

THE REEL STORY:

Looking Around at Spooling Lines



DIY BOAT OWNER

The Marine Maintenance Magazine
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Issue #2 2010

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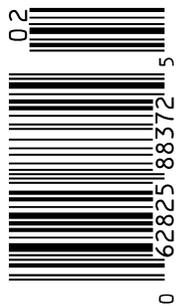
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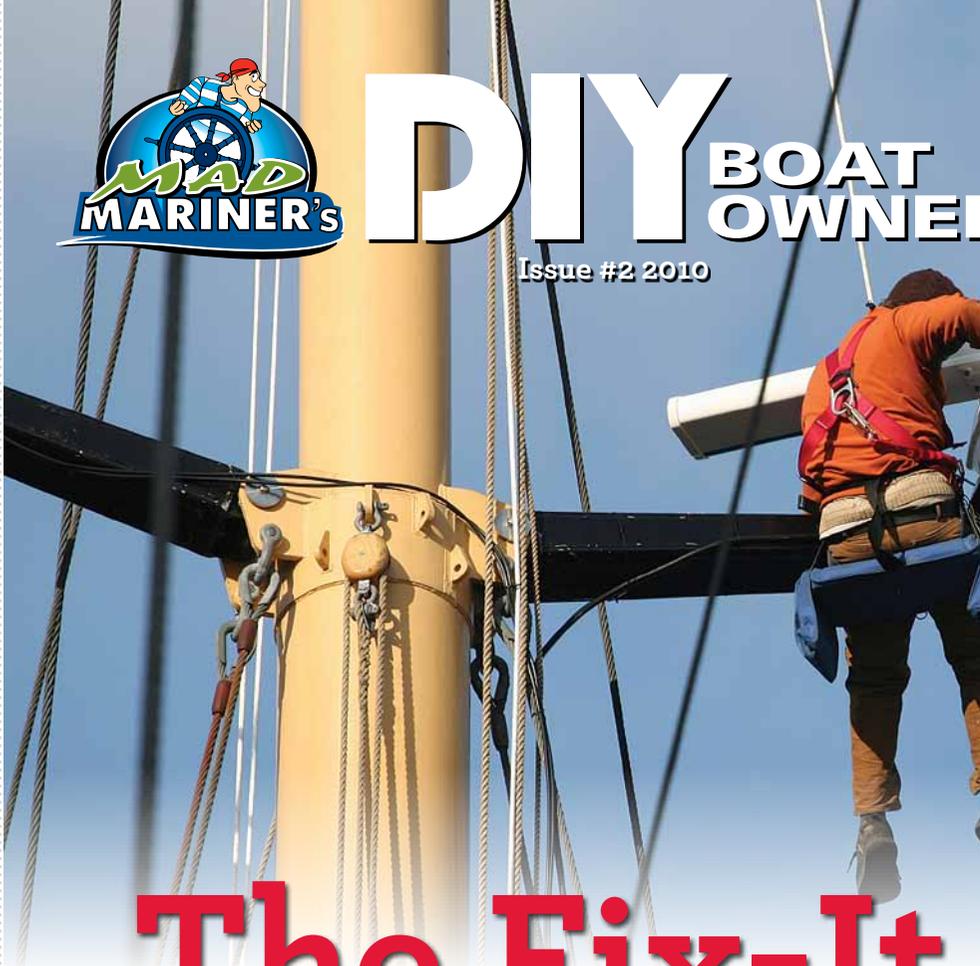


WE FOLLOW BWI'S ETHICS GUIDELINES



DIY BOAT OWNER

Issue #2 2010



The Fix-It

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- » Patch Your Dinghy
- » Servicing Bilge Pumps
- » Anchor Chain Splice
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- » Eliminate Head Odor



Cover Photo: © iStockphoto.com/fasttarget

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A Clear View

While fixing some blown-out seams on his dodger, one DIY boater decided to test his sewing skills and replace the aging windows on all sides. Read about the things he learned along the way.

Down the Hatch

Battle leaks and long-term damage by replacing your hatches. One cruising couple shows us how to do it right.

The Great Keel Ordeal

With no fiberglass experience, one couple forged ahead to repair water damage on a concrete-ballasted keel. And won.

Your Boat

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Tools & Gear

We Test So You Don't Have To

The Reel Story

We Look at Two Spooling Line Systems for Any Boat

By **Glen Justice**

For a very long time, seamen have been coiling rope around a drum to gain mechanical advantage and store lines efficiently. You see these outfits all the time on commercial fishers, tugs and working vessels. So why not on recreational boats?

Sure, sailboats have winches and some of us have a windlass. But why doesn't every boat come with a storage system that keeps them neatly coiled and out of the way yet easy to deploy?

In truth, there are a few such systems available—and so we decided to investigate. We obtained and installed Quickline's Flat Rope and Reel, which is flat Dyneema or polyester line coiled on a thin reel that is designed to mount on a rail or bulkhead. Prices start at \$430. To explore a cheaper alternative, we also bought the Anchor Reel from Sawgrass Distributors, a plastic wheel and handle mounted to an aluminum post, which fits into a fishing rod holder. The price for that was \$60.

At first look, these could be seen as solutions in search of a problem. But when we got them back to the boat, the utility of these systems was immediately clear. It's nice to have a good long line handy for towing, docking, rafting or dropping a lunch

hook—and nicer still to have an accessible yet unobtrusive place to store it.

It was also clear that to truly test these systems, the reels need to stay in use for a season, braving the elements and getting yanked and pounded by the crew. And that's exactly what we plan to do, reporting back to you later this year on how each held up and how they rank on our 1-10 scale. But after installing and playing with the units a bit, there is much to say already.

QUICKLINE FLAT ROPE AND REEL

Quickline's reel is fast becoming a standard. It is an increasingly common sight around marinas and on some high-profile vessels, too. Zac Sunderland, the teenage circumnavigator, had a Quickline on his boat.

The reels come in various sizes from 15 to 21 inches, with 135 to 400 feet of line. The one we chose cost \$430 and came with 135 feet of 1-3/8-inch flat line on a 15-inch wheel.

Two things were immediately clear. The first is that this is a reel, not a winch. As Quickline points out, the reel is not designed to carry a load, and so the line must be cleated before you run it out to tow, anchor or moor the boat. The reel provides

Stay tuned for DIY's recommendation on the high-end Quickline (seen below) or the budget Anchor Reel.

photos by Glen Justice



storage, not muscle.

The second is that this is very much an engineered product. As the line winds into the reel, it passes through a pair of rollers designed to wring out the water so it can dry well when coiled—a nice touch.

The reel comes with a winding arm to coil the line, which also functions as a deck key and a shackle buster, and the fitting for the arm will also accept a standard winch handle. More nice touches.

The reel, made of 316 stainless steel, was also solid and well assembled, with no rattles and clanks when used.

It came with a set of mounting hardware that included three stainless steel clamps for 1-inch railing; a set of three metal spacers to lead from the clamps to the reel; three plastic spacers for bulkhead mounting; and screws in two lengths.

The installation—we chose a rail mounting—was a relatively simple matter, accomplished with a multitool and a ratchet. The only concern was not to warp the reel by over-tightening. Perhaps the toughest part of the job was figuring out where to locate the reel, because this means deciding how you will use it. If anchoring is the task, the bow is an obvious



The Anchor Reel relies on a rod holder.

choice. If you want to tow, it will go on the stern. If you want to do both, you may have a conundrum.

Ultimately, the Quickline holds promise. We talked to a handful of owners and all were pretty big fans. If it holds up under use, we'll have ourselves a winner.

THE ANCHOR REEL

The Anchor Reel is something we came across at a boat show, rather than something we sought out, and we bought it to address a question: Could a cheaper piece of equipment work reasonably well? After all, not everybody is up for spending a few hundred bucks on a spooling line. Perhaps something like the Anchor Reel,

or even a DIY solution, could suffice.

The answer depends on your needs. The Anchor Reel is not the precision machine presented by Quickline, but it does have advantages. One big one is that it is portable. The Anchor Reel can be easily moved from one rod holder to another. You can locate it anywhere you have a rod holder—or anywhere you can clamp one on. You can also detach it and throw it in a locker.

Another advantage is versatility. The reel can accommodate 150 feet of $\frac{3}{8}$ -inch line or 75 feet of $\frac{1}{2}$ -inch line. We rigged it both ways, and it worked, though the $\frac{1}{2}$ -inch line was unruly. It's really designed to handle smaller cordage.

Price, too, is an plus. It's a smaller investment—and you won't be out hundreds of dollars if it gets mangled or stolen.

Which way buyers head will depend on how their boat is used. Sailors and traditionalists will invariably favor Quickline's well-thought-out instrument. Small boat owners looking for a quick and inexpensive solution will look to the Anchor Reel, or something like it. Which we recommend—well, we'll tell you at the end of the season. **DIY**

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A close-up photograph of a hand holding a Six10 adhesive cartridge in a caulking gun. The cartridge is green and white, with the brand name 'Six10' and 'ADHESIVE' clearly visible. The hand is applying the adhesive to a surface.

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Accusharp Knife and Tool Sharpener

Keeping knives sharp is not something you think about often, but it is part of good seamanship. And the Accusharp Knife and Tool Sharpener makes it pretty easy.

9

The Accusharp (\$10.99) is a hand-held plastic unit with a pair of crisscrossing tungsten carbide sharpeners. You draw the tool across the blade you want to sharpen, using light pressure until you get results.

This is one area where there is some snake oil on the market, but we found that the Accusharp works. You can see the tool remove metal and the blade get noticeably sharper after several passes. After a few seasons of playing with it, we found it works well on multitools, dive knives and galley cutlery—anything with a straight blade.

Serrated knives can be sharpened, too, but we were never sure that we were doing as much good. The blade was definitely sharper, but the tool leaves more shavings and the experience was generally less satisfying. We never tried a cleaver, ax or machete, but the manufacturer claims they, too, can be sharpened.

The sharpeners in the tool can be reversed, so you can use the opposite side and get a second life from the tool. We never had to—the Accusharp held up well—but we performed the procedure and found it easy.

Overall, we found the Accusharp to be a winner. Yes, it's one more thing in the tool bag. And knife aficionados might have better, more complicated methods. But for the rest of us, it's an affordable tool that works.

- Glen Justice

PROS: Affordable and holds up well.

CONS: One more thing in the tool bag.

www.accusharp.com



photo by Glen Justice

DIY Rating System

10. Everyone should own this
9. A very strong product
8. Strong, with a note or two
7. A fine product
6. Good for some applications
5. Think about it first
4. We don't recommend it
3. Product has major flaws
2. Don't buy this
1. Don't even look at it

The Whale Supersub Smart 650

The Whale Supersub Smart 650 (\$64) is a low-profile, automatic bilge pump with a capacity of 400 to 650 gallons per hour depending on the lift height associated with the installation (up to 9.8 feet).

9

Integrated in one housing is an ultrasonic (read: no moving parts) water sensor, a bleed ball (which prevents air lock) and an "easy clean" strainer. Measuring 3 inches by 9 inches, it can fit under raised floors (as a drainage pump) and in bilges that are tight for space.

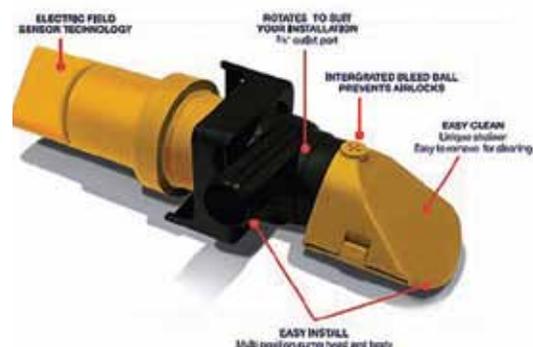
During 500 test cycles at a lift height

of 4.5 feet, the pump drew just 3.3 amps at 13.1 volts, emptying all but the last ¼ inch of liquid in the bilge. It also worked well on a low battery. However, we observed no resistance to backflow and recommend considering backflow protection in each installation.

- Dan Corcoran

PROS: Amazing capacity and ultrasonic water sensor/switch at just 0.71 pounds and 3.3 amps.

CONS: We wish it included integrated backflow protection.



Whalepumps

www.whalepumps.com



photos by Frank Mummert

The materials for mixing the putty are laid out for testing. Each mixing stick is marked to keep from confusing them.

BoatLIFE Marine Putty

According to BoatLIFE, its new two-part epoxy marine putty—called Fix—can cure underwater, be sanded, tapped and painted, and will not sag while drying. We tested it and found that for the most part, the claims hold water, when it comes to ordinary, non-emergency situations.

The putty (\$38.41) comes in a kit that contains everything you need to make one batch, although you don't need to make it all at one time. The kit includes three tongue depressors to be used as mixing sticks, but no gloves. The putty has to be mixed in a specific 4-1 ratio, but we found an "eyeball" approximation also works. The instructions say it can be worked for 45 minutes after mixing, but we found that it was still malleable for up to an hour. It didn't sag, even when we let it dry hanging from a piece of wood.

The putty had a harder time drying underwater. The instructions recommend letting the putty set for 30 minutes before using it to patch a submerged object, which can be done during a best-case scenario. But we wanted to see what would happen if you needed to use it during an emergency, so we applied it right away. While the ball hardened at the center, the surface remained tacky more than 12 hours later.

Using putty underwater would generally be something you would do to stop a leak, so speed is important. The conclusion: this isn't a putty for emergencies. But it is good for other applications. Overall, we had few complaints with the product. For general maintenance, it is a solid winner.

- Frank Mummert

PROS: Works easily and stays in place while drying.

CONS: Takes some time to set completely.

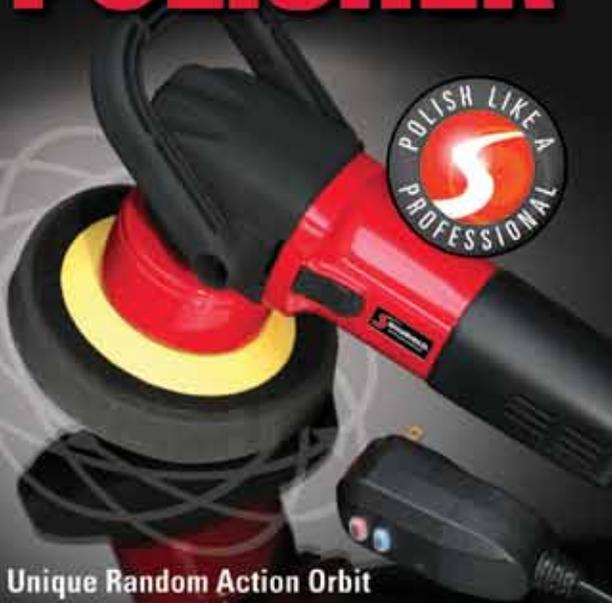
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Even hanging upside down, the putty did not sag and held two boards together.

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Tools & Gear

Kuhn Rikon Duromatic Pressure Cooker

I was initially reluctant to try a pressure cooker aboard our boat. I thought it was an expensive, potentially hazardous and complicated kitchen gadget.

9 However, newer designs like the six-quart, Swiss-made Kuhn Rikon Duromatic (\$230) are pretty fool-proof, offering more safeguards than a nuclear plant.

The first meal I tried—Swiss-style pork chops with mustard—was a revelation. All it took was seven minutes of prep using the low setting on our non-pressurized alcohol stove. The meat was tender, flavorful and moist. Pressure cookers also work great for healthy, high-fiber meals containing brown rice and beans.

How does it work? The Kuhn Rikon Duromatic uses a spring valve to hold and regulate pressure. These units are less likely than others to get clogged by bubbling food if you do overfill the pot.

The valves also allow more precision in cooking. The pressure valve stem has two red rings. When one ring is visible, you are operating at eight pounds of pressure; with two rings, the pot is at 15 pounds. This feature eliminates guessing whether you've reached a full head of steam and simplifies cooking times. To avoid fouling the release valve, don't fill the pot more than two-thirds full. And keep the lid gasket clean and free. If you do foul



the release valve, it can be easily disassembled for cleaning.

The Kuhn Rikon pots are stainless steel and come with a helpful user's guide and simple, tasty recipes. Though not cheap, the cooker saves us money: the one pot stove-top meals taste so good, it's often easier, quicker and yummier to stay aboard than go ashore to find a restaurant.

- Susan P. Gateley

PROS: Easy to use and clean, making meals a snap.

CONS: Pricy for a piece of galley equipment.

www.kuhnrikon.com

For the Record

DIY Boat Owner maintains the highest journalistic standards, and part of that is correcting our mistakes. This space is set aside for cases in which we have to set the record straight.

In a story on buying a generator in Issue #1 2010, DIY said that Kohler was the first to produce low CO-emission gasoline generators. While Kohler does produce low-emission units, it was Westerbeke that pioneered the technology, for which it won an Innovation Award from the National Marine Manufacturers Association in 2004.

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PART 1 OF A 2-PART SERIES

Out With the Old

Making Way for a New Diesel Requires Planning and a Few Strong Friends

By David Aiken

How many boat owners are lucky enough to install two new engines in the same, single-engine boat?

When my wife, Zora, and I bought the new Volvo diesel for our new-to-us Chris-Craft, we were replacing a 20-year-old gas engine. We just assumed this would be the last engine we'd ever put into this boat. But 25 years down the waterway, the Volvo just plain got tired.

With so many years of coastal travel, it had accumulated some hours. Precisely how many is a mystery, due to assorted gauge glitches through the years, but for most of that time, we pretty much ignored the engine's raw-water cooling system, focusing instead on the often-heard "that engine will outlast you." That our reliable Volvo chugged along as well as it did for as long as it did was a tribute to its solid construction even as it was a surprise to many of the brand's detractors. While we naturally hoped it would continue to surprise us for a few more years, the day came when reality intruded with absolute finality. "New engine" moved to the top of the buy list.

Having spent too many weeks in a

David Aiken has lived aboard a classic Chris-Craft sailboat for more than 25 years. He and his wife, Zora, are the authors of Good Boatkeeping, 2nd Edition; Cruising, the Basics; and Fiberglass Repair: Polyester or Epoxy.



photo by Zora Aiken

I could no longer coax another year from the old reliable Volvo: here's the engine before disassembly.

boatyard shortly before the engine quit, we weren't looking forward to a return to yacht-condo living, particularly because getting back to the yard now would likely require a tow. A haulout wasn't essential at this time, and the boat was at a marina whose owner generously agreed to let us install the new motor at the dock. He even volunteered whatever manpower or machine power might be needed on the actual out and in transfer days. As more friends volunteered suggestions and assistance, we decided to stay at the dock.

WEIGHTY DECISION

I always knew the Volvo weighed a lot for its horsepower. At 640 pounds, it was too heavy to lift out with a simple block-

and-tackle arrangement. In fact, lifting out would be the first problem. The boat is a center-cockpit sailboat, and the engine sits directly under a large hatch in the cockpit sole. In the boat's original design, only canvas covered the cockpit, so removing the engine with a crane would have been easy once the bimini fabric and framework were lowered. But years ago, we had replaced the bimini with a hardtop built over the cockpit to make it a wheelhouse. Even if we had easy access to a crane, it would be impossible to hoist the motor straight up and swing it away from the boat. Instead, we would have to lift the motor up and out of the engine room through the cockpit-sole hatch, slide it aft along a seat until it came to a

Departments

side opening in the cockpit, then manually lift it over the coaming and move it sideways over the deck and toerail to finally reach the dock.

To ease the removal of the block, I planned to eliminate as much weight as possible. Before removing anything, I closed the seacock for the raw-water intake, checked that the stuffing box was not leaking and pumped all the oil out of the engine. Then I began the process of removing parts. The battery box, with its three batteries, was easy to take out, as was the maze of wires, including the wiring for gauges and the starter. Piece by piece, off came the transmission, manifold and exhaust system, and flywheel. To remove the transmission, I had to slide the shaft back, but before doing so, I marked the shaft at the stuffing box so I could position it correctly later. (Because the boat was in the water, it would be impossible to check the shaft placement from outside the boat.) If any of the smaller items were still usable, I was careful to remove them intact: starter; alternator; oil, fuel, and air filters; cylinder heads; injectors. Eventually, the motor was stripped to bare block.

Next, I turned to the construction project that would become our crane replacement. A friend offered the loan of his heavy-duty chain hoist, but I had to make a substantial “bracket” from which to hang the chain. On each side of the pedestal, I placed a pressure-treated 4-by-4 standing vertically. I connected these uprights with a plywood support panel and tied the frame onto the pedestal with line and strapping. I used a larger 4-by-6 oak beam for the crossbar, resting it on the pedestal frame aft, and on the cabin top (with additional planks) forward. A second plywood panel on the upright beams kept the crossbar from slipping sideways. As a jury-rig, it was less than attractive, but it made a very secure support. The crossbar was situated over the cockpit hatch. When the chain hoist was tied onto the crossbar, the chain had a clear path to the engine.

To minimize damage during the move, I covered the cockpit seats, coaming and deck with heavyweight corrugated cardboard. I put heavy planks on top of the cardboard to support the engine block as it slid aft. More planks spanned the gap between the coaming and the dock to provide a safe route for the block to travel once it cleared the boat.



photos by Zora Aiken

Above: With the boat tied securely against the dock, helping hands transferred the block safely from boat cockpit to marina dock. **Below:** I removed the exhaust system and disconnected the transmission, which would be taken out later.



MOVING DAY

When moving day arrived, so did three willing friends. In a surprisingly short time, we hoisted the block up and shifted it back along the cockpit seat, then lifted it over the coaming and moved it out of the cockpit and onto the dock. After one more short struggle, we managed to set the block onto a dolly—but well balanced it was not. We rolled it slowly down the dock, as four pairs of hands pushed and

pulled the dolly upright and centered after each tilt.

A few parts of the engine had been deemed usable—those replacement parts that had been installed sometime during the engine’s tenure—and these were saved for those lucky owners of this Volvo model who were still able to save their motors with an occasional newer part. Understandably, the block itself was not one of these, and so it was off-loaded in the recycle section of the marina’s work yard to await the metal-man’s weekly pickup.

With the engine totally gone, access to the shaft coupling was ideal, so that last piece of the old motor could be removed. Having been in place for so many years, the coupling did not go willingly. I knew that any tools used to encourage the release of the coupling would have to be handled very carefully to avoid scarring the surface of the shaft itself. First, I cut the coupling flange with a hacksaw until the flange was nearly cut through, then I finished the job with a Dremel cutting wheel. I turned the shaft and repeated the cutting process on the opposite side of the coupling. Finally, I used a chisel to

coax the coupling sections to break apart. After the coupling was gone, I used wet/dry sandpaper to clean the shaft.

EXTREME CLEANING

With the engine room empty, I could not postpone an extreme makeover of the nautical kind. This was truly a now-or-never situation. Boat cleaning isn't a favored activity for anyone, and when the cleaning relates to engines, the expected mess is that much worse. Still, it had to be done. So we moved bottles of bilge cleaner and degreaser into the cockpit and gave the Shop-Vac a real workout. We used scrapers and scrubbies and sanders to clean and smooth all surfaces of the engine room, getting them ready for new paint. While navy gray has always been familiar engine-room décor, white is so much more practical from the viewpoint of identifying or locating problems quickly. Regardless of color, the new coat of paint did wonders for both the boat's appearance and the crew's morale.

For me, the job of removing the engine was the kind of boat project that was easier to handle in many short sessions than in one start-to-finish effort. However, if time is critical, and making allowances for a lot of variables, the job can probably be done in about a week: four days to disassemble the engine, build the hoisting framework and remove all parts; two or three days to clean and paint the engine room. The only costs associated with this take-apart job are the cleaning supplies and paint—and a favor or two we now owe to some friends. **DIY**

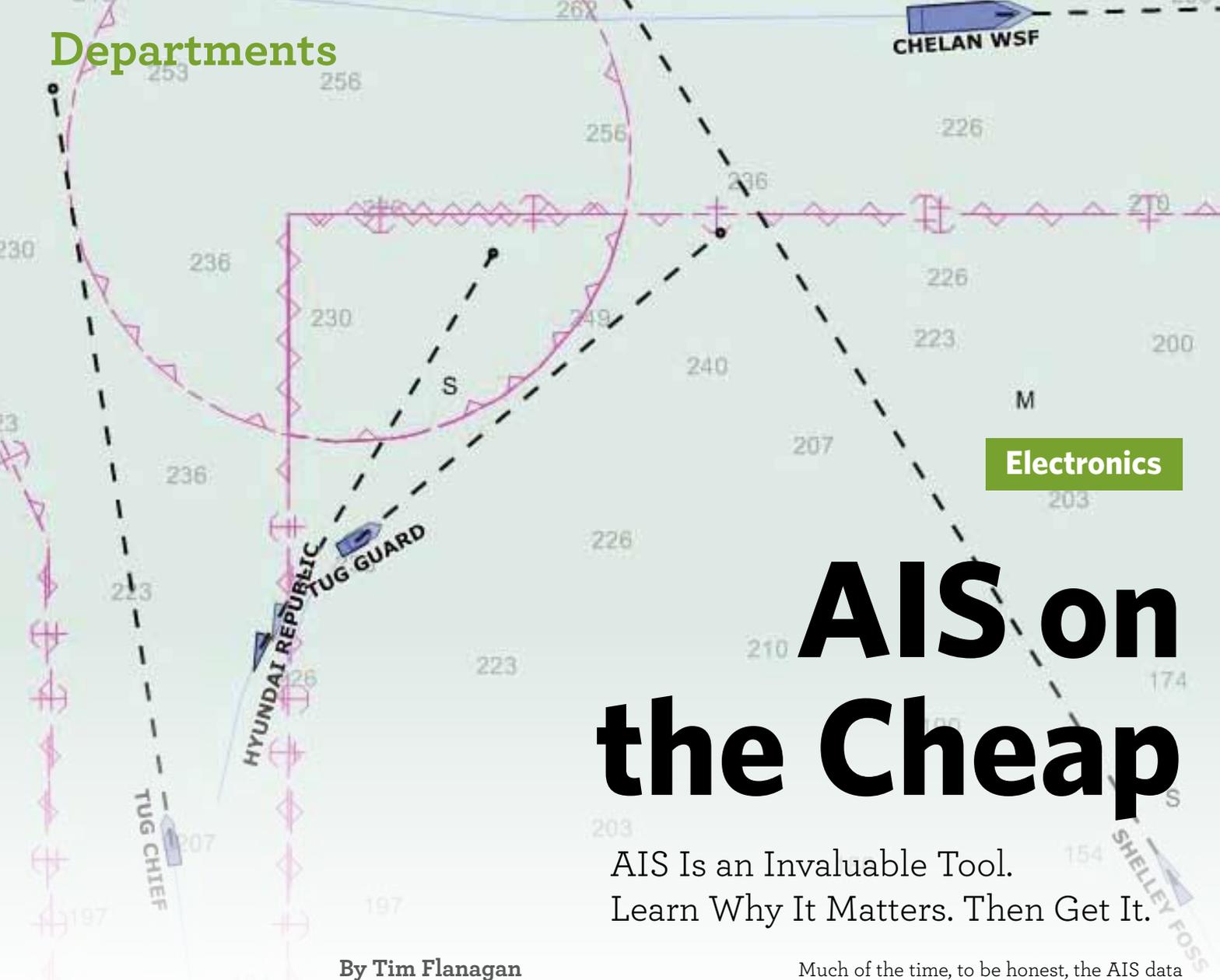
Next Issue: *With the old engine out, we put in the new.*



Top: When the engine was stripped, I prepared to hoist it out. **Left:** I used 4-by-4 verticals and a 4-by-6 oak crossbar to make a strong frame for the chain hoist. The chain had a clear path into the engine room. **Above:** The empty engine room gave me good access to the shaft coupling, so I could remove that last part of the old engine.

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Electronics

AIS on the Cheap

AIS Is an Invaluable Tool.
Learn Why It Matters. Then Get It.

By Tim Flanagan

If you've spent any time around major commercial ports or vessel traffic lanes, you've probably wondered about all those big ships. What's in those enormous vessels? Where are they coming from? Where are they headed? How fast are they going?

It turns out that the big ships broadcast answers to all of those questions, all the time. To receive that data, you need an Automatic Identification System, or AIS, receiver.

I've had AIS aboard my boat for two years now, in one form or another, and I'm here to say: I would not be without it. I navigate the sometimes crowded waters of Puget Sound, Admiralty Inlet, Rosario Strait and the San Juan Islands, and it is extremely handy to have access to accurate data about the shipping traffic displayed right on the chartplotter.

Tim Flanagan is the author of Navagear.com, a gear and gadgets blog for cruising boaters.

Much of the time, to be honest, the AIS data provide a form of entertainment; it's fun to learn the ships' names, see how long they are, how fast they're going and the rest. Recently, however, I was out in heavy fog, and obtaining accurate information about the commercial traffic satisfied a need far more compelling than mere curiosity.

UNDERSTANDING AIS

I'm surprised that more boats don't have AIS receivers, because you can add AIS data to your chartplotter for about \$300. About half the time, I get blank stares when I mention it to fellow boaters, and I get the impression there's still a good deal of confusion about the technology.

To begin with, let's clarify something: For most pleasure boats, the most valuable aspect of AIS is being able to receive the data that big vessels transmit. Transmitting data about your own vessel, at this point, is not especially helpful. So it's important to draw a distinction between simple AIS receive-only units, which can

be purchased for less than \$200, and the more expensive Class B AIS units, which cost about \$1,000. Class B units receive AIS data from other ships, and they also broadcast similar data about your boat.

I currently have one of Shine Micro's Class B AIS units installed aboard *Two Lucky Fish*, and I like it. But the fact is that nobody really cares where my boat is; the vast majority of the boats in a position to do anything (or care) about the position of my boat are not equipped to receive the AIS data I'm broadcasting. The big ships are equipped to see me, but they're not going to navigate around me anyway. It's up to me to stay out of their way.

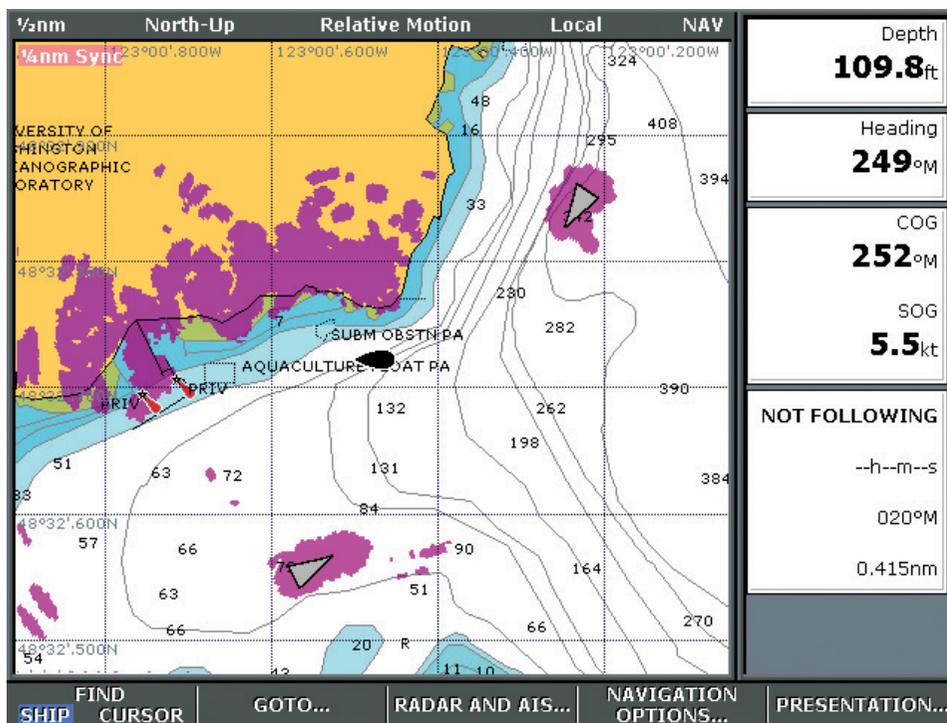
My point is that about 99 percent of the real-world AIS utility I have experienced so far comes from reception: I know the names, positions, headings and velocities of the big traffic I need to avoid. I have made active use of this data on several occasions, hailing them by name over VHF channel 13 (the bridge-to-bridge channel most big ships monitor) in order to clarify intentions in passing and crossing situations.

BETTER TO RECEIVE

Here is an example from one recent foggy morning. I was arriving at Friday Harbor, on San Juan Island. It's a harbor I know very well, but in the fog, it was mysterious and frightening. Big pink radar blotches on the screen are certainly nice, but they're a lot more helpful with AIS vector triangles overlaid on top, especially because you can click on the target and learn the name of that specific vessel.

As I arrived at Friday Harbor, one Washington State Ferry was departing and another was arriving. I never saw either vessel. Heck, I never saw the headland I had just rounded. It was extremely reassuring to see the AIS data confirming the radar data and to be able to hail one of the boats by name to clarify what they were going to do. I learned that they intended to pass one another right about where I was. Guessing that they would probably give one another a somewhat wider berth than they might in clear conditions, I decided to scoot in and hug the shore pretty closely.

Certainly, I didn't need AIS in any of the situations where I've made active use



Big pink radar blotches on the screen are certainly nice, but they're a lot more helpful with AIS vector triangles overlaid on top.

of it; I could just slow down and wait to see how each situation developed, or take the longer, safer route that keeps me outside the area where the conflict could occur. But it's empowering and, frankly, just good seamanship to know how to make contact with a bigger vessel, state your question briefly and clearly, and make a decision based on what you are told. AIS allows you to contact commercial vessels quickly—by name—to obtain additional information and confirm that events are proceeding according to your new, more complete understanding of the situation.

THE CHEAP WAY

So let me explain how you can add AIS data to your chartplotter inexpensively. One of the cheapest AIS receive-only units is Milltech Marine's single-channel SR161. This bare-bones unit sells for \$189, but the fact is that it works, and it does what you need to obtain the benefits I have described. To make it work, you need to connect it to three things: a 12-volt power source, a VHF antenna and a chartplotter.

The power is easy. The VHF antenna is fairly straightforward, if you have a separate antenna for it. You'll probably need to

track down a connector or adapter to get it all hooked up, and that can be a bit of a hassle because standard VHF antennae tend to use PL259 connectors and AIS units seem to favor the BNC adapters. Don't panic, but don't be surprised if you have to call around or order online to get the adapter or connector you need.

If you want to share your existing antenna between your VHF radio and the new AIS unit, you'll need an antenna splitter that can protect the AIS unit from the destructive potential of VHF transmissions you make when you key your mic. That kind of power can damage or destroy a radio receiver, which is one reason I prefer a separate, dedicated antenna for AIS. The cost (new antenna versus antenna splitter) is about the same, but you can often find inexpensive VHF antennae on Craigslist or at marine swap meets, so it can actually be cheaper to add a new antenna. I got mine for \$20. Ironically, the antenna mount cost almost twice that. I had to get the fancy stainless steel model.

All that's left is to connect the AIS unit to a chartplotter or a PC running navigation software. The AIS-to-chartplotter connection can be a bit tricky, I've found, and it varies a lot depending on your

Departments

chartplotter. I won't pretend to cover every angle, but suffice it to say that in the end, you'll need to connect three wires from the cable that plugs into the SR161's 9-pin jack to three wires in a NMEA cable you can plug into your chartplotter.

Connecting it to a laptop, however, is very straightforward, even though the SR161 comes with that old-fashioned 9-pin RS-232 connector and your laptop probably supports USB only. All you need is a Keyspan USB-to-serial adapter, which sells for about \$25. There are other brands out there, but the Keyspan seems to enjoy a great reputation, and I know from personal experience that it works, though it occasionally will require a reboot (unplug it from your computer, wait a few seconds and plug it back in).

If you decide to try it with your laptop, let me suggest that you install Rose Point Coastal Explorer. I really love the powerful way it displays AIS data on the chart, so underway I'll often run Rose Point on the laptop, right alongside my Raymarine chartplotter. I've got my installation set up so I can plug the AIS into my Raymarine C-80 chartplotter or my laptop.

Either way, I never leave the dock without AIS. It's too valuable to me. I think many recreational boaters would agree, if they had a chance to experience it for themselves the way I have. The fact that can be added so cheaply makes it, in my opinion, a pretty easy decision. **DIY**



One of the more affordable AIS receive-only units is Milltech Marine's single-channel SR161.

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DIY's Top 10 Maintenance Products

Miracle Workers

From Sealant to Polish, We Bring You the Best Boat Care Products—*Ever*

By **Lenny Rudow**

Few products become legends, but it does happen. Duct tape, for example, has become a part of American culture—and I'll bet everyone reading this article has at least one roll stashed someplace at this very moment.

WD-40 is another such product. It's become known as the galaxy's ultimate spray lubricant and can be found in virtually every household in the country. But what about us boaters?

Do we have any products that have become universally useful—or are destined to do so in the future? Based on my having tested hundreds of boat care products through more than a decade of writing for boating magazines and websites, a few have become fixtures in my boat

Lenny Rudow was senior technical editor for Boating magazine for more than 10 years and is currently the electronics editor for Marlin and GoBoating magazines.

Maintenance

maintenance arsenal.

These are the best that have been invented yet (note: products less than one year old have been excluded from the running, since there hasn't been time to thoroughly test them). Among them I'm sure we'll find one of those legends that lives on forever. In any case, you'll want to know about this stuff—and perhaps test it out yourself.

3M 5200

This stuff puts the “super” in “supergoop.” 3M 5200 Adhesive/Sealant is one of the most useful items ever invented for boaters, whether you're assembling a new boat or just trying to get something to stick on an old one.



Departments

It's no mistake that 5200 is the most popular adhesive/sealant on the market, especially when one considers the fact that it can create a bond with fiberglass that's so strong that you can break the glass before you break the bond. This used to be a problem as well as an asset—removing the stuff for repairs or maintenance sometimes proved impossible—but a few years ago a product called Anti-Bond was introduced to reverse the sticky effects.

Other than a long cure time (it's tack-free in 48 hours but takes five to seven days to cure completely), 5200 has no real flaws. Once cured, it's completely waterproof, can flex without losing its grip and costs just 10 bucks for a three-ounce tube—a mere pittance for such a mir-



acle product.

CORROSIONX

We boaters face an ever-present foe in the form of corrosion. Luckily, there are several corrosion inhibitors on the market. After thoroughly testing a half-dozen of them, both in a head-to-head comparison and through the years, I declare the standout leader in this field to be CorrosionX.

Once sprayed or wiped onto a metal surface, it creates a dielectric film that displaces moisture and halts the path of currents between electrons. As a result, corrosion simply cannot occur. CorrosionX also lubricates metal parts. Spray it onto a rag, use it to wipe down anything metal on your boat, and you'll discover that corrosion is stopped in its tracks.

GIT ROT

Though its usefulness has declined thanks to the advent of fiberglass as a boatbuilding material, there are still plenty of boats with wood in them.



And where you find wood, you find rot. Mix this two-part epoxy, inject it into rotted wood, and it creeps through the pores to make it hard and structurally sound again. This is pretty amazing stuff—I've seen it used to effectively repair partially rotted decks, stringers, T-top attachment points and other high-stress areas that one would think were beyond repair.

HOSECOIL SELF-COILING

Here's another invention that's had a huge impact on boaters, especially anglers. Look at a new boat today, and if it has a raw-water washdown, it will virtually always have a self-coiling hose attached to it.



Mounts that contain the hose can be placed in horizontal or vertical positions, and completely contained flush mounts are available. Grab the end of the hose, and you can stretch it from one end of the boat to the other; merely let go, and it springs back into the stowed position. That means no more time and effort spent coiling hoses, no more tripping over hoses left on the deck and no more hose stowage issues.

As a result, many boaters who used to wait to return to dock for a scrub-down now wash away the messes the moment they occur. In the long run, this saves both time and effort. There's just one downside to the HoseCoil: it's on the expensive side. While a 15-foot length of garden hose costs just a few bucks, a self-coiler mounted in an enclosure can run a couple hundred.

MARYKATE ON & OFF HULL & BOTTOM CLEANER

This formulation of hydrochloric, phosphoric and oxalic acids will clean anything—and I do mean anything—off fiberglass. Paint, rust stains, barnacles, seaweed, scum lines and tannic stains are just a few examples of the tough-to-clean problems that this stuff takes care of.



It leaves your gel coat bright and shiny, and—most amazing of all—it takes zero scrubbing. Just brush the stuff on, then rinse it off. It'll take off anything you've doused, which unfortunately includes your skin, pin striping, lettering or anything else that gets in On & Off's way. Yes, unfortunately, this stuff is just as nasty as

it is potent. Breathing its vapors is also dangerous, and if you inhale the smoke (which constantly wafts out of the bottle and off of your brush), you can literally feel it burn your lungs.

You have to be particularly careful about using it if your boat is on a trailer, because this stuff will even eat away metal. Drips that fall on the trailer will become holes in a single season. It's good, it's bad, and it's ugly—but used properly, it's one of the 10 best ever.

ORPINE WASH & WAX

We spend a lot of time cleaning our boats, and we want them to look good. There must be a hundred different boat washes on the market, and after using them time and time again you'll eventually discover that Orpine Wash & Wax has the best overall combination of cleaning power and

shine.

The pine-based gel is a concentrated, biodegradable soap that goes a long way (though the directions call for one ounce per

gallon of water, I've found it best to double this solution) when getting rid of dirt and grime. It also contains carnauba wax, which does little in the long term but leaves a wonderful shine behind for about a week after scrub-downs. Try it, try the others, and we'll bet you agree that Orpine Wash & Wax belongs in the top 10.

PLEXUS

For years, boaters had an ongoing discussion about how to best clean and treat their clear canvas curtains. Some people recommended Pledge, some advised a diluted mix of soapy water and some poor souls even used Windex (which turns that clear canvas yellow and brittle).

Plexus was developed for airplane windshields, then eventually made it into the marine marketplace. Today, it's the clear choice (ahem) for plastic curtains. Just spray it on, and wipe it off. No rubbing or buffing is necessary, it won't damage the plastic, and it replaces plasticizers that otherwise leach out of the curtains with exposure to sunlight.



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REJEX

Is it time to give your wax the ax? If you've tried RejeX, you probably think so. This stuff is a polymer coating that takes the place of a wax finish on gel coat. It's supposed to leave a slick coating that's less than a micron thick, which lasts for four to six months, has a great shine, protects the gel coat, and prevents stains and slime from sticking.

There have been other polymers on the market prior to RejeX, but it's the first one I've used that keeps all of its promises. Particularly impressive is its ability to "reject" surface contaminants; once it's cured, dirt that would normally require a scrub brush to get rid of often rinses away with a blast of the hose.

A word of warning: To get the desired results, this stuff has to be applied exactly ac-



ording to the instructions. It's as easy as wipe-on, wipe-off, but it can't be applied in direct sunlight or in temperatures over 85 degrees, and it must be protected from contaminants (which include dew or rain) for a full 12-hour cure time. To get the best results, you'll want to use this stuff in the early to mid-morning hours when the boat is dry and will stay that way.

STARBRITE STAR TRON

OK, so this product is directed toward motors, not the boats themselves. Still, it's become an incredibly important part of fueling up, for boaters across the nation.

When E-10 ethanol was introduced, countless problems arose with marine power plants. You've heard of them before: water attraction, sludge creation, gunked injectors, excess carbon buildup and more. Star Tron utilizes enzymes to attack these issues, by preventing water molecules from bonding with fuel molecules. They break it down into submicron-sized particles,



Reader Tested, Reader Approved

We asked readers to recommend their favorite products on the DIY-Boat.com website, and you definitely came through. We got recommendations that ranged from Atomic Tape to Dawn dish soap. Below are some of the highlights. We haven't tested them, but your fellow boaters have—and here's what they had to say:

PERMATEX FLOWABLE SILICONE

"It is invaluable for filling areas prone to leaks that cannot be plugged with regular silicone and sets up with a firm and tenacious hold. I also use it to make small gaskets for some electronics and as an adhesive. In more than 10 years, it has never failed in the applications where I have used it."

- Ed Cudworth

ISSO CANVAS CLEANER

"Will remove black mildew spots on white or colored vinyl or canvas without harming."

- Chuck Bianchi

ULTIMATE SOLE

"My BEST product favorite. I put it on out teak and holly sole five seasons ago and it is still glossy, but not slippery. Go to their website. It is everything they say it is."

- Bill Van Winkle

YACHT BRIGHT BUFF MAGIC

"Takes off heavy oxidation and is [a] great product. I've cleaned 4 heavy oxidized boats with this product and [it] does an amazing job."

- John Hupfer

BARKEEPER'S FRIEND

"This is without a doubt the best cleaner for inside and outside. It doesn't scratch and it cleans just about everything on the boat—stainless, wood, gelcoat, even cushions."

- Fred Lowe

WEST EPOXY

"Epoxy has probably seen more varied use on a boat than any other product in history: barrier coat, adhesive, filler, fairing compound, coating, rot repair, reinforcing, composite construction, and fiberglass resin. I never leave home without it!"

- Chip Lawson

SHEILA SHINE

"The best stainless steel polish I have used. Gets rid of all oxidation stains. Leaves it shiny and smells nice too!"

- Lupe Tucker

which can then be burned through the fuel system without creating any damage or loss of performance. They also break down sludge and deposits, stabilizing gasoline for up to one year and diesel fuel up to two years. Star Tron can even be added to old, oxidized fuel, and it will restore cetane and octane ratings.

It's the boater's ultimate answer to ethanol. It's also a bit pricey, at \$15 for an eight-ounce bottle. But eight ounces treats up to 128 gallons, so when considered as a percentage of the cost of tanking up, it doesn't seem too huge.

YACHT BRITE SERIOUS SHINE

This polish comes in a 14-ounce aerosol can, and is a spray-on, wipe-off polish. It's not intended for deep cleaning or long-term protection, so it doesn't really replace any of the other cleaners or protectants you'll be using on



your boat.

What it will do, however, is give everything from stem to stern—regardless of the material—an awesome shine. It works on waxed surfaces, metals, vinyls, paint, plastic and rubber. After you've given your boat the cleaning and finish you like, hit it with Serious Shine and everything will gleam a tiny bit more.

This stuff was designed by a yacht detailer who was tired of carrying around 10 different polishes for 10 different surfaces, so it's formulated to work wherever you spray it—and it does, boosting the shine factor for several days to a week. **DIY**

↗ Clean Anything

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Keep Your Cool

Misters Help You Beat the Heat,
Be It With a Spritz or a Blast

By Glen Justice

A few seasons back, my father and I were taking a leisurely ride across the Chesapeake Bay, ferrying our boat from Cambridge to Annapolis. Nice, except that it was hot—August hot. Dad was wilting, and I needed to revive him or face several hours alone at the wheel with no conversation.

When Mother Nature decides to roast her marine subjects, there's only so much you can do. You can swim, but in this case we were on a schedule. You can steer indoors from the pilothouse, if your boat allows, but the air conditioning in ours stood little chance of beating this heat. Thankfully, we had one more option: we could fire up the mister.

Misters can be a cool toy, and something worth considering as you ready the boat this season, especially if you live in a blazing climate. There are few things that cool you down like a blast of cold water in the face, and there is an entire industry built around delivering that blast.

In their simplest form, misters are simply glorified spray bottles—and any such bottle can get the job done, so long as you are not too particular about what you call “mist.” Just fill it, store the bottle in the ice chest



or fridge, and blast yourself as needed. But there are fancier models out there, ranging from hand-pressurized bottles to pump-driven systems with installed plumbing that provide mist—real mist—on demand all over the boat.

Depending on your needs—or perhaps your style—they, too, may be worth a look. Yes, it is one more thing to maintain and one more thing that can break. But they are a slick way to beat the heat—and they can be fun, too.

OLD SCHOOL

The mister I use is a portable industrial model called the Fogmaster Tri-Jet (www.fogmaster.com), which my father-in-law gave me a few years back. He had salvaged a few older models from the trash heap on a job site, where they were used to keep a construction crew from succumbing to the sun.

The mister is made of aluminum and has a two-part design. The lower half is a kettle-shaped water well, which stores about a gallon of fresh water. The upper half contains the motor, an adjustable nozzle and a carrying handle. They join together with a gasketed seal, secured by a pair of clasps.

The downside is that it runs on AC power, so I can use it only while the generator is running or at dockside. It is also bigger than I would like and pretty darned loud. The advantage is that it is portable, so I can move it around, and it is rugged. Though not marine gear, the Fogmaster is an industrial-grade outdoor machine, and I have yet to see it quit.

My general strategy is to set it up on the aft deck, where it won't pose any hazards. That means the electrical cord is run safely to an out-of-the-way outlet, and the mister isn't pointed so that it will create slippery decks. I then fill it with fresh water (nothing else), teach guests and crew how to use it and allow them to cool off whenever they like. It works well—and it revived my dad on that hot day on the bay.

If you want to go this route, you can find similar units on eBay, though the prices vary substantially. I have seen Fogmasters offered from \$100 to more than \$350. But there are also many similar products, and some cost far less. Just be sure that you fully evaluate what you are getting—and



photos by Glen Justice

Misters can range from the industrial grade, like this salvaged Fogmaster Tri-Jet, to the personal hand-pump models. All are worth considering as you ready the boat this season.

be sure it has not been used to dispense chemicals like pesticides. Whatever you buy, clean it thoroughly and run a few tanks of water through it before you use it on people.

NEW SCHOOL

Of course, there are many other options, some of which are far more refined.

Companies like Misty Mate (www.mistymate.com) sell what might be called “personal misters”: small units that pressurize with a hand pump and are available in different sizes and colors. One model holds 2.5 ounces and can fit in a pocket. Others look more like a thermos. Prices range from \$20 to \$50.

There are also more elaborate manual systems, such as those offered by Mistified (www.mist-ified.com). These systems are also portable and hand-pressurized, but they use larger bottles that hold several gallons and offer options like filtration, hose adaptors and tubing to deliver the mist where you like. Prices range from \$120 to more than \$200.

Then, there are the more complex solutions: customizable, installed systems that are designed for the marine market. These are sold by companies like Misters Unlim-

ited (www.mistersunlimited.com), which offers several systems, and Comfort Zone, by Taylor Made Products.

These are high-pressure systems that draw water from the boat's freshwater system (or overboard, in freshwater applications) and use a 12-volt pump to distribute it via small hose to jets that are located wherever you like on the boat.

While the basic Comfort Zone system can be found for about \$300, Misters Unlimited offers several complete, installed systems ranging from roughly \$1,400 to more than \$2,000. The company also offers accessories to customize these systems, such as swivel-mounted jets, flush-mounted jets, and light fixtures or fans with pre-plumbed lines. It's all very impressive—and potentially expensive.

With so many options—from the \$2 spray bottle to a system costing thousands of dollars—where you stand on the scale will largely be determined by your budget, your boat and your appetite for the slick and tricked. For my money, I'll stick with the industrial models I got for free. But I must admit that I have flirted with and fantasized over installed systems more than once—usually in August.

DIY

Learning the Hard Way

Everything Did Not Go Right on This Roller Furling Installation

By Frank Mummert

The roller furler on our Morgan 452 was a Hood Sea-furler, which had succumbed to cracks that had gone through the furler mechanism and the drum had fallen apart. It was time for a change.

Eager for new equipment, I purchased a Spin-Tec Triumph 2000 (www.spin-tec.com) at the Annapolis Sailboat Show. The Triumph unit consists of six 9-foot-long foils—aluminum tubes that go around the forestay and hold the jib in place. These would be trimmed to length to accommodate my boat's forestay, which is a little more than 50 feet.

I started by reading the instruction manual several times, identifying the parts and the pitfalls. I'll state upfront that things did not go according to plan, which is sadly the fate of many DIY projects. But one boater's cautionary tale, in this case mine, can be another's found wisdom. Let's just say that sometimes you have to look beyond the instructions.

OUT WITH THE OLD

The first step of this project was to take down the old roller furler and forestay. After removing the jib, I ran my spare halyard between the masthead and the bow to provide stability. Then I removed the broken assembly and lifted it high enough to expose the



forestay turnbuckle. I marked the threads of the turnbuckle rods and unscrewed the turnbuckle, releasing the tension.

Next, I removed the old furler foil. The foil connectors were held in place with large-headed pop rivets. I punched out the center of the rivet with a pin punch and hammer, and then used pliers to pull out the remains, releasing the old foil section.

My wife, Suzanne, went to the top of the mast in a bosun's chair and attached the jib halyard to the forestay. She used a drift punch and hammer to remove the rigging pin at the masthead. Using the jib halyard, we carefully lowered the forestay to the deck.

IN WITH THE NEW

Once the forestay was down, I laid it out straight on the dock. I took the Triumph's

top assembly and slid it onto the forestay from the bottom. Next, I put the bottom assembly in place at the foot of the forestay and pulled the forestay taut. I placed the foil sections alongside the wire, then measured and cut the top foil piece to fit.

Each foil section slid on to the forestay, starting with the shortest. Spin-Tech's method of allowing the foil to pivot freely on the forestay involves small, plastic doughnuts with a cut-through on one side, so they can be opened slightly and the forestay popped into the hole in the center. The inserts are rammed inside the foil, using an insertion tool, which is a 6-foot-long metal rod slightly narrower than a pencil. In the standard 9-foot-long foil, one insert is pushed to the center, about 5 feet from the bottom; the second and third inserts are pushed in to about 2½ feet from either end; and the fourth and fifth inserts go in about 6 inches from each



photos by Frank Mummert

Above: The drum of the furler is being held up by the vice grips, exposing the turnbuckle.

Left: The connector appears to be completely broken and the one below it stressed.

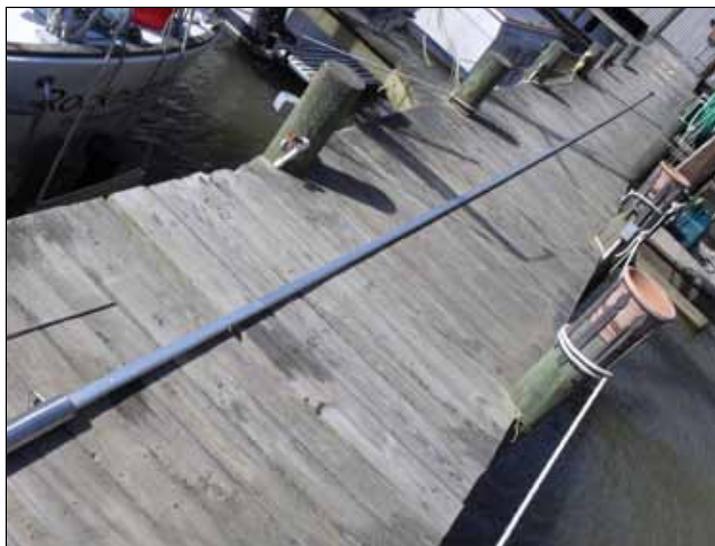
end. On the shorter foil section, only three inserts fit, one in the center and one 6 inches from each end.

After all the foil sections were in place, I installed the connectors. Each connector was a foot-long piece of aluminum stock, shaped like a square U. The forestay fit inside the connector and slid into the end of each section, joining them together. With the foils about 6 inches apart, I wiped the outside of the connector with water. I applied a liberal coating of Gorilla Glue, a polyurethane adhesive that swells to four times its original volume as it dries. Since it is also waterproof, it works to seal the foils together. Once the glue dried, I began to reinstall the forestay.

PROBLEMS AND LESSONS

I immediately realized I had a problem. My boat is in a slip at the end of the pier. It was bow-out, stern-in. In order

Frank Mummert spent 15 years in the Navy where he taught nuclear engineering. He is a licensed captain. He and his wife Suzanne live on a Morgan 452 ketch in Richmond, Va.



The assembled foil lies on the dock, ready to be moved into position aboard.

to get the forestay on the boat, I would have to pivot it out over the water, and then take it forward along my boat. With the help of Suzanne and a third person, Jeff Gallery from Sailor's Tavern Boat Works, we were able to get the forestay on board, with the head at the mast and the end hanging 10 feet off the stern. At this point, there was no way to turn the stay so that the end would be at the bow without moving it over the water on either side of us.

Thinking that getting the forestay vertical as rapidly as possible was key, I hooked the jib halyard to the fitting at the top of the furler and hauled. Suzanne tried to keep the foil as straight as possible, and Jeff tried to control the bottom end, maneuvering it into position. Unfortunately, I was unable to do this fast enough, and the resulting strain caused the foil to bend in two places, ultimately breaking one of the connectors. Since there was no way to return the forestay to the deck without causing more problems, we continued with the operation.

Jeff went to the masthead to reinstall the rigging pin. Once the pin was in, we retightened

the turnbuckle and reviewed the situation. The forestay was holding the mast up. However, we could not trust the furler in its present condition. Now what?

We made a plan. The boat is heading into the yard soon for engine work, and we'll have it positioned so that we have at least 50 feet available off the bow. We will drop the forestay again. Once it is down, we'll inspect for damage and get any replacement parts we need. We will reinstall the forestay in this more controlled environment, and, hopefully, have a better ending.

The Triumph 2000 cost \$2,370, including shipping. All of the supplies necessary came with the kit, and I had all of the tools I needed. The installation would have taken a weekend to accomplish, had it gone smoothly, which it did not.

But, as all DIY folks know, many projects—even those that are ultimately successful—experience problems along the way. It can be frustrating. But what matters most is how you react. We have a plan to fix our mistakes, and hopefully before too long we'll have a new roller furler. **DIY**

Tech Tips

OXALIC ACID BANISHES STAINS

As a teenager, I landed a job waxing a 47-foot yacht, and after washing it, there were still various stains that I couldn't wax over. The man who ran the marina told me to run over to the paint store and buy some oxalic acid. I came back with half a pound of this white crystalline substance and following his directions, mixed about half of it in water. Then I took a mop and wet down the topsides of the boat with the solution. No scrubbing; the stains went away! After rinsing the boat, I waxed it, and the yacht looked brand new.

Oxalic acid will get rid of many types of stains. Remember, though, you need to use common-sense precautions: Don't get it in your eyes, and make sure you rinse well.

- George Fogel

METAL HANGERS TO THE RESCUE

Don't envy the poor metal coat hanger: it rusts, it's cheap, and it's not very sturdy. That said, it makes a great tool for your boat tool bag.

Cut off the looped end (the part allowing it to hang on a clothing rack) with a wire cutter, and voila: a straight, thick piece of wire, which you can rebend to retrieve things that drop in the bilge or to pull hair from a clogged sink trap. Use it straight as a wire fish, to clean out the mussels from a water intake. There are a ton of handy applications. Sharpen the end, and you can poke holes in whatever you need.

It's a custom boating tool you can own for free. Even better, if you drop it overboard, you won't feel bad, except for the environment.

- Mel Kaluzny

SOAP AS MAINSAIL LUBE

I've tried different sprays and greases to lubricate my mainsail track, but always as the season wears on the effectiveness of those remedies fails. It makes a big difference at the beginning of the sailing season when dropping the main versus the end of the season when I have to tug on the sail to get it down.

Recently I tried a new remedy: using a piece of hard soap cut so that it fit tightly into the mainsail groove of the mast. I inserted this piece of soap when I installed the sail during spring launch between the top-most slug on the head board and the second slug below it. I made it a couple inches long so that it would last the season. As the sailing season was winding down, I still had about half of the soap in the groove, providing lubrication through November.

- Dee Osborne

Have a Tech Tip?

Share your expertise and experience. Send us an e-mail with your tip, name and contact info to the DIY managing editor at leefsmithbarnes@madmariner.com

Custom Cabinet, Handy Reminder

A Simple Storage Box That Strengthens Paper-Charting Skills

By David Aiken

Electronic chart plotters are standard equipment on all kinds of boats, but owners are still advised to practice traditional methods of piloting and navigation using paper charts. You never know when the electronics will fail, and a satellite glitch, though rare, is still a possibility. And there's just something satisfying about doing it the old-fashioned way.

To make chart work more convenient, I built a small storage cabinet in the cockpit of our 35-foot Chris-Craft to keep all the basic tools at hand. No more searching for the parallel rulers or dividers or pencils—and no more excuses. Surprisingly, the cabinet's contents often spark enough curiosity to prompt friends to try their hand.

The size and shape of the cabinet was dictated by our available space, a vacant spot on the forward cabin bulkhead, inside the wheelhouse of our center-cockpit sailboat. A simple rectangular shape wouldn't work. I wanted the cabinet to fit just above the end of the cockpit seat, but because the forward cabin top curved downward, there was not sufficient height to accommodate the parallel rulers, one of the essential items to be stored. I altered the rectangle, angling the top to make one side taller. The top angle followed the general line of the cabin top and the extra height allowed for storage of the parallel rulers.

Starting with a piece of ¼-inch white oak finished plywood, 2-by-4 feet, I cut panels for the front door and the back wall of the cabinet. The cabinet sides came from 1-by-3-inch finished lumber, also oak, and I used a piece of ½-inch oak for the single interior shelf. I assembled the sides

David Aiken has lived aboard a classic Chris-Craft sailboat for more than 25 years and is the author, with his wife, Zora, of Good Boatkeeping, 2nd Edition; Cruising, the Basics; and Fiberglass Repair: Polyester or Epoxy.



photos by Zora Aiken

Above: Mirror clips are used to hold the parallel rulers against the side of the cabinet. **Left:** The cabinet was designed for the basic paper chart navigation tools but has room for other small items.

to make a shallow box, using carpenter's glue and #6 flat head wood screws, two screws joining each corner. (If the cabinet were to be placed in an exposed location, I would have used epoxy for insurance.) I then countersunk the screws and covered them with ⅜-inch wood plugs.

Before installing the interior shelf (glue and two screws on each side), I drilled a few holes through it, so that pencils and dividers would stand upright and be less likely to fall out and get lost. Next, I turned the box face down, spread glue along the back edge of all four sides, and attached the back panel with finishing nails.

To finish the front door, I cut strips of 1-½ by ¼-inch oak trim, then glued and clamped the strips in place to frame the door. These trim pieces could have been mitered like a picture frame, though I used straight cuts on our cabinet. Inside, I added a few brackets to hold keys, a flashlight, a deck-plate key and a pocketknife. Erasers and Post-It Notes, always in demand and often misplaced, fit conveniently at the bottom of the box.

Adding the hardware finished the

job. I attached the hinges and the door-catch pieces. To hold the parallel rulers in place on the cabinet, I put four mirror clips onto the outer surface of the tall side panel, two clips at the top and two at the bottom. The rulers slide under the clips and are held snugly against the cabinet. The boat has a lot of wood in the wheelhouse, so I finished the cabinet with varnish, but paint may be a better choice on another boat.

To attach the cabinet to the bulkhead, I screwed through the back panel of the box from the inside, one screw near each corner, being careful to choose screws that would reach well into, but not break through, the bulkhead.

This project was both quick to complete and inexpensive to build. The wood and hardware cost about \$45, and the job took about six hours to complete, not counting the time for glue and varnish to dry. Moreover, the cabinet has proved even more useful than we anticipated. Things that belong in the cabinet can usually be found there—and that's a remarkable achievement in itself. **DIY**

Ask the Experts

Hull Blisters. Outdrive Position. Cooling System Temps. Our Experts Weigh In.

I am looking to purchase a 1985 CS 30. It has a band of cosmetic blisters along the waterline — hundreds of them. They are less than ¼ inch in diameter and appear to be dry inside. According to your 1998 fall issue, all those little blisters would have to be opened and patched. Would they all need to be drilled out and filled, or can they be just sanded down smooth and then add a barrier coating and gel coat—what would a job like this cost to repair? Or perhaps I should keep looking. Thanks.

— Raymond Vickers

It sounds to me like the blisters are above the protected part of the hull. If the hull has already been protected with a vinylester or epoxy gel coat, the boat may have gradually had extra gear added and the non-protected part of the hull sank into the water.

If this is the case, grinding out the blisters and filling the holes, then applying a protective coat such as Interlux's Interprotect, should solve your problem. If you find more blisters in the underwater part of the hull, you have a much larger problem and I would keep on looking.

As for repair costs if a boatyard were to do it (and I'm guessing at the extent of the repair), I'd figure six to eight hours to sand the boot top area around the boat and another six to 10 hours to repair the entire area and make it smooth. Again, this would depend on the amount of work to be done and may be much more or much less. Then the hull may need repainting to cover over the repair.

Figuring at \$75 an hour, you'd be into \$750 to \$1,500 minimum for the repair and possibly up to \$5,000 for the repaint job.

If the boat is painted, the paint sometimes bubbles along the waterline. In this case, sanding off the paint layer will usually fix the problem. However, you will need to respray the paint layer, which could mean spraying the entire topsides — or making the boot top extremely wide!

— Roger Marshall is a contributor to *DIY Boat Owner* and the author of 14 nautical books. His latest is *Fiberglass Boat Repairs Illustrated*.

I just bought a new boat with an outdrive. I have a mooring that at low tide, with the outdrive down, might allow the outdrive to hit ground. With the outdrive up, it will not. I have read that you should keep the outdrive down when the boat is out of the water because of the boot. Is it okay to keep the outdrive up when the boat is in the water?

— Rick Malm

Since you're only going to be high and dry during low tide, don't worry about it one bit. Issues that arise from leaving the drive up are related to long-term storage, not temporary dryness. Go ahead and leave it up!

— Lenny Rudow, is former senior technical editor for *Boating magazine* and current electronics editor for *Marlin* and *GoBoating magazines*.

I own a 1992 Searay 300 Sundancer with twin I/O's and 5.0L Alpha Thunderbolt engines. Upon arriving at a fuel dock after a good amount of traveling, say an hour's run, the engines are shut down and I fuel up. When the engines are started up again, my starboard engine raw water cooling system temperature begins to rise above the normal operating temperature (165°F to 180°F) while I'm slowly cruising to my slip. I have found when I put it in neutral and increase the RPMs, the temperature drops to normal. I have changed my thermostat on the engine and the impeller replaced to no avail. What else could be causing this problem?

— Victor Rivera

Your water flow is certainly getting cut somewhere along the line. I'd suspect the impeller, but you said you have already replaced it, so my guess is a bad set of risers or exhaust elbows.

These get scale build-up pretty often and have a limited life span. Replacing these parts is pretty simple, but because they are major items and improper installation can have catastrophic results, I recommend leaving this job to a certified marine mechanic.

— Lenny Rudow

The information in Ask the Experts is advice only and should not be used as a substitute for the services or opinions of a marine professional who can directly assess your boat and equipment.

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The Essential Tool Kit

Bringing Just the Right Tools on Board Is a Studied Art

By Nigel Calder

In 1985 my wife, Terrie, and I set sail from Lake Ponchartrain, La., across the Gulf of Mexico to Key West. We were headed for the West Indies, the Panama Canal, and what we hoped would be a round-the-world cruise. We never made it.

We were novices to cruising. I was somewhat paranoid about breakdowns in far-off places, so the boat was loaded with tools and spares. It had taken an extended period dockside, packing and repacking lockers, to get everything stowed.

During the 600-mile passage to Key West, we had teething problems that required unpacking several lockers to get at tools and parts. It was rough. Both Terrie and I got seasick. Under the circumstances, we found ourselves unable to get everything back into its allotted place. By the time we reached the other side of the Gulf, our boat was an unseamanlike mess.

This sparked a process of auditing and re-auditing our supplies, which has continued over 25 years and four different boats right up to the present day. At each audit, I have thinned the tools and parts.

At the first audit, I removed some large items such as a 600-foot roll of 3/4-inch braided line and a small oxy-acetylene welding rig. Lately we have been down to quite small items. I carry less and less in the knowledge that the ability to rapidly secure replacement parts

through FedEx, UPS and DHL has dramatically changed the supply side of cruising.

There are also a number of things I no longer carry because of changing technology. These include a grease gun and grease, because there are no grease nipples on my new engine; packing for a stuffing box, and the cork-screw-style packing removal tool I used to have, because I now have a PSS dripless shaft seal; nozzle cleaners and spare burners for diesel or kerosene stoves, thanks to the propane stove; and spare cable and fittings for the steering system, which is now rod-driven.

What I do still carry could be called a moderately extensive tool kit.

ELECTRICAL ITEMS

Electrical problems are now among the most common problems on boats, and many boats can't function without electricity.

As a result, my single most important and useful tool is a high-quality digital multimeter, together with the knowledge of how to use it. In fact, I carry several, including a clamp-on model that will measure up to 400 amps, both AC and DC, which I find to be invaluable (I recently sourced similar meters in the Sears catalog for \$69, which is a tremendous value).

I carry small rolls of several sizes of tinned cable and some lengths of larger sizes up to the largest on the boat (2/0). I have a wide selection of end fittings to fit all cable sizes; wire cutting, stripping and crimping tools; and a variety of sizes of heat shrink tubing together with electrical tape. I have lots of different size cable ties. I have a soldering iron and rosin core solder. It seems like

Nigel Calder is the author of the best-selling Boatowner's Mechanical and Electrical Manual and Marine Diesel Engines.



I use my electrical tool kit all the time.

This tool kit is augmented with spare fuses to fit every size and amperage on the boat; a selection of light bulbs, especially for the navigation lights; and, if I am headed offshore, a spare alternator and voltage regulator. If the boat had wet cell batteries (the type that need topping off), I'd carry distilled water and a hydrometer.

ENGINE MAINTENANCE

The most common maintenance chore is changing oil. The ideal situation is a permanently plumbed-in oil change pump, but failing that I like the hand-operated vacuum pumps mounted on a 5-gallon container (so far as I am concerned, the cheap electrical ones are a waste of time).

You need a filter wrench to fit the various oil and fuel filters on the boat. There are "one-size-fits-all" wrenches on the market, with a rubber band that you wrap around the filter, but these can be hard to use in tight spaces. It's much better to get individual properly sized wrenches for each filter size.

Invariably, when you change an oil filter it makes a mess. I carry a pack of disposable diapers to lay in the bilge and catch the oil—they hold a remarkable amount—and Ziploc bags large enough to take the filter and contain its mess.

The only spares I carry for the engine these days are the oil and filters (enough for at least two changes); fuel filters (three changes, in case we take on dirty fuel); all belts and a raw-water pump impeller. On any boat, you need to make sure you have whatever tools are necessary to change the impeller, as some can be particularly

hard to get out. If that is the case on your boat, invest in a Speedseal cover (www.speedseal.com). If the heat exchanger has zinc anodes (modern engines don't), you should have several of these on hand.

I've long since given up on injectors and other such exotic stuff.

My Essentials: Nigel Calder

The key to minimizing problems and maintenance on board is to buy quality equipment and install it properly in the first place.

We have always spent a lot of money upfront on ensuring that our systems are adequate to the kind of long-term cruising to which we aspire. I am then pretty good about keeping up with routine maintenance. As a result, we suffer from far fewer problems than most cruisers.

Most of the time, when the tools come out it is because I am tinkering with the systems or experimenting with new products, rather than troubleshooting or fixing problems.

My essential tool kit:

- » A good quality digital multimeter with a clamp-on ammeter that reads to 400 amps. This is the one tool I take with me when visiting other people's boats.
- » The rest of the electrical tool kit, including quality side-cutting pliers, wire strippers and especially a ratcheting crimper. I have a cheap crimping tool for wire sizes up to 2/0, which gets a surprising amount of use.
- » A decent oil change pump and appropriate filter wrench.
- » A quality socket set and hand wrenches in both American and metric sizes.
- » A heavy ball-peen hammer for those times when there is no substitute for brute force.
- » A range of quality screwdrivers, including a couple of large ones useful for levering things, and short ones for tight spaces.
- » A comfortable, secure, bosun's chair with decent pockets for the tools (and from which the tools will not fall out).
- » A couple of snatch blocks that also have a surprising amount of use, especially for providing a fair lead to drag the bow of the boat around after running aground (we like to explore the spots other sailors usually avoid).
- » A universal deck fill key (fits both slotted deck fills and those with two small holes): We have one that sits in the top drawer of the chart table next to the companionway and gets a great deal of use.
- » Different sizes of vice grips, which are especially useful for gripping fasteners with corroded heads.

- Nigel Calder

MECHANICAL TOOLS

At the core of any mechanic's tool kit is a quality socket set. I prefer a 3/8-inch set to a 1/2-inch set because the 3/8 inches is smaller and easier to handle in tight spaces. Currently, I have a set that is designed to work with both American and metric nuts and bolts, but its universality makes it a bit of a sloppy fit in any given situation. It's better to have sets individually matched to metric and American fittings.

A socket set needs to be supplemented with a wrench set, preferably the type that has both open ends and box ends. And then I have a couple of crescent wrenches, two sizes of vice grips and a couple of pipe wrenches, but these could be supplanted in most circumstances by one of the clever multipurpose wrenches that have come on the market in recent years. Side cutting pliers and needle nose pliers are sometimes invaluable.

I have a variety of flat-bladed and Phillips screwdrivers. There are times when you need one of each type with a short handle for awkward spaces. You need quality screwdrivers. Cheap ones have poorly designed hand holds and tips that break off or wear away in the case of Phillips screwdrivers.

I have a ball-peen hammer. The ball end is particularly useful on those rare occasions when it is necessary to make a gasket (for which I carry a couple of sheets of different thickness gasket paper). You lay the paper over the casting that needs a new gasket and gently tap around the edges with the hammer. The casting will cut through the paper to achieve a perfect fit.

Then there's a set of Allen wrenches, a tapered punch (useful for aligning bolt holes), a straight punch (excellent for knocking out clevis pins), and a hacksaw and blades. I have several grades of wet and dry sandpaper, which has multiple uses.

I also always carry penetrating fluid and a propane torch, because extreme heat is sometimes the only way to loosen frozen fasteners.

PLUMBING AND RIGGING

On the plumbing side, I carry a collection of hose lengths of different diameters, with hose barbs and a variety of all 316 stainless steel hose clamps to fit them (the "all 316" designation means they will not corrode). I have a small assortment of plumbing fittings and a soft wood plug of a suitable size to hammer into any failed through-hull on the boat.

A particularly useful item is a length of rubber cut from an old tire inner tube. This will seal a variety of leaks in hoses and pipes if wrapped around tightly and either clamped or taped in place. Lately I acquired some Rescue Tape at a boat show that looks like it would work even better. I always carry Teflon tape and some form of caulking.

Every sailboat should have a quality bosun's chair on board with decent side pockets to hold tools. It makes all the difference between a stressful trip up the mast and something far more relaxing.

For offshore work, I used to recommend carrying a length of wire long enough to replace the longest stay or shroud on the boat, but I no longer do this because modern synthetic running rigging is strong enough, and stretch-resistant enough, to serve this purpose. (I do not carry a synthetic backup because my spare Genoa sheets are long enough.) You do, however, need to think about how you would attach it to the boat and

My Essentials: Chuck Husick

Every boat should have on it a kit of good quality tools. Using low-quality tools can damage the parts they are used on. The best tools will allow repairs to be done in the least possible time. As a boat owner, I am prepared to adjust or repair virtually any device on my vessel.

Manuals for engines, transmission and gensets are always onboard for just that reason. I keep the standard replacement parts kit for the engine and genset on the boat, with two spare seawater pump impellers, filters and a set of drive belts.

My essential tool kit:

- » Screwdrivers: assorted flat, Phillips, torx (if torx screws are used on boat).
- » Small screwdriver set (17-piece precision screwdriver set from Radio Shack) needed when working on electrical connections and when trying to repair eyeglasses.
- » Wrenches, combination open end/box end, 4mm to 24mm and 1/8-inch to 1-1/2-inch sets.
- » Socket wrench sets, 1/4-inch and 3/8-inch, with ratchet handle and extension bars. Sizes are 4mm to 24mm and

1/4 inch to 1 inch.

- » Tapered reamer.
- » Vise Grip pliers, small, medium and large.
- » Channel lock pliers, medium and large.
- » Slip joint pliers.
- » Diagonal wire cutters.
- » Needle nose pliers.
- » Wire stripper.
- » Ratcheting wire fitting crimp tool and crimp fittings.
- » Water pump impeller puller tool, sized to match the pump on engine/genset.
- » Digital multimeter (volts, ohms, current).
- » Utility knife.
- » Battery-powered drill, set of drill bits.
- » Flashlights, both standard and headlamp style.

Chuck Husick, a former chairman of ChrisCraft, is a marine consultant and technical editor for BoatUS Magazine.

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mast if necessary, and make sure the necessary fittings are on board. I have a variety of end fittings and clevis pins. Another way to go would be the replacement shroud kits now available from Colligo Marine (www.colligo.com).

I carry a couple of heavy-duty snatch blocks. These come in handy in all kinds of different ways, such as adjusting the lead of sheets, moving heavy loads, tensioning rigging and especially for providing a fair lead to a kedger anchor rode after running aground!

My sail repair kit includes pieces of self-adhesive Dacron, a sailor's palm, thread, a device for unpicking threads, a variety of needles and various bits of sail hardware. Luckily, I've never needed it.

A MODEST KIT

I no longer carry woodworking tools, although I do have a collection of scrap pieces of teak and plywood for odd repairs. A cordless drill, and set of drill bits, is a fairly recent addition, by no means essential but very handy. Even more useful over

the years has been a set of hole saws—it amazes me how often I have used them.

This adds up to a relatively modest tool and spares kit for what I consider to be an offshore cruising boat. I would not downsize it much for coastal cruising, but that's because I like to be fairly self-sufficient. The other extreme is to have a subscription to a towboat company, stay within cell phone range of the shore, and carry almost nothing. It depends on your cruising philosophy.

There is a balance here between trying to carry everything, and carrying almost nothing. Where you fall on the spectrum will depend on the age and condition of your boat, how far off the beaten track you intend to sail, and your personal level of paranoia.

Our kit takes up three moderate-sized lockers, with the electric cables, particularly the large gauge cables, taking up the most space. Despite 25 years of downsizing, it has served us well and never left us dead in the water or unable to fix a critical problem. **DIY**

My Essentials: Roger Marshall

Because I spend most of my sailing time in offshore waters, I like to be prepared for emergencies.

I've found that if I don't carry the right gear or replacement part, that part will break, so my tool kit is aimed at being able to make repairs without a lot of effort.

I favor small, versatile tools and, if possible, I like my tools to be nickel alloy or stainless steel so they don't rust. Most are fairly standard, but I have found a few gems.

My essential tool kit:

- » A Ryobi portable drill with two extra batteries and drill bits. I'm amazed at how many uses I find for this drill.
- » Tank keys for fresh water and fuel tanks.
- » A multimeter (preferably water-resistant) to diagnose electrical problems.
- » A Marine 125-piece tool kit from Great Neck. The kit has a good selection of wrenches and comes in its own box that floats. It isn't really 125 tools—more like 70 to 75—with wire terminals, cable ties and a circuit tester. The box is pretty rugged and withstood my tossing it off the dock, both open and closed, to see if it would really float. It did. I wouldn't say the tools are high quality, but for use onboard, where they are just as likely to end up on the seabed, this is a useful kit.
- » Bolt cutters.
- » A hacksaw with many blades, both coarse and fine.
- » A ClampTite Tool (www.clamptitertools.com) with several coils of wire. This tool can make a hose clamp should you lose one on your trip. It's great for emergencies and for wiring anything to almost anything. You can also use this tool to wire together a split tiller or a busted stanchion or even to clamp together two lines.

- » Atomic Tape (www.atomictape.com). It stretches to twice its length and can be used to repair broken hoses.
- » Duct tape. For anything Atomic tape doesn't fix, including sailing shoes.
- » A very sharp knife, non-stainless steel. This is an exception to my preference for corrosion-proof tools. A high-carbon steel knife holds a sharper edge but needs to be coated to prevent rust. I coat it regularly with Corrosion Block, grease or any other corrosion preventative I can find, but they wear off fairly quickly. It still rusts.
- » I'm old-fashioned and carry a bunch of sailmaking palms, a couple of fids, whipping twine, pressure sensitive tape (Stickyback) and other sail and rope repair gear.
- » A large bucket. Many uses here, including washdown, totting gear to the masthead, as a head in an emergency, and as an all-round container for anything to do with the bilge.
- » A dozen or more throw-away chip brushes of various sizes, which are handy for touching up varnish or paint.
- » Various grades of wet and dry sandpaper for sanding paint, varnish, the hull bottom and the outboard spark plugs.
- » Two Syntho-Glass (www.synthoglass.no) pipe repair kits. Syntho-Glass is a quick-acting, water-activated fiberglass repair kit that can be used for almost anything, such as repairing a broken instrument housing, patching a small hole in the hull or even making a cast for a broken arm. Just cover that arm with plastic wrap first.

Roger Marshall is the author of 14 books including his newest, Fiberglass Repair Illustrated. Marshall has written extensively on boats of all sizes for magazines in most parts of the world.

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Fix It Now!

Learn 11 Truly Useful Skills to Fix Problems All Over Your Boat

Troubleshooting a VHF

Your VHF is one of the most important items aboard, so when problems arise, you need to take care of them quickly.

The most common issue? You turn the power on, and nothing happens. As is always the case with electronics or electrical gear, the first thing to do is check the fuse. If it's good, move on to the power leads and battery connections.

If the unit powers up but won't receive, the antenna, or a bad connection between the antenna wire and the radio, is almost always the culprit. Suspect the connection first. If that is fine, you'll have to trace the antenna wire and look for breaks. Look for potential problems where the wire makes a 90-degree turn. Sharp edges in hard angles, often found where wires run through aluminum T-tops or superstructure pipework, have the potential to chaff through the wire's insulation.

Transmission issues are trickier to troubleshoot. If you can hear but you're not being heard, first make sure your radio is

set to 25 watts, not one watt—a simple but common problem. Next, check that antenna wire/radio connection. Sometimes a weak connection (or just the metal connector and a bit of bare wire) is good enough to receive strong signals (you can almost always hear marine weather, for example) but doesn't cut it for transmitting.

If neither of these issues applies, consider the power supply. It may be good enough to power up, but transmitting requires a solid supply of juice. As you transmit, watch the LCD display on the radio; if it fades, you're not getting enough electricity and you need to check your power leads and fuse connections. Still no luck? Sometimes microphones, which are exposed to the weather, get rainwater or moisture in them, which garbles your voice. You're transmitting, but because no one can understand you, your calls go unanswered.

To diagnose the problem, have someone stand a few yards away with a hand-held VHF, listening as you try to transmit. If that person hears an unintelligible voice, you'll need to dry the mic—and find a better place to stow it in the future.

- Lenny Rudow



Multimeter Diagnosis

The ice chest is packed, the fishing gear is ready, the kids are antsy to get going and the sun shines on your day. Load up the boat, and you're set. Battery switch on? Check. DC panel breaker on? Individual equipment circuits on? Check. Give the bilge the sniff test and flip the switch for the blower motor. Nothing. Check the cabin light. Nothing. VHF? Nothing.

When the power available dims your plans, you can perform a few fundamentals to isolate the cause, even if you're not an electrician and the fix is beyond your skill set. The magic is in the multimeter.

"Digital" is the operative word in meters, although even the most basic "cheapie," the analog meter, will give decent clues to help locate a problem. Here is a basic and limited but quick course for tracking a DC (12-volt, direct current) problem with the user-friendly multimeter, alias the voltmeter, VOM for analog, DMM for a digital one.

Our preference is for an auto-ranging DMM, which self-adjusts the decimal point based on the value being measured. They are not cheap, but they take the potential for math error out the process. The other accessory that's valuable is a set of long leads. Two sets are even better: one with probe ends and the other with alligator clips. For specific test directions, use the meter maker's instructions and keep them with the meter itself for ready reference. Multimeter reading is a "use it or lose it" skill.

Meter in hand? Where do you start? First, check the circuit breakers or fuses and switches and then isolate the circuit from the battery or batteries to the panel and then from the panel to the component that, in our case, is the blower motor and the engine ignition switch. With each step, the process of elimination will bring you closer to your trouble point.

Start your troubleshooting at the connections to the equipment and, as you progress back toward the power source, check wiring connections for tightness and corrosion. Loose or corroded connections are the most common sources of power loss to electrical and electronic equipment. Battery cable connections made with wing nuts often loosen from vibration, and corrosion is a wall of resistance that blocks current flow.

Have a wire brush (nylon bristle type) and a corrosion inhibitor for use in cleaning connections. Loose connections should be redone. It's only a beginning, but you could get lucky and be up and running in time to save the day.

- Patricia Kearns

Tune Your Rigging

Tuning the mast rigging is not difficult, but it does require methodical steps and patience to keep from chasing your tail. Different types of rigs require different adjustments, but most recreational sailboats have a single-spreader masthead rig with dual lower shrouds.

The first step is to center the masthead athwartships on deck while at the dock. (Remove the wedges if the mast is through-stepped). Start by hand-tightening the turnbuckles of the upper shrouds and stays as much as possible, then loosen the lower shrouds until they are slack.

Cleat the main halyard so it is long enough to just touch the shackle to one of the chainplates, and then walk the halyard over to the opposite chainplate and measure the length with the same tension. If the two sides are not equal, move the masthead to port or starboard by tightening one turnbuckle and loosening the other until the halyard length to the chainplates is equal on both sides. Once centered, alternately tighten one upper shroud turnbuckle a full turn, and then the other a full turn, until they are tight. The mast should still be centered, but a final halyard check can confirm this.

Now adjust the mast rake, which is the distance the masthead is moved aft of the mast base. Mast rake affects the balance of the helm. To increase weather helm, increase the mast rake. A little weather helm is desirable when the boat is heeled over 15 degrees to 20 degrees, but different boat designs have different positions for optimal rake. Contact your boat manufacturer for the correct specification. Otherwise, some trial and error will be necessary while underway; start with about a 6-inch rake at the dock.

To determine the rake, hang a heavy object from the main halyard (for a plumb bob) just above gooseneck level and measure the distance between the halyard and the mast. That is your rake. Alternately tighten and loosen the forestay and backstay to adjust the rake distance. Once you have the desired rake, tighten both stays alternately (one or two turns at a time) until they are tight, and check the rake again.

Now, set the bend of the mast by uniformly tightening the forward lower shrouds, which will pull the center of the mast forward. You can measure the bend by tightening the main halyard against the sail track, or simply sight up the sail track. A 1-inch distance between the halyard and the mast at spreader height is a good start. Then tighten the backstay to increase that distance a few more inches, but typically no more than the fore and aft width of the mast. Then tighten the aft lower shrouds until they are a little looser than the forward shrouds. (Install mast wedges again if through-stepped.)

Now it's time to go sailing and fine tune the rig, preferably in a steady breeze that will heel the boat 15 to 20 degrees on an upwind course. Sight up the mast track and check the alignment and bend, which should be the same as dockside. If the masthead falls off to leeward above the spreaders, luff up and tighten the upper shroud, then continue sailing and recheck the alignment. If the mast falls off to leeward at the spreaders, luff up and tighten the lower shrouds.

When you are happy with the shape of the mast, tack over to the other side and repeat the process. Note that the leeward shrouds should loosen, but not go completely floppy slack. If



they go slack, they were not tightened enough at the dock, so luff up and tighten uniformly where necessary.

Finally, check the helm balance and the forestay sag. The forestay will always sag, but tightening the stays will eliminate excessive sagging. If there is an acceptable amount of weather helm, just tighten the forestay and backstay uniformly to eliminate excessive sag. If there is too much weather helm, tighten the forestay and loosen the backstay to reduce the rake.

Just remember, whenever you make one adjustment, think of how it affects other parts of the rig. For example, you should check the mast bend if you tighten only the backstay. Make sure all the terminals have cotter pins. Allow the rigging a week or so to settle into shape—and then check it again.

- Doug Cowie

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Patch Your Dinghy

If you own an inflatable, sooner or later you are going to be confronted with patching a hole, tear or puncture.

Inflatable dinghies are generally made of either PVC or Hypalon. PVC is cheaper and easier to manufacture, but Hypalon lasts much longer and does not tend to break down during use. The repair kits for each cost about the same, but the glue needed for each is different.

After you determine which patch kit you need, you need to find the leak itself. If it's large, the job is easy. Small leaks, and leaks in out-of-the-way places, can be

found by inflating the dinghy and using a paintbrush to apply a soapy water solution to the areas you suspect are leaking. If air is indeed leaking, the soapy water will bubble and you've got your location.

The repair kit will come with patches and a tube of contact cement. Clean the area with an alcohol-soaked cloth to remove any residual soap and dirt. Cut the patch to cover the hole and the surrounding area, which is generally about 3 inches in diameter for a small leak.

Apply a thin coat of cement to the patch and the dinghy fabric. Let the glue dry, then repeat. After the third applica-

tion, the patch should be ready to apply. Very gently, put the patch in place. If you need to move it, lift the corners with a dull knife or spatula. Once the patch is in the right place, use a smooth curved object, such as the back of a spoon, to press the patch in place. Work from the center out toward the sides.

Let the patch dry in place for 24 hours before reinflating the dinghy. Once there is sufficient air in the dinghy to hold its shape, perform another soap bubble test to ensure there are no additional leaks. If the patch is secure, inflate fully and check again for leaks. **- Frank Mummert**

Anchor Chain Splice

Anchor lines get punished over time, and there's only so much maintenance you can do. Sooner or later, it's necessary to make up a new anchor rode.

That's simple enough—just get some rope and some chain and hook it all together. You can put an eye splice (with a thimble) in the rope and shackle it to the chain—or you can splice the rope directly to the chain, which is a lot more friendly if you use a windlass.

The simplest way to splice rope to chain is to make a back splice in the end of the line and capture the chain in the splice.

A back splice is begun with a crown knot. First, take some twine and put a clove hitch around the new anchor line about 8 inches from the end. This gives you a firm stopping point for unlaying the line. Cutting off the fused end of the line, wrap some tape around the end of each strand. Old-line boatswains would scoff, but most nylon rope these days is fairly soft laid and the strands are prone to untwist. A bit of tape keeps things in check.

Make a crown knot with the strands, that is, lay the strands back along the standing part, each strand catching its neighbor. Make sure that all three of the strands passed through the last link of the chain. Draw up the crown and splice the strands back into the standing part—over one and under the next.

When making a splice we like to give the strands a clockwise twist to tighten them for the first tuck, then give a counterclockwise turn on the succeeding tucks to partly unlay them and flatten the splice.

Make the required five tucks for nylon. If there isn't enough left to do a taper (which doesn't add any strength anyway), trim the shortest strand and make another tuck with the other two.

Leaving about ¼ inch of each strand protruding, roll the splice under your foot and the splice is done.

- Gene Bjerke

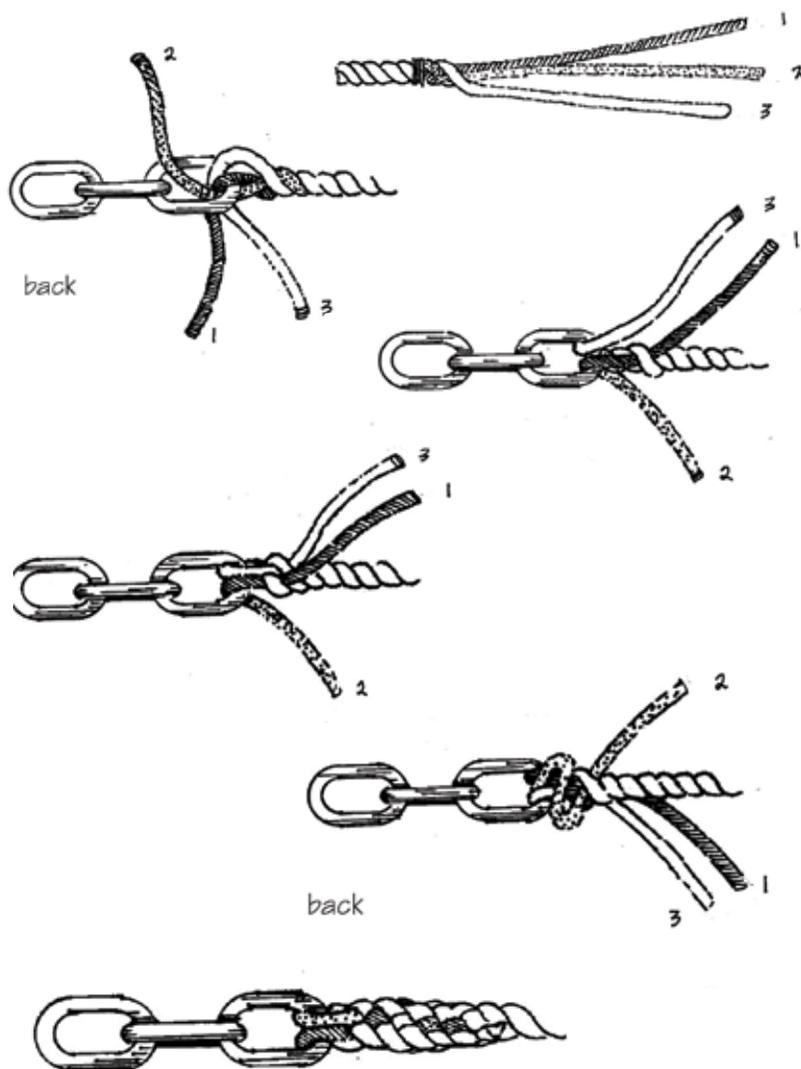
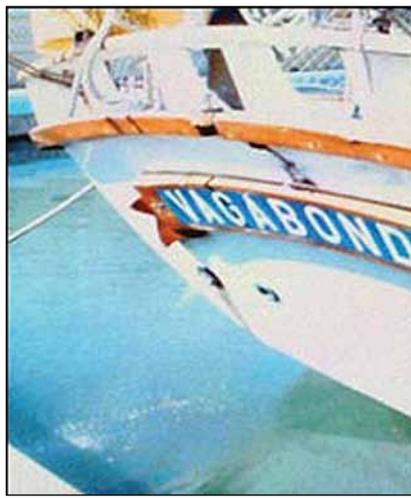
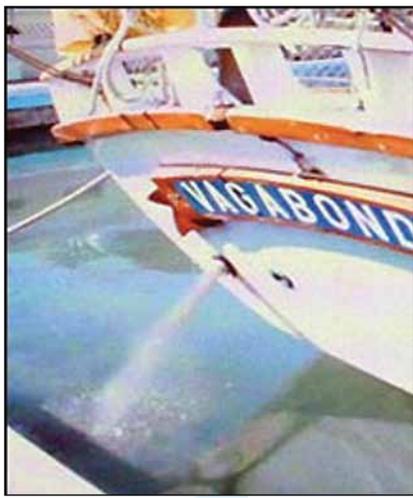


illustration by David Aiken



Sweet Water

Sanitizing a drinking water system on a boat is a simple process for killing bacteria, but it doesn't always ensure that the water you draw at the tap will taste good.

How clean is clean water? If it tastes bad and smells bad, even after sanitizing the system, what's wrong? The "yuk" factor is not always related to the water quality or the sanitary condition of the system. It can originate in the route along which water travels from the tank to the faucet.

On boats, potable water flows from the tank to the distribution points, via a pump, through flexible hose and therein often lives the perpetrator of "yuk." The minerals and other elements in our clean, potable water supply come into the boat via a hose, and topping-off the water tank after a cruise is a common protocol.

In the journey from the city water hookup to the tank, the water picks up residue from the hose, maybe a little harmless bacteria, and it doesn't take long for algae to form in the system. Flushing the system during use moves the trace contaminants through the system but, over time, even the best hose, fabricated of FDA-approved compounds for drinking water, will eventually be affected by water that stagnates in the system during periods of non-use.

When you know the water source was pure and the tank and system have been routinely sanitized but the water still "tastes funny," consider replacing the distribution hoses. The visible, telltale signs that clear (sometimes reinforced with fiber) plastic hose is the offender include the appearance of yellowing or darkening inside the hose and/or the plasticization of the hose, which has a sticky feel on the outside.

Both conditions are caused by exposures to light or high temperatures that can develop in an engine space during normal operations. Replace all the old hose with marine grade potable water hose, or use one of the semi-rigid polyvinyl piping systems that assemble with various quick connect fittings and piping sections. Voila! Refreshing sweetwater.

- Patricia Kearns

Read the Smoke Signals

The beautiful thing about diesel power plants is their reliability. It's rare for a diesel to quit on you. But when one does have a problem, it's often something serious.

The best way to prevent big trouble is to constantly monitor your engine's performance and catch little problems before they develop—and one great way to do that is to watch your exhaust. You can spot a lot of issues early in their development, merely by looking at the color of the exhaust cloud.

Other than a puff at start-up, you shouldn't be seeing smoke on a regular basis. Black smoke—the result of unburned carbon particles—commonly indicates an overload. A fouled prop, bottom growth or added auxiliary equipment should all be checked. If there doesn't seem to be an obvious overload, next on the list is air flow.

Check your air filter, turbo or supercharger, intake vents, and exhaust ports. If anything is restricted, that smoke will be black. But restriction isn't the only possibility. If the air that's getting to the motor is too hot, the same symptom will be present. Additional machinery, insulation or other temperature-raising culprits could be the problem.

Blue smoke, created by burning oil, usually appears as an engine ages. If you're seeing blue, suspect worn piston rings, valve guides and/or worn seals on the turbo or supercharger. Another potential reason for blue smoke is an oil overload in the crankcase. Make sure the level isn't too high. If your engine has an oil bath air filter, overfilling this can cause blue smoke, too.

White smoke indicates either water vapor in the exhaust, or air in your fuel supply. If it's a water issue, the problem can be caused by water in the fuel. If the fuel is good, however, you need to check for a much bigger problem—you may have a leaky head gasket or worse, a cracked cylinder head. If you check them out and all's well, look at your injectors and fuel lines and see if you can identify where air is working itself into the system.

- Lenny Rudow

➤ Launching Lessons

Have questions as you launch this season?

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Chasing Down Leaks

Chasing down leaks is never fun—but it is worthwhile. After all, the first rule of boating is to keep the water on the outside. That holds true for fuel and sewage, too. You want that stuff to stay in the system designed to hold it.

Leaks generally come in three varieties. Overhead leaks come from badly sealed fittings or poorly fitted hatches or ports, which allow rain or spray into the cabin. Hull leaks are from cracks in through-hulls or hoses, weeping seals or, rarely, actual cracks in the hull. System leaks are usually bad connections or split hoses.

Water can travel remarkably long distances and can even flow uphill, especially in fabric and unsealed wood. The best investigative tools in this search are a magnifying glass, inspection mirror and bright flashlight, preferably with a flexible gooseneck. Getting behind and under bulkheads is key.

To find water in wood-cored structures, rap the object with a soft mallet or a screwdriver handle. A dry structure will sound sharp; a saturated area will sound dull. If possible, try this first on an area where you know there's damage, to hear the difference.

To find a large area leak, pressurize one side of the area with a shop vacuum or leaf blower and use a soap-water solution on the other side to look for active bubbles. Seal the area with plastic bags and tape. This works best on horizontal surfaces, but with a thick, soapy solution and sharp eyes, it can work on vertical surfaces, too.

With system leaks, the leak is generally between the pump and where the drops appear. Many boat manufacturers will run several hoses together in the same bundle. A bundle might contain fresh water, sewage transfer and raw-water deck-fitting lines. Use your senses; the rule is “sniff, then taste.” If the fluid smells bad, it is probably sewage. A quick taste may tell you if it is fresh or salty/brackish water. If you can't tell, unbundling the lines may be your only recourse.

The only permanent solution for a leak is “remove and replace.” While it is never a good idea to rely on a temporary repair for fuel lines or engine exhaust hoses or piping—leaks in these systems can result in potentially deadly problems, from toxic carbon monoxide vapors to volatile fuel leaks—you can use two-part epoxy putty for emergency repairs on most leaks. Work the putty until it is a uniform color, and then apply it over the leaking area. You may need to hold it until it sets, but the putty can work its way into the leak to seal it completely.

- Frank Mummert

Servicing Bilge Pumps

Bilge pumps are rated in “gallons per hour,” or GPH. This is the volume that the pump can move in perfect conditions. The best way to test how efficiently your onboard system is working is to measure how much water comes out of the discharge port over a one-minute period.

The first step is to clean the bilge. You can be fined for pumping oil or grease over the side, and debris in the water can jam the pump, causing a “locked rotor” and risking a fire. Once the bilge is clean and dry, fill it with enough water to fully submerge the base of the pump, turn the pump on, and have someone outside capture the discharged water for one minute. You can use any convenient container and measure the volume more accurately in another. Then multiply the volume by 60 to get the GPH.

If the pump is not running near its rated capacity, don't be too surprised. The factory GPH rating does not take into account all the variables that can reduce the pump's output, such as the height the pump must push the water to exit the boat and less-than-optimal battery output. However, there may be other reasons for poor performance that can usually be attributed to one of three things, any one of which can produce a trickle discharge rather than a strong, steady stream.

The first is a problem in the discharge hose. Make sure that there are no kinks or holes in the hose, and check the overboard discharge through-hull. Trapped debris can block the port.

The second problem is reduced electrical flow. The leads to the pump are generally short, so the pump is connected to the boat's electrical system by connectors that often sit in or near the wet bilge. Ensure that these connections are watertight and corrosion-free, and tie up the wires as high as possible above the bilge floor.

Finally, there may be something caught in the rotor, causing it to run slowly. Disassemble, inspect and clean the rotor assembly to correct this condition.

- Frank Mummert



Sew Your Sails

A sail can tear in two different ways: either a seam will let go or there will be a tear in a panel. Either problem can be dealt with easily. All you need is a needle and some thread—preferably waxed. If sail thread is not available, waxed dental floss is a good substitute.

Repairing a ripped seam is a matter of replacing the broken stitching. Always use the smallest needle that the thread will pass through. It is best to use the existing needle holes if possible and a basic, flat stitch.

Thread the needle—don't double the thread—and put a small knot in the end. With the seam oriented to the left, push the needle down through the sail a short distance to the right of the seam, and then back up a short distance inside the seam. Make the next stitch the same way. If you are not using the existing needle holes, you should aim to complete four or five stitches to the inch. When you get to the end, take a hitch or two around the last stitch and bury the end in the seam.

If the sail is torn, the object is to pull the two edges together and hold them there. Here a herringbone, or locked, stitch is needed. Working from right to left, anchor the thread just to the right of the tear. Take the needle down through the tear and push it up from below on the far edge of the tear. Then come straight across and push it down from above on the near edge. The needle comes up again through the tear to the right of the stitch just made. Draw the stitch just tight enough to pull the two edges of the tear together. Passing the



needle over the stitch to the left, take the next stitch a short distance down the tear. This action locks the stitch into place without having to pull it tight enough to create a lump in the sail. Finish as before on the ripped seam repair.

- Gene Bjerke

Eliminate Head Odor

Got a stinky head? To find the problem, follow your nose. The most common culprit is an air leak in the lines, and the best way to check is to wipe down the hoses and attachment points with a clean wet cloth and give it the sniff test—one foot at a time.

If you can't find an obvious leak, your system may be constructed with permeated hose. The permeation of gases through flexible hoses, which have a service lifetime of only a few years, is a lot more common than you might think. To find out if this is the problem, soak a clean rag in hot water and wrap it around a section of hose. Let it sit until it cools, then remove it and inhale deeply. Your nose will know if the stink is making its way through the hose. Pay specific attention to low spots, droops and bends in the lines, where sewerage collects and saturates.

The next smelly suspect is the bowl itself. Even though no sewage is present, the raw water used by your head contains organic material, which may sit for weeks at a time. If this is where your sniffer is offended, you'll need to start closing the seacock and pumping the bowl out whenever you leave the boat. But don't leave it water-free or else the seals will dry out. Instead, after getting rid of the raw water, pour a half-gallon of freshwater into the bowl and give it a few pumps to run it into the system.

If neither the lines nor the bowl presents a solution, you'll have to check your vent line. If it has any sharp bends or is smaller than $\frac{3}{4}$ inch, you may have found your problem. Anaerobic bacteria (which don't need oxygen) are what cause a stink, not aerobic bacteria. Give the aerobic bacteria an assist by increasing ventilation, and they'll usually overcome the problem.

- Lenny Rudow

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A Clear View

Dodger Windows Get an Assist From the Captain and His Sewing Machine

By Graham Collins

While fixing some blown-out seams on our dodger, I decided to replace the aging windows on the sides. As is common with Sunbrella, the cloth was still in great shape and had outlasted the windows. One was cracked, and both suffered from low visibility.

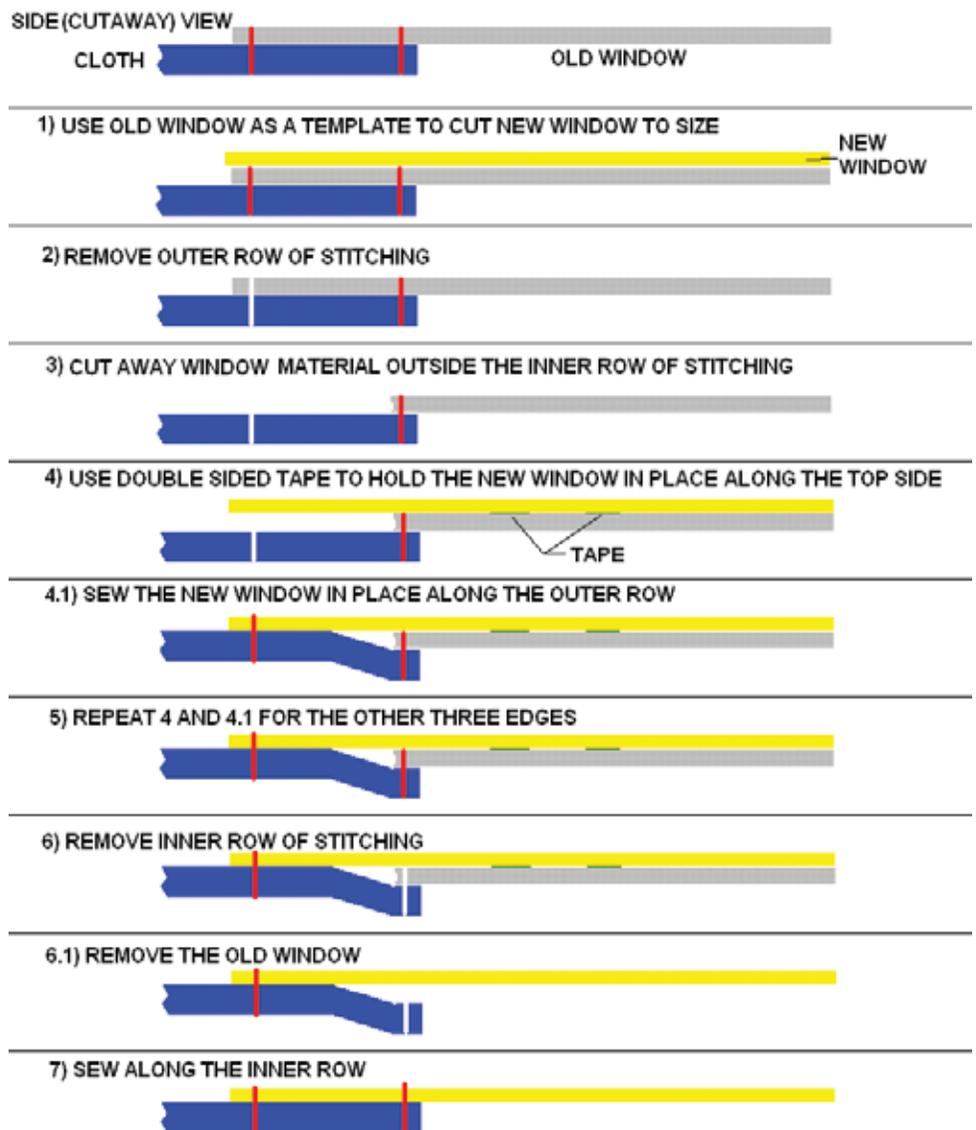
My sewing skills could be charitably classified as novice, but some test sewing, using a regular sewing machine and some window material, went well, so I figured it would be an easy job: Simply remove the old window, cut the new window to size and sew the new window in place. I was wrong.

LESSONS LEARNED

Once I removed the old window, the cloth flopped all over. Basting tape wouldn't hold the windows well enough to wrestle them through the sewing machine. Because the window material is thick and rigid, it was not possible to pin them in place. So in order to hold the window in alignment, I had to put in a hand stitch every two inches. Once that was in place, I finished the job on the sewing machine. Suffice it to say, it was a frustrating and time-consuming experience.

For the second window, I reasoned, there had to be a better way. I did consider cutting the old window out along the cloth edge (leaving a "frame" of old window to keep things aligned), but it didn't look like the right way to go. Plus, on close exami-

Graham Collins is refitting and sailing the C&C 35 Secret Plans out of Halifax, Nova Scotia, with wife Jill and 5-year-old Sam. He is an engineer by day and messes about with the boat on weekends.



nation, I found that a previous owner had done just that. So I came up with a plan: I would use the old window to hold the cloth in the right shape, partially sew the new window in, remove the old window and then complete sewing.

To begin, I lined up the new window

material with the old window and marked it to size. The vinyl cut easily with sharp scissors. Dodger windows are typically attached on with two lines of stitching, with one line at the edge of the cloth opening and the second about an inch in from the edge. I removed the furthest line of stitch-



photos by Graham Collins

Using the old window as a template and leaving it partially attached helped keep the fabric shape while stitching on the new window.

ing on the old window, so that it was being held in place only by the stitching at the edge of the cloth. I then cut the outside edge of the window off, almost to the inner line of stitching. I had to be careful not to cut the cloth or the stitching.

Now I had the old window still installed but cut so that it just fit to the cloth edge. This maintained the shape of the cloth.

SEWING IT UP

On my dodger, the outside line of stitching along the top of the window was the most difficult to sew because the window has to be rolled up to fit through the sewing machine. I sewed that edge first, because any misalignment could be more easily adjusted on the other three edges. To hold the new window in place, I applied two strips of double-sided tape to the top edge of the old window, and then applied the new window on top, stuck to the tape. When I rolled the windows up to fit through the sewing machine, the tape held everything in place along that edge.

Once I had sewn the outside line of stitching along the top side, I unrolled the dodger. I added more double-sided tape to hold the window in place along the other three edges. I then sewed the outside edge of the window along the other three sides.

With all four sides now sewn in place along the outside edge of the new window, I used a seam ripper tool to pick off the inside line of stitching, and pulled out the remaining piece of old window. It was then pretty easy to go back to the sewing machine and sew the cloth edge into place on the new window, finishing the job.

The difference in techniques resulted in a faster job (two hours compared to six), significantly better results and less colorful language from the captain. The costs for this project were very reasonable: the vinyl window material cost \$40 and the thread a mere \$5. **DIY**

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Down the Hatch

Battle Leaks and Long-Term Damage by Replacing Your Hatch

By Nonnie Thompson

Just as we were decommissioning our boat and preparing to leave the San Juan Islands, the Pacific Northwest winter began its annual deluge.

Living 1,000 miles away, we take great care securing our 50-foot Able Apogee, *Bittersweet*, for our absence. So, we were especially worried when we discovered rainwater coming in one of our main hatches with a steady drip, drip, drip. Knowing we couldn't leave the vessel to a winter of water damage, we confronted a major problem. With our flight home just hours away, a quick, temporary fix was necessary. A blue tarp—a boater's best friend, as vital as duct tape—was found and secured tight and low over the main hatches, between the grab rails. The fix would hold for awhile, but not through the winter. We measured interior and exterior dimensions, took photos and raced off to the airport.

On the way home, the debate began. Re-bed or replace? Do it ourselves or have it done? The acrylic hatch lenses, particularly two Lewmar Ocean 60s in the work area under the boom, were badly scratched and sun-damaged (and now leaking). Two smaller hatches forward by the mast were also sun-damaged and had shown the occasional drip. Since



photo by Nonnie Thompson

David draws a bead of Boatlife LifeSeal continuously around the opening.

they were serviceable and in good working order, we could pull, clean, reglaze and re-bed them all—if we had more time. At home, searching the Internet, we found that having the work done would cost more than buying four hatches, two

roundtrip flights to the boat and accommodations. We had been discussing replacement for years, and now the time and price were right. We ordered the Lewmar hatches from Fisheries Supply in Seattle, two size 10s and two size 60s, to be delivered to Friday Harbor on San Juan Island.

Five weeks later, we returned to an even wetter and colder scene. Moving forward with resolve, we hung two new

tarps over the boom and dried the deck. Then, we brought out the boxes and unpacked the hatches. They were beautiful, clear gray-smoke shock-resistant acrylic, with flawless satin-finished aluminum frames. After a moment of awe, we began gathering the tools: knee pads, heat gun, scrapers, wrenches, screwdrivers, socket set, Allen wrenches, bedding compound and application gun, epoxy, power drill and bits, new bolts/washers/nuts, pencils, tape measures, 3M blue tape, towels, and, yes, foul weather gear.

THE PREPARATION

First we had to remove the interior trim and bolts. We were glad to find that we had room to work and access the bolts, without removing the headliner. To remove the bolts, a two-person task, we took turns, one of us on deck with a screwdriver and the other on a ladder in the cabin with a wrench. Both jobs require a lot of torque in strained positions.

Next we removed the leaking hatch. We put a good layer of tape along the frame edges to protect the painted deck. Then we used a heat gun to loosen the old sealant. We were careful to heat only the aluminum, starting at a corner and steadily working the heat over a larger area until the frame was hot to the touch. Using a sharp wood chisel as a pry bar, we loosened the first corner. Then, with a series of small screwdrivers as spacers and a mini pry bar, we worked away from the corner, warming and prying, slowly and surely,

Nonnie Thompson is a freelance writer and photographer, licensed USCG captain, US Sailing instructor and blue water cruiser. With her husband, David, she's sailed over 20,000 miles. They are currently commissioning their Able Apogee 50 for world voyaging and sail training.

until the hatch came free.

Next we had to scrape off the old sealant. Again, using the sharp wood chisel, with steady, even pressure, we were careful to stay within the tape and trim perimeter. We found voids in the old sealant, filled with sand and dirt, which served as funnels for invading water. The voids may have been caused by original installation problems or sealant that had broken down over time, 12 years in our case. It was then time to sand the surface and wipe it clean with acetone. Carefully we prepped the work area to fill unusable holes.

Controlling the lid so that it wouldn't swing open, we checked the fit by placing the new hatch in the opening. Ours perfectly fit in the space, but unfortunately only a few of the new holes matched. Wanting a strong repair, we filled the bolt holes with West two-part epoxy. It's the best system we know, with pre-measured pumps for 105 Epoxy Resin, 205 Fast Hardener and the 807 syringe. To enhance the structural characteristics while thickening the epoxy, we added 406 Colloidal Silica Filler to achieve a marshmallow fluff consistency. It needed to push through the syringe tip, cut to smaller than bolt hole size, without dripping. We placed tape over the bottom of the hole before filling.

By the time we got all the holes filled and the tools put away, it was cold, wet and dark. So we called it a night and retired to Friday Harbor's Elements Hotel and Spa (doing it yourself has to have rewards). In the morning, the epoxy had dried and we were ready for final prep and installation.

THE INSTALLATION

First we scraped and sanded the filled holes before drilling new ones. Drilling is easiest done by placing the



photos by Nonnie Thompson



Counter-clockwise from left: Remove the bolts on the interior finish frame. Using painter's tape to protect the deck, carefully heat the old sealant and pry up the frame. You need a clean fit for the new hatches, pictured above.



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hatch exactly where you want it, drilling the first hole, placing a bolt in that hole and then drilling a second hole on the opposite corner and inserting another bolt. That secures the hatch and allows you to keep both hands free while drilling the rest of the holes. Always finish all holes with a champhor bit to get the maximum amount of sealant around the bolts and then clean it again.

To reset the new hatch we retaped the area, perfectly outlining the new frame. It's a good idea to drop a few bolts in the holes so the hatch doesn't move around during taping. Then, using BoatLife Life-Seal, with a 3/8-inch cut on the caulk tube, we laid a good-sized bead around the edge of the deck, with an extra dab in the bolt holes.

We laid the hatch and squared it carefully on the tapelines. Again, a two-person job: one drops in the bolts from above while the other wipes excess sealant and places washers and nuts from below. You will hold the bolts in place with the screwdriver while the nut is tightened to help



David completes a final cleaning and dry fit before sealing and affixing the new hatch.

keep the sealant from being displaced by a rotating bolt. As we worked, we called out the location of each bolt to avoid confusion, "aft/port #1," "forward/starboard #1," "forward/port #1" and so on.

In the end it is best to have excess sealant to wipe up, showing a thorough bond. We kept the tarp up until the sealant had dried and cured, 24 hours or manufacturer's recommendation. Replacing the four hatches took us three full days, allowing for some downtime for curing and hardening, and cost approximately \$2,500. The single largest expense was the hatches themselves: Lewmar Ocean series #10, which cost \$373 each and #60 hatches, which were \$700 apiece.

Working against the clock and the weather makes any job more intense, but Lewmar.com helped us be efficient, with lots of online information on repairing and replacing hatches. Though the weather continued to be damp and breezy, we sailors are champions at performing in those conditions. Remember the old boat-owner prep: Stand in a cold shower fully dressed and throw \$100 bills into the toilet. That said, we can now look clearly into our future years of cruising, having thrown good money into our blue-water yacht. **DIY**

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The Great Keel Ordeal

With No Fiberglass Experience, One Couple Forged Ahead to Repair a Concrete-Ballasted Keel. And Won.

By C.E. Grundler

It began simply enough: We wanted to send the prop and shaft from Annabel Lee, our 1977 32-foot Cheoy Lee trawler, out for balancing. This required the removal of the skeg and rudder. That's when we noticed a slow drip from beneath where the skeg had bolted to the keel. The boat's previous owner had paid a boatyard to install this skeg, which was attached by through-bolting it to the aft end of the keel, and records showed that seeping water had been a recurring problem ever since.

This seemed odd; our bilge was bone-dry. Closer inspection of the leaking area revealed a small crack that separated with disturbing ease, and a 10-inch chunk of keel that literally fell out. It turned out the bottom of the keel had been cut away to accommodate the skeg mount, and

C.E. Grundler grew up sailing Hudson River waters, and boats have remained a constant in her life ever since. She and her husband, Frank, are currently refitting their 1977 32-foot Cheoy Lee trawler, Annabel Lee.



photos by C.E. Gundler

Top: The skeg and keel before repairs were made.
Above: What we found inside was wet concrete.

this structural area where the bolts secured the skeg to the boat was never properly reinforced but simply packed with thickened epoxy.

With only inches between the keel and ground, it was difficult to see within the void, so we aimed a camera skyward. Pictures revealed a layer of crumbling, waterlogged concrete ballast. Concrete ballast poured over scrap metal is a time-honored and proven system, common on many workboats. I've read instances of hulls remaining watertight despite severe damage due

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to the concrete within. And as comforting as that was, the keel still needed repair, and with no prior fiberglass experience the project ahead was, to put it mildly, intimidating. As winter closed in, we left the open area to dry out while we anxiously considered what lay ahead.

CORE CLEANOUT

Our first job was to assess the condition of the ballast. With limited room to work, excavating the old concrete involved contortions, cursing and creativity. We drew some strange looks as we used a sledge hammer and chisel to attack the ballast. Reaching more solid concrete, we switched to a Makita angle drill tipped with masonry bits and a DeWalt heavy-duty grinder fitted with a Hitachi premium diamond turbo blade. Finally, a Dremel with a grinder head reached the tighter spots until all that remained was clean, dry, extremely solid ballast. Fortunately, the saturation had extended only a few inches up.

To give the keel maximum structural strength, we needed to reinforce the core as well as grind away $\frac{1}{4}$ inch of exterior fiberglass, then build the area back up by wrapping layers of cloth and mat in alternating directions. We marked reference points along the keel, well beyond the area of repair, noting original dimensions and bolt hole locations. These marks were vital for accurately determining the final dimensions as well as aligning the skeg.

The next challenge was to remove the fiberglass. We tried rotary sanders, belt sanders and various sanding heads on the grinder, concluding we'd be there forever at that rate. Finally, we put the diamond turbo blade back on the grinder, using the safety guard as a depth gauge and very carefully scored the fiberglass. A wood chisel effectively removed the scored layers. A DeWalt 80 grit zirconia flap disc cleaned things down, and we sanded a gradual taper (approximately 12-1) around the perimeter, providing the resin and fiberglass cloth sufficient "tooth" to grab.

As we moved further along in the process of destruction, we could only hope we were doing everything right. The odd looks we got from our marina neighbors had turned to nervous glances and uncomfortable smiles. I suspect many of them were questioning our sanity. I know we were.

CORE REINFORCEMENT

With the keel prepped inside and out, we moved onto reinforcing the core. I've heard opposing views on using teak within resin, but throughout this boat any structural wood was teak lumber, still solid and well bonded after 33 years. We constructed a replacement core to match the empty space, sandwiching biaxial/mat fiberglass (15-ounce non-woven E glass fabric two layers, 45-fiber orientation with a 0.75-ounce per square foot mat backing) between three layers of $\frac{1}{2}$ -inch-thick teak, laminated with West System epoxy and clamped until cured. This piece was sanded with 80 grit sandpaper and cleaned down with acetone. We wet out the void within the keel with epoxy thickened to a peanut butter consistency using West 403 Microfibers, then positioned the new core in place, supported from beneath with an automotive jack. Once it set, we sanded off any excess epoxy.

Using our reference marks, we determined the correct location for the skeg bolts and drilled $\frac{3}{4}$ -inch diameter holes. We then completely filled those holes with thickened epoxy. After



photos by C.E. Gundler

The void was filled with teak encapsulated in epoxy.



Oversized holes were drilled, then filled with epoxy. Later, the holes for the skeg bolts would be drilled into this epoxy, leaving the interior of the keel completely sealed.



The whole thing was glassed over carefully.

fiberglass lay-up, these holes would be center-drilled to accommodate the 3/8-inch bolts while leaving the new core completely encapsulated.

FIBERGLASS LAY-UP

Before going any further, we pre-cut each piece of glass cloth, numbered in order of application and stored between layers of cardboard, keeping them flat, clean and ready as needed. Though we were working at ankle level, technically this was a vertical/overhead repair. The system we used (practiced first on scrap wood) was to wet the area with epoxy resin and wait for it to “kick,” turning tacky. We then applied the cloth, wet it out, rolled it, squeegeed excess resin away, waited for that to kick, and repeated the process. So long as each layer was applied prior to the previous layer fully curing, it created a chemical bond, which is stronger than a mechanical bond.

The day started chilly but steadily warmed. Understanding the relationship of hardener speed to temperature, we controlled the rate in which the epoxy set up. Smaller portions kicked faster by mixing 205 Fast Hardener in a clean yogurt container; using a larger pot and 206 Slow Hardener slowed the kick down. A portable table served as our main workbench, with all necessary tools and materials laid out. Once epoxy starts to kick, you don’t want to find yourself searching for needed tools.

We wrapped biaxial fabric/mat up from beneath the keel and then from behind, each layer extending beyond the previous one, reinforcing the area from multiple directions. The skeg was heavy and clumsy even for two people to move, so we created a wood duplicate of the skeg mount, allowing us to easily check and recheck fit as we went. The day stretched from sunrise to long past sunset, and each layer moved us closer to the proper final dimensions. It was a sticky, itchy, messy—but highly satisfying—marathon, and the formerly uneasy onlookers watched in curious admiration. By dark, the keel was solid and reinforced in every direction. The following day, we faired out the repair.

Using a rolling automotive jack, we lifted the skeg into position, then reinstalled the shaft, prop and rudder. With everything aligned perfectly, we drilled new holes for the skeg bolts, then primed and painted in preparation for launching. While we had approached this job with outright terror, we were very proud of the result, and in the process we’d overcome the fear of fiberglass work. Our total cost was approximately \$500, the largest expens-



The skeg was reattached.



The finished product cost about \$500.

es being the resins, cloth and sanding materials. Yard estimates for this project ranged between \$3,000 and \$5,000, and while savings factored into choosing to do it ourselves, the peace of mind we have from knowing the job was done to our standards is priceless. **DIY**

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Success Stories

One WWII-Era ‘Crashboat’ Lives On

Randy Cunningham was just a child when he saw his first Navy “crash boat,” but its sleek lines and purposeful stance remained ever-present in his mind. Decades later, the hobbyist restorer would buy his own on Craigslist for about \$20,000 (plus the same amount for shipping) and begin the years-long process of stripping and refurbishing a 63-foot wooden military boat with six decades of wear.

“You absolutely have to be maniacally in love to go forward with such a project, at least on my income,” said Cunningham, 55. “I love real things, not replicas, and this is a damn sexy boat, with an incredible cosmic vibration.”

Used by the U.S. military during World War II as a high-speed, seaworthy rescue and patrol craft, the vessels were constructed with closely spaced frames and a double-planked hull with the inner layer laid diagonally.

Cunningham’s find had been altered slightly from its days plucking airmen from the water: The mid-ship cabin had been gutted, and the galley had been moved to the aft cabin, which was the infirmary during the boat’s service time. The lower helm station had been removed to make a bigger chart area for teaching navigation, a requirement during the postwar years with the Sea Scouts.

Once home with Cunningham in Richmond, British Columbia, the boat revealed itself: Nearly every area of the vessel needed attention. While rot was limited, the pilothouse and surrounding area aft were very rough. The original wind defuser on the upper bridge was gone. Also missing were the port and starboard gun tubs, though the cutouts remained.

Cunningham is now bringing the boat virtually back to its original wartime layout throughout.

The latest news: He’s going to go with original V-12s—2200-cubic-inch, Hall Scott Defenders with overhead cams and twin plugs. He has acquired several, including two rebuilds circa 1957. And he



photos by Randy Cunningham



Randy Cunningham refurbished the World War II-era craft after finding one on Craigslist. Each area of the boat needed attention, including the rot on the pilothouse and surrounding area.

plans to change the cam profile, add an electronic ignition and a programmable fuel injection. The goal: “looking for 45 knots ... crazy,” he says.

It’s been an incredible amount of work. But Cunningham is cool. “I sometimes

think of my life as a great pond filled with lily pads, some big, some small, but each representing one of my dreams,” Cunningham said. “No point in just looking at them—do the frog thing and jump in.”

—Leef Smith Barnes

To read more about this project, please visit: www.madmariner.com/crashboat

Successes are worth sharing.

Whether you’re knee-deep in renovating an old boat or you’ve just finished building one from scratch, we’d like to hear about it. Drop us an e-mail with a before and after picture and a 200-word-or-less description of your work at LeefSmithBarnes@Diy-Boat.com. If we publish your story, we’ll give you a one-year subscription to *DIY Boat Owner*.

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- **Reduced Solvent Content:** a lower solvent content in the paint will reduce the amount of organic compound emitted into the air. Normally, you would also get a thicker film and improved longevity from a 'high solids' bottom paint
- **Polishing Action:** with self smoothing characteristics an abrasive paint will maximize on fuel efficiencies and the right product will help reduce green house gases by consuming less fuel
- **Copper-free Formulation:** Copper occurs naturally in all waters around the world and while high concentration levels can be harmful to humans and the environment, copper is an essential micronutrient to life and a certain amount is essential for the well-being of animals, including humans**. The accumulation of copper in some marinas has led to the demand for products that can help boat yards reduce the overall copper content collected when hauling & pressure washing boats. A copper free product can be suitable for professionals and consumers alike

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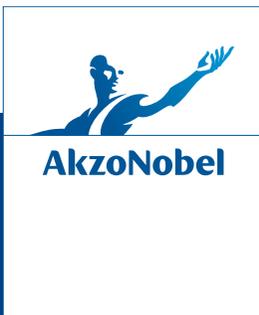
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* Compared to standard, old fashioned hard and abrasive antifoulings.

** For further details see the summary provided by the National Paints and Coatings Association on the 'Boating and the Environment' section of Interlux www.yachtpaint.com

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