investigation. However, a one-time analysis has to be carefully reviewed and interpreted prior to waving a red flag. The machinery total hours, type of machinery and use, type of oil and hours on the oil, knowledge of average baselines common to a particular unit—such context is important. This is where you may need the services of a knowledgeable marine-engine technician or surveyor; she can review the report in light of all known information, and then make recommendations.

I’ve found that many brokers dislike one-time samples because of questions that can arise due to lack of experience and the lack of a detailed service history typical of many vessels. The less knowledge there is about the sample taken, the broader the interpretation of the results must be. I recommend OSAs every year, more often for high-use engines or for those that have red flags from previous analysis.

HOW TO TAKE A SAMPLE
I mentioned earlier that a “carefully taken” sample is useful; you wouldn’t want your doctor to use contaminated equipment to draw your blood. The same is true for oil sampling. There are some very simple but important steps...
to ensure the sample taken represents the average fluid in the engine or gear. Sampling mistakes include: getting oil out of a drain pan after the oil is drained, pulling an oil gallery plug and drawing a quantity of oil while the engine is running, sticking a suction probe to the bottom of the oil pan, reusing suction tubing or sample containers, or contamination of the vacuum pump. These can all skew a sample, not only making it worthless but possibly sending you on an expensive trail trying to fix a problem that may not exist.

Most heavy-equipment manufacturers sell suction pumps and oil-sample kits that are convenient and inexpensive. For most marine engines and marine gears, a simple vacuum pump, semi-rigid disposable plastic tubing, and a plastic bottle that can be screwed into the vacuum pump are all you need. The pump is a one-time purchase and can be reused many times. The OSA kits contain a collection bottle with cap, a label to be completed by the person taking the sample, a length of plastic tubing, and a mailer of some type to mail the sample to the lab. The cost for an OSA kit at my local Caterpillar dealer is about $17, which includes processing the sample and sending me the analysis of the results. That’s a bargain by any measure.

Note: If the fluids have been changed very recently, an OSA isn’t likely to be particularly useful except to see if there is something catastrophic happening. Fifty hours in service is generally a suitable time of operation to obtain meaningful results.

Follow these steps to draw a representative oil sample:

1. Run the machinery to warm up the fluid and suspend the particulates.
2. Cut a length of tubing that allows you to extend the tube into the engine or gear and with enough length to allow you to get in a comfortable position to operate the pump.
3. Insert the tubing into the top of the pump so it extends through the pump approximately 1 to 2 inches. Tighten the knurled top so the pump O-ring grips the tubing tightly, ensuring a good seal.
4. Take the cap off the sample bottle, place the cap in a clean location, and screw the sample bottle to the pump.
5. Pull the dipstick, and lay it alongside the suction end of the tubing. Mark off this length on the tubing with a marker or tape so you will know when the end of the tube is far enough into the unit to reach the oil but not too far where it could reach the contaminants that may have accumulated at the bottom. **Touching the bottom would likely contaminate the sample, resulting in false readings.**
6. You may need to straighten the tubing by applying a reverse bend several times until the portion being inserted is reasonably straight.
7. Carefully insert the plastic suction tube into the dipstick tube just to the mark you made on the tube, and operate the pump. You may have to reinsert the tube a few times in the event it curves and doesn’t enter the lubricant, or you may have to insert it a little further than your mark. Just don’t go too far.
8. Pump the prescribed amount into the bottle (about two ounces in most cases) but do NOT fill to the top as that would contaminate the pump. Always keep the pump level.
9. When nearly to the correct level, pull the tubing up until it is clear of the sump oil and draws only air. This will clear the tubing of most oil.

10. Cut the tubing off several inches above the pump.
11. Unscrew the bottle, and replace the cap securely.
12. Loosen the pump’s knurled top, and push the remaining short section of tubing through the top of the pump and out of the bottom. This will keep oil from contaminating the pump.
13. Clean the pump of any residue. Do not use solvents, as solvent residue could skew future samples.
14. Fill out the label as completely as possible with all requested information. Incomplete or inaccurate information will result in less accurate analysis.
15. Place the bottle with label in the provided container, and drop in the mail, or return it to the equipment dealer where you purchased it.

What you get back is a report that highlights suspected abnormalities, with possible causes and actions for you to take (see the Online Extra for a sample report).

Congratulations! You are on the way to establishing a meaningful service record for your equipment. Having a log of OSAs over a period of time can be an excellent sales tool when selling a vessel. It shows the true condition of the machinery, and it demonstrates that the vessel has been well maintained by a conscientious owner. ▲

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**TOP HEAVY ACCESSORIES**

Last fall, Captain Mike Dunn from TowBoatU.S. Crystal River near Tampa Bay called *Seaworthy* to report a disturbing trend: several capsizes of pontoon boats and skiffs outfitted with hardtops. The weight of these structures six feet or more above the deck increases the already high center of gravity on what are essentially flat-bottomed boats. Add a large wave, a big wake, or a bunch of guys on the hardtop as in the photo, and the boat may well be happier upside down than right side up. The weight of the hardtop in combination with a full load of partiers in the stern can also lead to backfilling of livewells on skiffs, causing the boat to capsize or sink. Bottom line: If you’re thinking of accessorizing, check with the manufacturer to be sure the boat can safely take the weight, and don’t allow passengers to ride on your new upper deck. If the boat came equipped with a hardtop but doesn’t have a ladder or seating up top, it’s not meant to be used for sightseeing. Even if the hardtop is clearly designed for passenger use, pay careful attention to the builders’ recommendations as to how many people can safely be on top of the boat as opposed to in it.

**GETTING YOUR BEARINGS**

The beauty of trailerable boats is their portability: As long as there’s a boat ramp, trailer-boat owners can go to a multitude of places not accessible by marina-bound boats. But key to getting to those places is a trailer that’s properly maintained. One of the most common failures on trailers is their wheel bearings, and a frozen bearing is almost sure to ruin your outing. Bearings on trailers have a particularly hard life. They only get used occasionally, so the grease tends to dry out, but worst of all is that they get routinely dunked in water, often corrosive salt water. Bearings tend to get pretty warm when they’re carrying the boat’s weight over a distance, and submerging them while they’re still warm instantly cools them, which can force grease out, and water in. After a few dunkings, there may not be enough grease left. This spring, check your bearings and if it’s been a couple of seasons, repack them. Installing Bearing Buddies is a smart option; they protect the bearings and keep the grease under pressure so the bearings always have proper lubrication between repacking.

**LIFT SAFETY**

*Seaworthy* regularly reminds readers with boat lifts to inspect cables and all associated parts annually to be certain they’re not deteriorating due to corrosion or wear. But neither of those caused the cable in this photo to snap. Member Roger Sands wrote in to tell us how his wife had just stepped off the lift and onto the dock after riding the lift up on their Waverunner when the ¼-inch stainless steel cable snapped. The galvanized steel cradle of the 1,500-pound lift and the Waverunner went crashing down into the water. Fortunately, she was not injured, and the Waverunner was not damaged. But the cable appeared in perfect condition, so why had it broken? When the technician came out to do the repairs, it turned out that the culprit was the auto-stop. Despite its name, when it got to the top the motor continued to crank on the cable until it snapped. Sands was informed that this is a common problem affecting owners of PWCs and boats alike. So make sure to inspect your entire lift this spring looking for any signs of wear or corrosion, and replace suspect parts. And if your lift has an auto-stop feature, check to see if it also has a failsafe cutoff if the load gets too high. If it does not, don’t rely on the auto-stop. And don’t ride up and down with the boat or PWC: Lifts can and do fail.
LIFE JACKET LOVE

A few years ago, the editors of Seaworthy participated in a BoatU.S. Foundation test of inflatable life jackets. For the most part, we were impressed by how well they worked, especially the automatic inflation type. When the tests were over, there were quite a few previously inflated inflatable life jackets lying around; once they were properly dried, they needed to be repacked and re-armed. This turned out to be surprisingly easy — easy enough for an owner to inflate on purpose occasionally, so that if/when they are ever needed in an emergency, wearers can be confident they’ll work. Manufacturers typically sell re-arming kits that include the CO₂ canister and the inflator bobbin and they’re not hard to install. Even if you decide never to auto-inflate your life jacket, it’s a good idea to manually inflate it (using the included tube to blow in) and make sure it holds air for 24 hours. Refolding the bladder into the cover is not hard, but make sure it’s folded correctly; manufacturers typically include re-packing instructions on the inside of the life jacket. You can find more detailed instructions at: www.BoatUS.org/life-jackets/inflatable-life-jacket-care/

OH, TO BE TOWED

Hopefully you will have no need to call TowBoatU.S. or Vessel Assist this summer, but if you do, do you know how your boat should be towed? Different boats have different requirements. Some jet skis, for instance, cannot be towed at more than five miles per hour or water will enter the exhaust and flood the engine. Most boats are equipped with reinforced attachment points (usually cleats) on the bow that must be strong enough to take the load of an anchor line or mooring, and these are what should be used for an on-the-water tow. While TowBoatU.S. and Vessel Assist captains are professionals with years of experience towing all different types of boats, each one cannot be familiar with every vessel on the water. As skipper, it’s your responsibility to know how your boat needs to be towed, and to communicate anything unusual to the tow boat captain. Your owner’s manual should tell you where the reinforced attachment points are on the boat, and outline any unusual requirements for towing. Take a look now, before the season gets underway, then relax and enjoy the summer. Hopefully this is information you won’t need to use.
REMEMBER SUPERSTORM Sandy? Though she blew through the Northeast two-and-a-half years ago now, our BoatU.S. claims adjusters still get reminded of her on a regular basis. Take this 1997 Sea Ray 280, for example.

The claim report filed on November 3, 2014, five days after the storm made landfall, says the owner returned to his marina “to find the marina gone as well as his boat.” Not surprising – the marina was located just to the east of Brick, New Jersey, near the Mantoloking bridge that got wiped out during Sandy. A month later the boat had still not been located. The owner filed a police report for his missing boat, the boat was declared a total loss, and the claim was paid a few weeks later. End of story? For the owner, yes, but not for BoatU.S.

In December 2014, the Brick police department notified BoatU.S. that the Sea Ray had been located at a nearby marina. Surveyor Steve Mason was assigned to investigate. He found the vessel blocked up at a landlocked storage and repair facility more than three-and-a-half miles from Mantoloking. The marina owner had been trying to figure out who the boat belonged to for more than a year. The story of how the Sea Ray came to be there is one of the many Sandy mysteries that may never be unraveled.

In the wake of Sandy, everything was in chaos, with boats scattered all over the area. The marina owner leased some space out to insurance companies for storage of totaled boats pending salvage sales. He returned from lunch one day to find the Sea Ray, outdrives missing, in the center of the yard. Someone had trucked it into his landlocked facility and blocked it, and then left without talking to anyone. He moved the Sea Ray to the side of the yard and figured someone would come forward with paperwork to claim it. The boat sat through the spring and summer of 2013, but so did many other boats. With so much damage to marinas and beach houses, many people were not boating. By the end of the 2014 season, most of the other boats were gone, but the Sea Ray was still there. After failing to contact the owner, the marina owner went to the state police and found the police report that had been filed. From there, he got in touch with BoatU.S.

“Somehow that vessel was salvaged, the drives were removed, and the boat was put on a truck and then blocked in a marina yard and no one knows who did it,” Steve Mason said. The chances are we will never know what happened to that Sea Ray from just before the storm until several weeks after. But one more Sandy boat has been accounted for …

THERE HAS BEEN talk of driverless cars for several years now. While progress is being made, getting a car to react appropriately and instantaneously to everything from stop lights to potholes to dogs running out in the middle of the road has proven to be more challenging than some tech-savvy companies had anticipated. Now think about what a driverless boat might mean. There are no roads, no lane markers, no stop signs, no intersections. The article on the COLREGS in this issue
demonstrates how complex it can be for a human to figure out which vessel is to give way, even a human with years of experience who is keeping a proper watch. Yes, out in the middle of the ocean it would probably not be particularly difficult to get a boat to steer itself safely – many boats already do so using “dumb” autopilots. But how about navigating an inshore waterway with all of its buoys, shoals, barge and tug traffic, ferries, and recreational boats?

Well, don’t look now … or rather, do look now. Look very carefully.

The science and technology company, Leidos, announced on January 27 that a 42-foot work boat equipped with the experimental “maritime autonomy system” successfully completed the first “self-guided” voyage between Gulfport and Pascagoula, Mississippi. The prototype system, developed as part of the U.S. Defense Advanced Research Projects Agency (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel (ACTUV) program, had previously completed 42 successful days of at-sea demonstration, as well as approximately 26,000 simulation runs, but this was the first time a fully self-guided voyage had been undertaken.

Using a navigational chart of the area loaded into its memory and inputs from its commercial-off-the-shelf radars, Leidos said that the surrogate vessel successfully sailed the 35 nautical miles within the inshore environment of the Gulf Intracoastal Waterway. During its voyage the maritime autonomy system avoided all obstacles, buoys, land, shoal water, and other vessels in the area and safely followed the COLREGS. Leidos intends to use the system on the Sea Hunter, the first ACTUV prototype vessel, which is scheduled to be launched in late 2015 and begin testing on the Columbia River shortly thereafter.

But don’t despair – this technology is highly sophisticated and top secret. We’ll probably be enjoying our driverless cars way before they take the helm away from us …

If you have a trailerable boat in North Carolina – or Georgia, Wisconsin or 13 other states – and you ever fill up at a roadside gas station, you’ll need to pay extra attention to those labels on the pump starting this spring. Gas stations in a total of 16 states – Georgia, Kansas, Nebraska, South Dakota, North Dakota, Minnesota, Wisconsin, Iowa, Tennessee, Alabama, North Carolina, Michigan, Florida, Ohio, Illinois, and Arkansas – have begun to offer E15, a combination of 15 percent ethanol and 85 percent gasoline. But any gasoline with greater than 10 percent ethanol (E10) is prohibited for use with recreational boat engines and can void the warranty. For the nine out of every 10 U.S. boaters who own a trailerable boat and may fill up at a roadside gas station, the increasing presence of E15 at the pump makes misfueling more likely. So keep an eye out for the E15 label if you live in one of those 16 states, but, given the rapid expansion of E15, don’t assume you’re safe if you live elsewhere. If you tend to fill the tow vehicle first, then simply pull the boat up to the pump and insert the same nozzle into your boat’s fuel fill, make it a habit to check that it’s not E15 before starting that fuel flowing. E15 should be clearly marked with an orange EPA label.

There are a lot of smart, sharp-eyed Seaworthy readers and starting this issue, we’re going to challenge you and see just how sharp your eyes really are. In every issue, we’re going to publish a new photo that contains at least one major safety-related no-no, and we want you to find it/them. 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 an extra minute, we’ll also post the answer on the Seaworthy magazine website before the magazine is mailed. So check out this photo and see if you can figure out: What could possibly go wrong?
On February 11, 2015, at the age of 85, BoatU.S. founder, Richard Schwartz, passed away after a short illness. If Richard hadn’t been who he was, hadn’t had a vision and pursued it, hadn’t been passionate in advocating for the rights of boaters, you would not now be reading this publication, would not be insured with BoatU.S., would not be part of a membership organization that works tirelessly for the interests of boaters. Richard truly was the heart and soul of BoatU.S. He defined who and what we were for almost 50 years, and he remained the Chairman of the Board and read just about every word that went into BoatU.S. Magazine right up until his death.

It all started more than 50 years ago, in the early 1960s, when Richard was invited aboard a friend’s boat, and, soon after departing the dock, the Coast Guard stopped and boarded the vessel, and ticketed the owner for improper engine compartment ventilation – over which the owner had no control. This may have been the first time Richard used his soon-to-be-stock phrase, “That’s outrageous!” with respect to boating. At the time, Richard was working as an anti-trust attorney after graduating from Yale Law School. He asked his boating friends if there was anyone fighting for their interests – and the answer was no. The idea of BoatU.S. was born, and the reality followed soon thereafter.

A few years later, Richard’s testimony to Congress proved crucial in the passage of the watershed Federal Boat Safety Act of 1971 which gave the U.S. Coast Guard the power to hold manufacturers accountable for certain safety standards – including engine compartment ventilation – and created the U.S. Coast Guard Office of Boating Safety, saving countless lives.

But he didn’t stop with legislation. The BoatU.S. Marine Insurance program, started in 1967, offered the first recreational boat policy in clear, understandable language rather than the unintelligible, centuries-old, commercial ship language. When Congress directed the U.S. Coast Guard to stop providing routine on-the-water assistance in the 1980s, Richard created the largest on-the-water towing service in the nation, the red boats of the TowBoatU.S. towing fleet. He also created the nonprofit BoatU.S. Foundation for Boating Safety and Clean Water, which, among other initiatives, provides a free Online Boating Safety Course, life jacket lending for children, and EPIRB rentals.

Richard is gone, and his loss is deeply felt. But Richard’s legacy lives on in a strong organization that has been forged around his deep commitment to boat owners, and the employees who share Richard’s passion for helping people enjoy their time on the water.