



DIY BOAT OWNER

The Marine Maintenance Magazine
www.diy-boat.com

Issue #4 2009

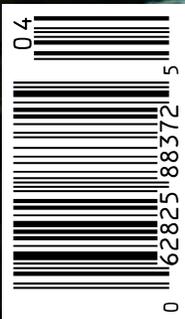
The Winter Projects Issue

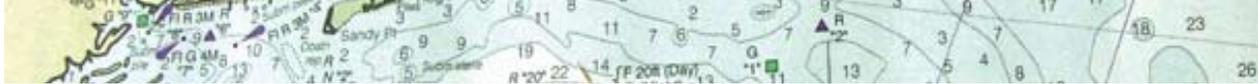
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Using wood from his shed, our author creates a laminated sink top.

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Wanting to filter fuel without paying someone, our author creates his own.

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A New Captain for DIY

You might notice something different about the magazine you hold in your hands, starting with that little guy atop the cover. He's the Mad Mariner—and on this ship, he's the new captain.

Mad Mariner is a group of veteran journalists and dedicated boaters, with publications in print and online. Earlier this year, we proudly took the helm of DIY Boat Owner, and we want to explain our new course.

What do we plan to do to your magazine? The answer is simple: very little. It's not broken, and so we do don't plan to fix it. If you are a subscriber, you will continue to get your magazine in the mail. You don't have to do anything. If you buy it on the newsstand, it will be available in West Marine as always.

The magazine itself is the same size. It is printed on the same paper. More important, DIY's editorial focus will remain the same. We share your commitment to simple, economical, self-reliant boating—and we will continue to publish expert advice on maintenance, repairs, upgrades and projects. We will also continue to champion technical standards set by the American Boat and Yacht Council.

DIY's product line will also remain the same, offering 14 collections of archived articles on CD-ROM—and soon via download—on the DIY-boat.com Web site. The digital edition of the magazine will still be available, as will back issues.

We have also made some improvements. We are revising DIY-boat.com, adding more free content and making the site easier to use. We have added a Solution Center, which we are filling with stories that can help you solve problems and make improvements to your boat. We have also added a weekly e-mail newsletter that will let you know when there is fresh material to read on the Web site.

The magazine, too, has adopted a new look, which we think presents information more clearly. We added a new Tools & Gear section, which puts equipment to the test before you put your money down, and a new section called Your Boat, which presents ways to improve your vessel both large and small.

The result is the first issue of DIY on our watch, the magazine you see here. The theme is Winter Projects, with a focus on how to maintain and improve your boat during the off-season. That means articles that explain how to economize, with 10 improvements you can undertake with virtually no money; how to assess and buy key pieces of gear, like an autopilot system or a man overboard alarm; and a full spread of do-it-yourself projects, from how to replace lifelines to how to build a portable fuel polisher.

We sincerely hope you enjoy it. We know that DIY readers are hard-core do-it-yourself boaters who demand high-quality, heavily reported insight and advice. And we plan to provide it, getting better with each issue. We look forward to writing for you, and to hearing any suggestions or ideas you have. We'll work hard to maintain the spirit of your magazine.

Glen Justice
Editor



DIY BOAT OWNER

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Tools & Gear

We Test So You Don't Have To

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

Vice Cleat

6

The Vice Cleat (about \$80) is a stainless steel vice grip pliers, with large aluminum jaws attached. Its mission is to act as an emergency jam cleat, stalling a line at the block and allowing you to address a tangle or similar problem behind it. We clamped it all over the place and found it held fast, even to line as large as $\frac{3}{4}$ inch. But its utility will be dictated by your rigging. If your lines run to the cockpit, this may be useful. On the mast, perhaps less so. Either way, it's only for emergencies.

PRO: Points for originality—it's a good idea. And it does look cool.

CON: Each jaw is attached to the pliers with a pin, and they wobble a bit. We worry they will separate with heavy use.



EZ Splice

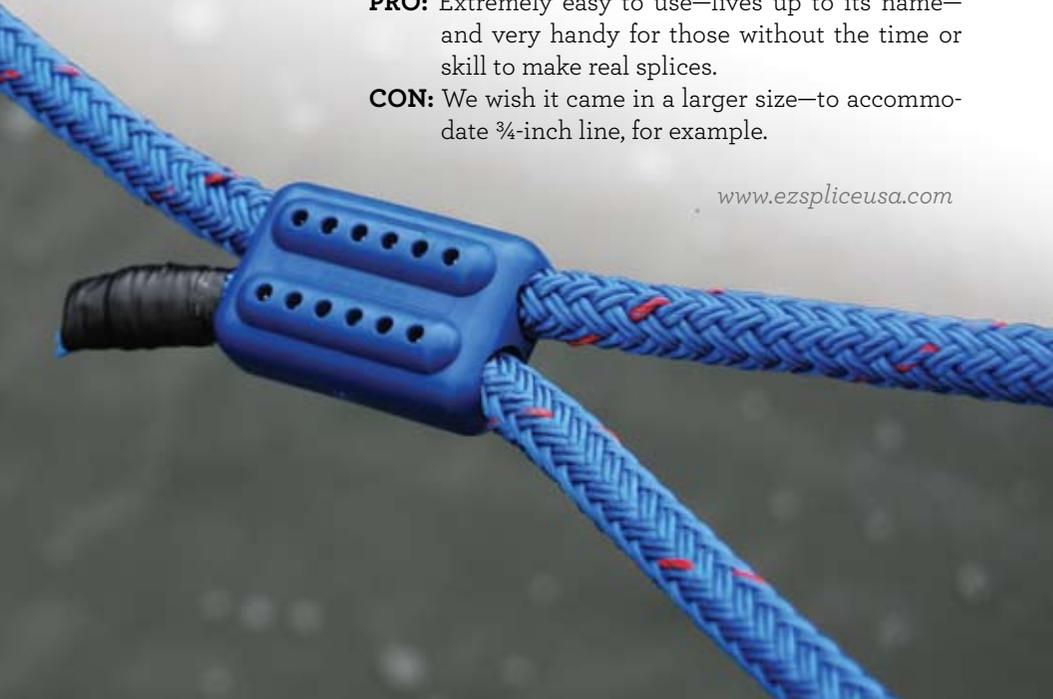
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EZ Splice is a fastener designed to splice line quickly by joining lines with stainless steel pins in a single plastic unit. It comes in ½-inch and ¾-inch models (black, blue or white) for \$21.99. We tested a ¾-inch model, creating a dock line and letting it hold the bow of a 40-foot trawler for a month. It was rock solid. We prefer pro splicing for heavy loads, but EZ Splice is great for other jobs.

PRO: Extremely easy to use—lives up to its name—and very handy for those without the time or skill to make real splices.

CON: We wish it came in a larger size—to accommodate ¾-inch line, for example.

www.ezspliceusa.com



Sea Spanner

5

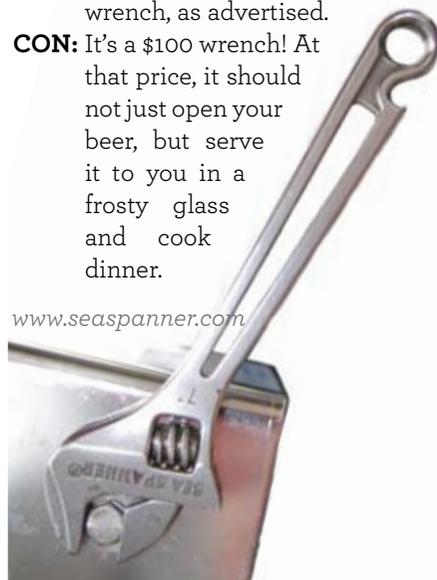
The Sea Spanner combines an adjustable wrench, shackle tool, bottle opener and a deck key. Designed by a New Zealand sailor, it got raves from a bunch of bloggers—and some magazines—when it was released a few years back.

We like New Zealand, bloggers and wrenches, so we got one and played around with it for quite a while. What we found was a handy tool—and that's kind of it.

PRO: It is a solid and durable wrench, as advertised.

CON: It's a \$100 wrench! At that price, it should not just open your beer, but serve it to you in a frosty glass and cook dinner.

www.seaspanner.com



Charge N'Flow

The Rule Charge N' Flow portable pump won an Innovation Award this year, and we were eager to play with it.

The 12-volt, 280 gallon-per-hour pump (\$99) comes with the battery housed permanently in the carrying case. You can charge it using an AC wall plug, a DC outlet or directly from a 12-volt battery using clips, and all attachments are included.

The pump itself is the size of a small flashlight and comes with eight feet of lay-flat hose and a nozzle attachment. Connect it to the battery, and it starts running.

The pump itself is compact and submersible. We found it could get into tight spaces, though the hose kinked easily, and trailing the case was some-

times awkward. We wish the battery had a light, so you could see when it is charging (or how much it is charged). We also wish the pump had an on-off switch, and that the battery connections were a bit more substantial.

But overall, it made a nice transfer pump and was powerful enough to act as a portable washdown for light jobs—a very nice addition for a smaller boat that does not have washdown systems. The nozzle worked well, without leaking. All told, it is a helpful and versatile product.

PRO: A versatile pump that goes where you go.

CON: One more thing to charge.

www.rule-industries.com

www.diy-boat.com



ITT

Fein MultiMaster

I've used a Fein MultiMaster for a couple years now, and I keep finding new applications for this excellent cutting tool. It's an interesting tool in that its head moves very fast (11,000 to 21,000 oscillations per minute) to create a cutting edge that allows you to get into spaces you just couldn't reach with a rotary saw or a Sawzall.

The MultiMaster is driven by a 250-watt motor and comes with a 16-foot long-cord, a distinct bonus when most tools deliver a short, three- or four-foot cord that leaves you searching for an extension cable.

On one recent job I needed to remove a hatch bossing while leaving the area flush with the deck. A rotary saw would have left me with a half-inch ridge. Making it flush would have meant grinding away the remaining fiberglass - an unpleasant chore on a summer afternoon. With the Fein MultiMaster I cut it flush with the deck in one pass.

The MultiMaster has a variety of interchangeable heads to suit the task. There is also a special caulk removal tool for teak decking, a scraper blade, a triangular sanding head, and a finger-style sanding head. While changing tools on an older-model Multimaster required you to remove a bolt and a



Photo by Roger Marshall

washer, the newest model has a lever to make the change-out easier and faster.

When you use a MultiMaster, you need to change your traditional sawing technique. Instead of pushing the blade along the job, as you would with a Sawzall, the Multimaster's oscillating blade requires that you angle the tool to the job and hold it tightly to avoid wandering off your line. For long cuts, use the high-speed segment or high-speed saw blade and watch your guide lines carefully. For deep, cut-off style cuts (if you were cutting a pipe or the slot in a mortise joint) use the E-Cut or wood sawing blades.

The MultiMaster blades are not inexpensive, and neither is the tool itself. The FMM-250Q Select tool kit lists for \$339 on the manufacturer's

website (www.cpohein.com) and comes with a sanding pad and several blades. New blades can cost between \$25 and \$125. The circular segment blades are the most expensive.

If you do a lot of work with a MultiMaster, you'll blunt a saw blade in about four or five hours of heavy use. Still, after getting experience with the tool, it's a piece of equipment that I wonder how I ever did without. The MultiMaster has a permanent place in my toolbox.

- By Roger Marshall

Don't let minor repairs limit your time on the water

New WEST SYSTEM **Six10. Thickened Epoxy Adhesive** is the fastest way to make strong, lasting, waterproof repairs with epoxy. The dual-chambered, self-metering cartridge fits into any standard caulking gun. The static mixer delivers fully mixed, thickened WEST SYSTEM epoxy in the amount you need for the job at hand. No waste. No mess.

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Tools & Gear: Innovation Report

This Year's IBEX Innovation Awards Highlighted Some Promising New Equipment

New Lithium Ion Battery

Lithium Ion battery technology is widely used in other applications, but had not penetrated the marine space when it comes to cranking or house batteries—until now.

Mastervolt's new lithium ion battery is the first on the market and, though we have not tested it, it holds a great deal of potential. The battery won an innovation award at the International Boatbuilders' Exhibition & Conference (IBEX) in October.

The 24-volt battery—a 12-volt model is in development—weighs just 115 pounds, with an output comparable to four 8D batteries, according to the company. Made with lithium iron phosphate, it can be discharged to 80 percent as rapidly and as often as desired without the wear that traditional batteries experience. The company claims a lifespan of 2,000 cycles, which is three times that of normal batteries.

Mastervolt's lithium ion battery produces no gas byproducts, and includes the company's battery management system, which balances cells to provide full voltage, current and temperature control. It can be connected in parallel without limitation and in series up to 250-volt DC, according to the company.

One drawback is the cost: at more than \$7,500, it is expensive. But company officials say that the battery will outlast three sets of 8D batteries, which would mitigate the costs over a period of years. They also expect it to come down in price.

A Helluva Hinge

Hinges and other ordinary hardware rarely get their time in the sun. But the Intelli-Hinge by Taco Metals deserves some sunshine.



The hinge operates on a ball and socket model, making it far easier to couple rounded surfaces, and other tough-to-join components. The hinge won an IBEX Innovation Award in October.

The hinge builds on the company's line of ball-and-socket fittings for canvas and bimini hardware. We haven't tested it, but it seems like very smart stuff.

Groco's Raw Water System Monitor

Groco's new raw water system monitor reads the water flow to your engine's cooling system and sounds an alarm — audible

or visual — if there's a reduction. And it does it within seven seconds.

We haven't tested it, but warning the captain of cooling problems—when they can still do something—seems like a strong idea.



The system can protect engines, generators, air conditioning or any equipment that uses raw water cooling. It uses an in-line "T" fitting with an impeller inside to measure flow. Information is then relayed to a central unit that handles the monitoring and alarms.

The fitting can be removed to change the impeller—or to add function. Plumb in a hose and the fitting can become an emergency bilge pump, pulling water from inside the boat using an engine or generator.

The system can monitor seven different components and can be retrofit on boats using lines from 3/4 inch to 6 inches. It won an IBEX Innovation Award in October.

— Glen Justice



Mastervolt

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Repowering: A Holistic Approach

Before You Start, Know Your Needs and Your Engine's Shortcomings

By Nigel Calder

Replacing engines on older boats is becoming more common. This is not because engines are failing sooner, but because boats are lasting longer. There are plenty of 30-year-old fiberglass boats that, with proper care, will last another 30 years. Given this extended life, it is reasonable to expect

that the core systems will be replaced at least once during the life of the boat, some of them several times over. The current economic downturn will also encourage boat owners to upgrade an existing boat rather than buy a new one.

When it comes time to replace these systems, the engine is probably the single most expensive item: It is not unusual for the bill to top \$20,000, for even a small auxiliary diesel in a sailboat—and a large powerboat repower can cost several times as much. Before making this kind of investment, a boat owner should carefully review the vessel's power requirements to ensure that the new engine is the best possible fit. The review should focus on two inter-related questions:

Will the new engine be expected to perform the same functions as the old one? And, are there lessons to be learned

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



Photo courtesy of Nigel Calder

Trying to change the raw water pump impeller on a Yanmar 3GM proves to be tricky with a tight install.

from the old engine that can be applied to the new one?

CHANGES IN PHILOSOPHY

During the 10 to 20 years an engine has been in place, the underlying philosophy that determined the boat's original system configuration has almost certainly changed. Most dramatic has been a substantial increase in onboard comforts, which have had an equally dramatic impact on the boat's electrical systems, particularly the DC system. These upgrades, in turn, significantly affect engine use. On

cruising sailboats, for example, engines have evolved from a means of propulsion into the primary means of generating the power necessary to support today's cruising lifestyles.

Often, this change has taken place without any analysis of its impact on the engine and other onboard energy systems. In extreme cases, the engine may now be run more to charge the batteries at anchor than for propulsion. At these times, it is operated under almost no load (a horsepower or two), at little more than idle speed. Such a regime is destructive to

Departments

engines, particularly diesel engines, leading to excessive carbon formation and accelerated wear. In some cases, the need to replace the engine may be a direct consequence of this kind of use.

So before you blindly replace the existing engine with a carbon copy, carefully review the boat's overall energy equation—the balance between energy production and energy consumption. Because every owner has a different lifestyle, which will place different demands on the boat's energy systems, this kind of energy audit has to be conducted on a boat-by-boat and an owner-by-owner basis.

On many boats, an audit may find that a thorough re-vamping of the DC system, and perhaps the AC system, should become a part of the repowering equation. It may prove worthwhile to separate power generation functions from propulsion functions and install a separate generator, solar panels or a wind generator. At the very least, fitting the new engine with a high-output alternator and a multi-step regulator (not as a replacement, but as an addition, giving the engine two alternators) is often strongly recommended.

Whatever the case, the point is clear: Before spending money on a new engine, it makes sense to ensure that it is suited to your needs—and to know precisely what those needs are.

NEW TECHNOLOGIES

In the past two years alone, there have been more innovations in engines and engine systems than we saw in the previous three decades.

Today we have electronic controls and, on larger engines, incredibly sophisticated engine management systems built around electronic units



Photos by Nigel Calder

An old engine is removed in preparation for repowering.

and common rail injection systems. We have “fly-by-wire” throttle, gear shifting and steering, and, emerging right now, the integration of engine control and monitoring systems with navigational systems into a single network (notably NMEA 2000). At the other end of the spectrum, on engines below 100 horsepower, we still have conventional, mechanically operated and controlled systems. There's a new range of choices here to fit every predilection, from the most conservative to those who yearn to be on the cutting edge of technology.

Moving away from the engine, we have new battery

technologies that, among other things, have astonishing charge acceptance rates. These are likely to upend all the formulas traditionally used in designing marine DC systems. Notable are Odyssey Thin Plate Pure Lead batteries (www.odysseyfactory.com), with Firefly carbon-graphite batteries about to hit the market (www.fireflyenergy.com), and lithium-ion waiting in the wings. On the AC side, we have synchronizing inverters that can parallel an inverter's output with shorepower and/or an onboard generator. This upends many of the formulas traditionally used in designing marine AC systems. Check

out the products from Victron (www.victronenergy.com) and Mastervolt (www.mastervolt.com).

These new technologies are being brought together to create hybrid propulsion and house systems that integrate alternative energy sources such as solar, wind and, on sailboats, regeneration when under sail. An increasing number of people who want to repower are looking at hybrid options, although my advice is to wait a year or two. There is a great deal of potential here that has thus far been poorly assimilated into marine engine and systems planning.

LESSONS LEARNED

Technological innovations aside, when repowering is in the offing, it's important to carefully review the life of the old engine to derive practical lessons. Particular attention should be paid to those times when problems or frustrations have arisen—because repowering presents an excellent opportunity to eliminate them.

What should you look for?

■ I might put on my list the time on Lago Izabal in Guatemala when our anchor dragged in 50-knot winds and extremely steep seas. Under power alone I was unable to drive the bow of the boat against the seas through the eye of the wind. We were underpowered, a situation which any new engine should remedy.

■ Just as common is the problem of overpowering. If the old engine has never been used at or near its full output, down-sizing should be considered. Overpowering adds unnecessary weight and volume with no benefit, and in fact can result in harmful engine operation.

■ The old engine may have had a problem with carbon for-

mation in the exhaust system, which is indicative of a generalized carbon-fouling problem inside the engine (the exhaust should be as clean after 20 years as it was after 20 hours). Causes may be an inadequate air supply to the engine or an undersized or over-long exhaust system, but more typically it will be the common cruisers' affliction that comes from running engines for long periods at low loads when battery-charging at anchor.

■ At times the exhaust may have filled with saltwater. It can then find its way into the engine, locking it up and potentially doing serious damage. This invariably happens at the worst possible time (in rough seas) and generally occurs as a result of an improperly designed cooling or exhaust system.

■ What about maintenance frustrations? Has the inaccessibility of the oil filter been cursed every time the oil was changed? When the oil filter is removed, does it dribble over the engine bearers and into the bilge? Does the engine have to be removed from the boat in order to service the shaft seal? I have seen a number of installations like this, and it is important to ensure that the same problems don't recur with the new engine.

■ And then there's noise. All too many boat engines are way too noisy. This does not have to be a continuing fact of life. The new engine installation can be designed to keep noise within acceptable levels.

I'm sure you get the picture. An hour or two spent reminis-



The author's engine room with a conventional diesel in the foreground and experimental parallel electric on the upper left with the electric propulsion generator in the background.

ing about the old engine, and the troubles and aggravations it has caused you, can be repaired many times over in terms of ease of use and maintenance with the new one. Every engine installation is unique, with its own quirks, idiosyncrasies and problems. The more its history is studied, the better the chance of eradicating problems with the new installation.

If there is one important thing to remember when undertaking a review, it's this: Do not make assumptions about the inevitability of frustrating features. Just because getting at the shaft seal has always meant hanging upside down in a cockpit locker with the steering quadrant jammed in your back doesn't mean it has to continue. With this kind of approach, the new engine can become the framework for a qualitative improvement in efficiency, onboard lifestyle, and ease of use and maintenance. That's when you're going to feel like the price tag was worth it. **DIY**

In the Field

Designing and Testing New Hybrid Propulsion

By Nigel Calder

For a decade I have been observing marine electric propulsion developers. Several appeared to be on the verge of creating viable systems for a broad marine marketplace, but they never quite got there.

The principal difficulty lies in designing a system in which a fossil-fueled engine operates only at peak efficiency. With the introduction of high charge rate batteries a couple of years ago, it seemed to me that we had the critical missing piece in the puzzle. To test this, I set up some experiments on my own boat. These morphed into a €2 million grant (about \$2.8 million) from the European Union for the Hybrid Marine project, or HYMAR.

The project is built around the approach developed over many years by Dave Tether of Electric Marine Propulsion (www.electricmarinepropulsion.org). In conjunction with Homewood Products Corp., Dave has created extremely rugged, marinized electric propulsion motors that have held up well over time. Aside from inadequate battery technology, what he, and everyone else, has lacked is a dependable source of purpose-built generators, ancillary equipment such as battery chargers and inverters operating at the higher-than-normal DC voltages in these systems, and a control system that would take the operator out of system management and make these systems as easy to use as a conventional system.

Through the HYMAR project we have brought together a multidisciplinary team that can supply all these pieces. We have a test boat outfitted with terrific instrumentation and a custom-built data logging system to fully evaluate products as they evolve, with Malo Yachts of Sweden supplying architectural and engineering services. Dave and I have already collected enough data to know how to design generators that we think will be more efficient than anything currently on the market. We are moving to prototype development.

Engine technology is coming from Steyr Motors of Austria, which has some of the finest small marine diesel engines in the world. The Bosch Engineering Group, which arguably has the most experience in automotive hybrid control systems, is working on a system controller. The Odyssey division of EnerSys, one of the world's largest battery manufacturers, is working on optimizing thin plate pure lead (TPPL) technology for this application. Bruntons Propellers and INSEAN, an Italian naval research institute, are developing optimized propellers. We have a major power electronics company creating purpose-built chargers, inverters and converters.

HYMAR is a three-year project. By the end I believe we will have optimized marine hybrid systems that will finally make this technology viable for a broad range of applications. **DIY**



Install a Stereo

From CDs to MP3s, Music Is Just a Connection Away

By Roger Marshall

These days the hardest part of installing a new sound system on your boat may be deciding what to buy.

Do you want a single speaker driven by an MP3 player, or do you prefer several speakers driven by satellite radio? Do you want to play your old CDs or use your iPod as a source for your music? Answering such questions will direct your search to the system that is right for you—and that in turn will dictate the complexity of your installation.

Electrical

In recent months, my sons and I have installed both a Prospec Electronics system and a Poly Planar system, each on a separate boat. The installation involving the Prospec

Electronic JBL SIR2.5 (since discontinued and replaced by the Sirius SCC-1) using twin waterproof speakers was installed in a J/24 sailboat's cockpit, with a Sirius

Satellite radio providing the music. We

plan on installing an MP3 player later to make the system more versatile. The Poly Planar system uses an MP3 player connected to twin speakers mounted in the aft end of the cockpit in our rigid-hull inflatable.

Both of these systems were extremely easy to install, requiring some simple fiberglass cuts and wiring, aided

greatly by systems that come with templates, color-coded wiring connectors and instructions. But any system you choose will require some planning, to place speakers properly, eliminate long wire runs and keep components as dry as possible.

INSTALLING SPEAKERS

The Poly Planar Kit-A system is intended for small craft such as yacht tenders, inflatables and other boats under about 20 feet. It uses two, 5-inch diameter speakers that need to be placed where the sound can easily be heard, and the system box must be located near the speakers. The hardest job was probably choosing where to locate the speakers. On our 16-foot RIB, we decided to put the speakers at the back of the cockpit, where the sound would point forward toward the driver and passengers.

We used a 4½-inch hole saw to cut through the fiberglass at the forward end of the engine compartment. Before you cut into your boat, make sure that there is nothing located behind the hole you are about to drill. With this check made, you can proceed to drill the holes needed for your speakers. Then install the rubber O-rings that surround the speakers and use the bolts provided to fasten them securely to the fiberglass. To keep the connections short, we installed the amplifier/system box between the speakers on the inside of the engine compartment, where it would stay dry.

On the Prospec Electronics system, we had an unusual problem. Because we were restoring an older J/24, we found that holes for a system had already been cut in the aft end of the cockpit. Unfortunately, these holes were large, so finding something suitable to fill them was not easy. Eventually, we lucked into a pair of 8-inch diameter speakers at a boatyard sale, so we installed these instead of the speakers that came with the kit.

Roger Marshall is the author of 14 books, and his newest book Fiberglass Repair Illustrated will be published at the end of this year by International Marine. Marshall has written extensively on boats of all sizes for magazines in most parts of the world.

Product photos courtesy of ProSpec and Sirius



Before cutting your boat, make sure there is nothing behind the hole you are planning.



Speaker placement is a major part of any installation.



Photos by Roger Marshall

Many marine systems are now color-coded, making installation a breeze.

The wiring was led to the system box, which Prospec calls the “black box,” and it connected up easily.

WIRING AND CONNECTIONS

Both systems came with waterproof DIN and USB ports, an antenna socket, a CD changer socket and conventional connectors. All the connectors were color-coded for easy installation, so the entire connection process took only about 10 minutes. The last job was to run electrical wires from the fuse panel to the system box and connect them up. We used crimp-style connectors from Ancor to ensure an

electrically sound connection.

Installing the MP3 player and the satellite radio panel was almost as easy as doing the speakers and system box. We simply marked the locations of these units using the paper templates provided and then cut the openings with a jigsaw. After a little filing with a rasp, we sealed the opening using the O-rings that came with the kit. The units then dropped in without a problem.

The Sirius satellite radio uses a 13-pin DIN connector to link it to the black box and an antenna lead. Because all the connectors are color-coded and clearly

marked, making the connections is trouble-free. We sprayed each connector with CRC before joining them together to help prevent corrosion, the bugaboo of on-board systems.

It seemed as if only moments after each of the systems was hooked up, music was blasting across the boatyard, and my college-age sons—who simply must have music wherever they go—have made great use of them since. One advantage from my point of view is that it is now relatively easy to locate them on the water. They are the ones with music echoing across the bay. **DIY**

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Choose the Right Man Overboard Alarm

There Are Many Options. Learn How They Work, What They Cost and What's Best for Your Boat

By Timothy Flanagan

Much of the time I'm the only adult aboard my boat. I either single-hand or cruise with my young daughters. And one particular risk troubles me more than all the others combined: What if I fall over-

Electronics

board?

There are several products designed to sound an alarm and assist with the recovery of crew overboard. To be clear, these systems are distinct from distress radio beacons such as EPIRBs and Personal Locator Beacons (PLBs), which help authorities with search and rescue.

Instead, man-overboard (MOB) alarms alert the boat's crew that one of their crewmates has fallen off the vessel. They work like this: A transmitter—usually a small tag, about the size of a car remote—is attached to each crew member, and a receiver is installed aboard the vessel. The receiver sounds an alarm automatically when a crew member falls overboard. The alarms can also be manually activated.

Some receivers can also trigger the MOB function on a GPS or chartplotter, generating a waypoint where the overboard took place. Many can disengage the vessel's engines or activate other MOB recovery gear. Some systems can even provide real-time direction finding to help recover the crewmate in the water.

MOB alarms have gained in popularity in recent years, with roughly a dozen companies, including Raymarine, Mobilarm



Raymarine

and Autotether, adding to the arsenal of modern safety gear now available.

Although the best advice remains “Don't fall off the boat,” once a crew member has fallen into the water—hopefully with a life jacket on—the top priority is getting that person back aboard. Ideally, falling in the water would trigger an audible alarm, set a GPS waypoint and stop the boat—and quickly.

PROACTIVE OR REACTIVE?

The MOB alarm systems currently available use one of two basic operating principles, and it is important to understand the distinction between the two to select the right one for you.

Proactive or proximity systems are activated when a constant signal produced by the transmitter, worn by a crew member, is interrupted. Signal interruption might occur because of an increase in the range between the transmitter and the receiver, as when a crew member falls overboard. However, an interruption could also occur if the transmitter were unable to transmit because of radio-frequency interference from other equipment, a discharged bat-

tery or damage to the transmitter itself. False alarms are more likely with these systems because any disruption in the signal triggers an alarm.

Reactive systems are activated when the transmitter, worn by the crew, is immersed in water. However, if the transmitter or its battery fails, no alarm is triggered aboard the vessel, so it's possible to experience a situation in which somebody has fallen in the water but no alarm is triggered. Transmitters remain off most of the time, so there is little drain on their batteries. Some reactive systems use a direction-finding antenna aboard the vessel to help the crew locate the overboard crew member.

So which is better?

The biggest benefit of a proactive system is reliability. It's essentially impossible for a transmitter-equipped crew member to leave the vessel without triggering an alarm. The major drawback is that false alarms are likely, perhaps even probable, since any interruption in the transmission triggers an alarm. A secondary drawback of the proactive system is that the system can't be used easily at anchor or in port,

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because every crew member who leaves the boat for any reason will sound an alarm.

For this reason, proactive systems require active transmitter management; crew members have to leave their transmitters aboard—or the system has to be disabled—every time somebody leaves the boat intentionally. Proactive systems cannot be relied on to alert you that a guest has capsized the dinghy or your child has fallen off the dock.

One advantage of some reactive systems is real-time tracking. Receivers with direction-finding antennas can provide a bearing to the MOB's current position, not just a waypoint indicating the vessel's position when the alarm first sounded. Another advantage is that, because the system remains passive until triggered, crew members can keep the transmitters attached to their PFDs all the time. Nobody has to remember to take it off before going ashore or put it back on later.

For vessels with children aboard, a reactive system eliminates the need to juggle transmitters in port; the kids can con-



A reactive system eliminates the need to remove transmitters in port, ideal for boats with children aboard.

tinue to wear their transmitter-equipped PFDs, and you can keep the system active or not, as you judge appropriate. The biggest weakness of a reactive system is that transmitter or battery failure triggers no signal, and therefore no alarm.

PROACTIVE SYSTEMS

RAYMARINE'S LIFETAG (www.Raymarine.com) integrates easily with Raymarine multifunction displays using the SeaTalk data and power interface. Installation is easy, and the system can track up to 16 separate sensor/transmitter units, called "pendants." Pendant batteries last about a year for typical boaters, because they power off automatically when the base unit is deactivated. They can operate continuously for about 12 weeks, long enough for some bluewater cruisers. The pendant case must be opened to change the battery, so care must be taken not to damage the waterproof gasket.

To minimize false alarms, the system includes a 10-second delay between signal loss and alarm activation. This gives the system a chance to restore contact in cases where the signal was interrupted for some reason other than a fall overboard. LifeTag includes an auxiliary 12-volt circuit that could be wired to kill an engine. The list price for a basic system with two pendants is \$685.

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larm.com) interfaces with other NMEA 0183-compatible navigation equipment, and the rechargeable pendants use induction charging, eliminating the need to open the transmitter case at all. Functionally, it is similar to Raymarine's LifeTag but may be easier to install aboard boats with chartplotters from other manufacturers. MOBi-lert activates instantly upon signal loss; there is no delay, as with LifeTag. The base unit also includes an auxiliary 12-volt circuit for triggering engine cutoff, but this circuit is subject to a 10-second delay. The system can monitor up to six pendants. The list price for a basic system with two transmitters and charging cradle is \$895.

AUTOTETHER (www.Autotether.com) is the only proactive MOB system built around engine cutoff, and it features the simplest installation of all. It is self-contained and battery-powered, requiring no external wiring. It's also the least expensive unit available. In use, it replaces the existing engine kill switch clip that fits on a collar around the ignition switch aboard most smaller boats. When the skipper falls in the water, an alarm sounds and the clip pops off the ignition switch, stopping the engine. The skipper's sensor is the only one that kills the engine; the other sensors sound an alarm but do not stop the engine, allowing the skipper to pick up the overboard crew member. Autotether can track up to four sensors, but the system does not interface with navigational electronics. The base unit is powered by six AAA batteries, and the sensors each use three, providing about 100 hours of service. The list price for the receiver with two sensors is \$295; additional sensors are \$69 each.

REACTIVE SYSTEMS

MARITECH INDUSTRIES' VIRTUAL LIFELINE (www.Maritechsafety.com) is described as a "wireless engine shut-off system," so it is similar to the Autotether. Being a reactive system, however, it can accommodate any number of sensors.

Although installation is more complex than for the Autotether, operation is simple: It is activated automatically when the vessel's ignition switch is turned on, and it shuts off when the ignition is turned off. Two helm-mounted rocker switches allow control of the system for sensor testing and



REACTIVE SYSTEMS

PROACTIVE SYSTEMS

Clockwise from top: Maritech Industries; Alert2; ACR's MOB Alarm system; Sarfinder 1003; Mobalarm; Mob Guardian; Amec Amulet; Mobi-lert 720i; and Autotether. Photos from vendors' Web sites.

to engage "rescue mode," which allows the engine to be restarted immediately while the MOB alarm is still activated. Unlike all the other reactive systems, however, real-time tracking is not possible. A waypoint can be set at the splash point with some navigational electronics. The list price for the complete system with two transmitters range from \$599 to \$897, depending on engine configuration.

ALERT2 (www.Alert2.com) consists of the vessel-mounted AR100 receiver (\$500) and any number of AT101D transmitters (\$235 each). A third component of the Alert2 system is the APDF100 Portable Direction Finder (\$800), a rugged handheld directional antenna and receiver that allows the vessel's crew to locate the MOB transmission by sweeping the horizon. In operation, the AR100 receiver remains active while under way. The transmitters remain dormant until triggered, as with all reactive systems, and the APDF100 unit is stowed where it is accessible in an emergency.

Once triggered, the AT101D transmits a coded 418-MHz signal to the AR100 unit aboard, which sounds an alarm and can, if wired to do so, shut down the engines

or tell the vessel's navigation system to generate a waypoint at the splash point. Upon hearing the alarm, a crew member aboard the vessel deploys and activates the APDF100, sweeping the area to determine the bearing to the victim. As the vessel is brought around, the spotting crew member can continue verifying the relative bearing with the direction-finding receiver until a visual sighting is made. Alert2 is a serious tool well-suited to offshore passagemakers and commercial vessel operators and is the least expensive direction-finding MOB alarm system on the market.

ACR's (www.acrelectronics.com) **MOB ALARM SYSTEM** uses the Vecta3 receiver (about \$2,000) and the Mini B 300 water-activated Class B EPIRB (\$250). The Vecta3 cleverly serves as both a vessel-mounted alarm monitor and, when removed from its cradle, a hand-held direction-finding receiver. The Mini B 300 transmits a conventional 121.5-MHz homing signal, which means that ACR's system is compatible with equipment already onboard many search-and-rescue aircraft and vessels.

The Sea Marshall (www.seamarshall-us.com) system's **SARFINDER 1003** base

unit (\$3,243) uses a three-element, vessel-mounted antenna and sophisticated direction-finding radio gear to provide a relative bearing to the MOB right at the helm, with no hand-held horizon sweeping required. Sea Marshall SMR8-LR transmitters are \$295 each and feature an antenna that must be deployed by the victim for maximum effectiveness. Sea Marshall, like ACR, uses the 121.5-Mhz search-and-rescue homing frequency.

The Sea Marshall system is the most expensive of those surveyed here because of the clever direction-finding receiver and helm display, as well as the complex antenna. Because it requires less effort on the part of the crew remaining onboard, Sea Marshall may be the only MOB-tracking system usable by short-handed crews.

I haven't covered every MOB alarm system here, just those widely available in North America. Several systems are either in development or available elsewhere, but not yet here. These include proactive systems **AMEC AMULET**, **MOB GUARDIAN** and **NKE MARINE ELECTRONICS**, as well as reactive systems **SEASAFE**, **MOBALARM** and **WAVEFINDER**.

In addition, reactive systems are being developed under at least two names—**DEEP BLUE** and **MERMAID ID**—that use a sonar-like ultrasonic digital pulse to communicate with the vessel, rather than regular radio-frequency transmission. The receiver, in this case, uses a through-hull hydrophone transducer rather than a conventional antenna.

YOUR BEST BET

As Page Read, founder of Emerald Marine Products, puts it, "There's a market for every one of these products." This is the fellow who designed the Alert2, but he doesn't bad-mouth his competition. He's very much aware that the features most important to offshore sailors will differ from those of freshwater anglers, harbor-hopping cruisers with children or commercial fishermen.

Before you buy, consider the product features and operating modes within the context of your own vessel, your typical crew and your cruising style. There are also some basic items to consider when conducting your own assessment.

If you've got a steel or aluminum hull, you'll probably want to stick with a reactive system, because proactive systems can produce false alarms when the radio signal is disrupted.

If you primarily cruise protected inland or coastal waters, real-time MOB tracking may not be necessary. A simple MOB waypoint will provide all the location data you'll need to get the vessel back to the person in the water. If you cruise offshore, where you're likely to encounter heavy weather, direction-finding gear may be more important, although some will regard the fail-safe nature of proactive "alarm-on-failure" systems more compelling. Unfortunately, there are currently no systems that combine the utter reliability of proactive systems with the direction-finding

capability of reactive systems.

If you cruise shorthanded in a powerboat, your top priority in a MOB situation may be stopping the boat; an alarm that can be rigged to kill the engine might suit you best. If you cruise with children, you'll often have your hands full, especially while leaving or docking. You might want to select a system that requires minimal hands-on effort to engage and disengage; chasing down the kids to collect or turn off their sensors could become bothersome.

No matter your situation, be sure you understand how each system really works in practice. Most of the manufacturers make their installation and operation manuals available online, which you can read to be sure you understand what's going to happen. Marketing materials aren't likely to point out the factors you will find most annoying in practice.

Once you select a system and install it, practice with it. Throw a floating cushion over the side with a sensor attached and see what happens. Walk away from the boat and see how range affects the system's performance. All the systems include procedures for commissioning and testing. Do that—and then adjust the test procedure by throwing in some tests of your own. It's important for you and your crew to be aware of the system and how it works and what they should do if somebody falls overboard.

With the right system aboard and a little practice, you can stack the deck in your favor in the event of a fall overboard—and even turn a tragedy into another great sea story. **DIY**

Before you buy, consider the product features and operating modes within the context of your own vessel, your typical crew and your cruising style.

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Corrosion Control

Battle Back With the Proper Hardware Installation and Regular Attention

By Priscilla Travis

A common problem on metal boats, particularly in a saltwater environment, is the corrosion of steel or aluminum around stainless steel or other metal fittings and fasteners.

When water gets under the paint or bedding compound, a galvanic action between dissimilar metals can speed the development of corrosion. On steel surfaces, the paint may crack or degrade around fittings, allowing water in, which causes rust and corrosion. On unpainted aluminum,

Maintenance

corrosion in the form of white powder and pitting may occur (this is sometimes seen around stainless steel fittings mounted directly on unpainted aluminum spars).

Applying primer paints and compatible topcoats—in an unbroken film, sufficiently thick—is the first barrier against corrosion. Plastic isolation materials should also be used with stainless steel fasteners, along with waterproof bedding and thread sealing compounds wherever possible. The goal is to isolate the fasteners from contact with the steel or aluminum, and to prevent saltwater from intruding—especially important for fittings mounted on unpainted aluminum, such as hardware on masts and booms.

Even with proper painting and isolation materials, it is almost inevitable that water will find its way between dissimilar metals and cause corrosion, presenting a maintenance challenge for metal boat owners—and not only for cosmetic reasons. Uncorrected corrosion around deck tracks, pad eyes or spar fittings can have serious consequences if hardware pulls out under load.

Priscilla Travis has owned and maintained metal cruising yachts since 1978. When not keeping ahead of corrosion, she is currently enjoying summers sailing European waters.



Photo by Priscilla Travis

Rust is removed from steel with a high-speed wire brush and Dremel tool with abrasives.

THE CHALLENGE

My boat, commissioned in 1990, has a steel hull and toe rail and aluminum decks and deckhouse. After 14 years, I have begun to deal with both rust and galvanic corrosion around some fittings and fasteners. It took a number of years for visible corrosion to develop, because the initial protection was done properly, but it eventually arrived.

The areas of concern are near stainless steel deck tracks (T-tracks) and stanchion bases, and around some foredeck fittings. The corrosion near the tracks and stanchions is rust on steel under the paint. On the aluminum deck, galvanic corrosion near the tracks has lifted the paint or cracked the fairing compound in some places.

On the foredeck, two items of chromed bronze hardware were installed by the builder. One is a flush-mounted saltwater deck wash assembly with a hose tap and cover plate. The other is a deck plate for a four-inch cowl vent for the rope locker.

The paint and fairing compound lifted around both.

All tracks and stanchion bases are mounted on plastic isolating material, and the stainless steel machine screws were installed with bedding compound. In the case of the T-tracks, the corrosion is localized so I have not removed track sections, electing to treat only the areas nearby. Stanchion bases are removed where corrosion is present because only a few fasteners are involved.

In the case of the deck wash fitting, the amount of corrosion required the removal of the bronze unit, which was replaced with a welded, heavy aluminum plate with a hose nipple—simple, if inelegant. This prevented further damage to the aluminum deck from galvanic action, but the area had to be re-faired and repainted. The bronze cowl vent deck plate is still on the foredeck, and I have chosen to repair the area around it, because the corrosion affects the paint and fairing, not the aluminum.

THE REPAIR

Repairing corrosion around stainless steel fittings involves removing the fitting (in some cases), cleaning the corroded areas, re-fairing if necessary and then painting with primer, undercoat and topcoat. If fittings are removed they are re-bedded, replacing any plastic isolating material that may have cracked or degraded.

On steel, rust is removed primarily with a high-speed wire brush and a Dremel tool with abrasives. If fairing is necessary, the bare metal is coated with a phosphating solution, which is allowed to dry for 24 hours and then painted with two coats of a compatible two-part epoxy metal primer. The dry epoxy is lightly sanded with 180-grit sandpaper before applying the fairing compound. If fairing is not necessary, the undercoat and topcoats are completed over the epoxy primer.

On aluminum, flaking paint is removed with a wire brush or Dremel tool, then a wire brush or abrasive paper is used to thoroughly clean the aluminum surface. If the fairing compound has lifted, the area is opened, chipped back to tight fairing compound and the underlying aluminum is cleaned to bare metal.

I fair the cleaned aluminum areas with one-part 3M Marine Putty (#05962), which dries fairly quickly, allowing multiple thin coats to be applied over about six hours at 60 degrees Fahrenheit. A two-part epoxy fairing compound could also be used. Build up deep areas with several thin layers. Using a flexible artist's palette knife enables the putty to be applied smoothly and in tight areas, minimizing sanding. When dry, faired areas are sanded smooth with 120- and 150- grit sandpaper. A detail sander makes it easier to reach tight



The area around a bronze deck plate for a four-inch cowl vent on the rope locker was repaired after the paint and fairing compound lifted.

spaces.

I then dust the sanded areas, wipe them with mineral spirits and paint them with two coats of International Pre-Kote undercoat. Bare aluminum is treated with International Etch Primer before the undercoat. On both steel and aluminum, two coats of International Brightside topcoat finish the job. (Other brands of paint could also be used.)

When the paint is thoroughly dry, fittings that have been removed are reinstalled with plastic isolating pads and one-part polysulphide (or polyester) bedding compound, making certain the compound coats machine screw threads as they are installed. Non-acrylic types of plastic should be used with either of these

bedding compounds.

Some repairs on our boat have been exposed to the elements for more than seven years now without any corrosion returning, so the method I have described seems to take care of the problem. However, as metal boat owners know, corrosion control is never-ending. **DIY**

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Racy Rig

Fiber Rigging Comes of Age—Again. And It's Not Just for Racers.

By Paul Esterle

Sailboat rigging is in a near constant state of evolution. We've come from manila lines rigged with deadeyes and lanyards, to stainless steel wire and rotary swaged fittings. Dyform wire improved on stainless wire, and solid rod rigging followed.

Now comes the latest stage: fiber rigging with deadeyes.

Technology

Deadeyes? Yes, but it isn't your great-grandfather's rigging. For one thing, this stuff costs a whole lot more. That's

because modern fibers like Kevlar, PBO and carbon offer substantial benefits over materials of the past.

These modern fibers have conquered the main problem with fiber rigging—stretch. These new materials are both stronger and stretch less than stainless steel wire, the predominant rigging material on today's sailboats. While they started on all-out racing and megayacht sailboats, they are gradually working their way down the food chain to the rest of us. It's a technology worth watching.

WINDAGE AND WEIGHT

One of the first questions anyone might ask is, why? What's so great about fiber rigging that makes it worth more than 1-by-19 stainless wire rigging? The answers are found in windage and weight.

It's a fact of life that rigging (wire, rod or whatever) has a

round cross section, and that form is a terrible aerodynamic shape. In fact, any book on aerodynamics will make the comparison between a round aircraft strut and a teardrop or streamlined one. Because there is no practical way to make streamlined rigging and align it with the airflow, we're stuck with round cross sections. That said, the smaller the diameter of the rigging, the less airflow disruption around it and the less drag, or windage. Because fiber rigging is stronger than the rod or wire it replaces, it can be smaller. On a tall racing rig, that can make a great deal of difference.

Because these materials are lighter than the materials they replace, fiber rigging can also reduce the weight aloft on a large yacht by a ton or more. That reduced weight aloft will mean less ballast and result in a lighter boat. In races where captains make their crew cut the handles off their toothbrushes, that counts for a lot.

NEW MATERIALS

A variety of materials are being used in fiber rigging configurations.

One of the first advanced fibers ever manufactured were called Aramids, and the most well-known fiber of this type is Kevlar. Kevlar has been used in everything from boat hulls to sails and rigging. Because Kevlar is susceptible to damage from UV rays, it is usually encased in a braided cover, which also provides abrasion resistance. Pound-for-pound, it is stronger than steel. But Kevlar is also subject to "creep," or long-term stretch under constant load.

PBO (polybenzoxazole) fibers have almost double the

An inveterate DIYer, Paul Esterle is a boating writer and editor when he isn't working on his fleet of old boats.

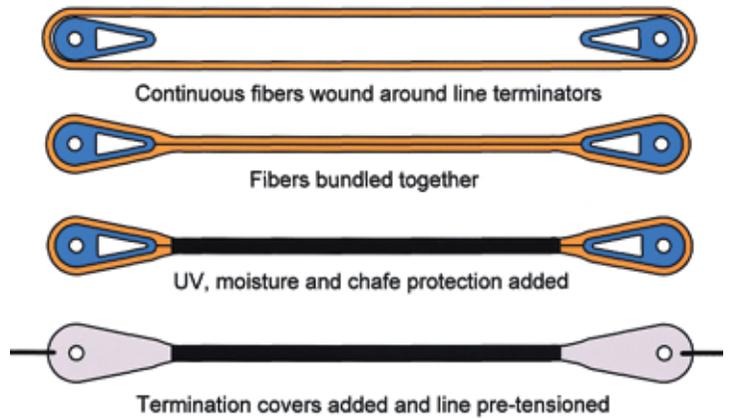
strength of Aramid fibers—and they have creep resistance superior to Kevlar. For one PBO fiber, ZYLON®HM, the non-recoverable creep after 100 hours under 50 percent of breaking load is less than 0.03 percent.

Carbon fiber is another option. We most often think of carbon fiber as a cloth material used in conjunction with epoxy resin to create composite forms, like a hull. Yet it can also be made in the form of a rod and used similarly to rod rigging. Initially, carbon rigging was fabricated as a solid rod, with the size of the rod's diameter matched to the strength required for the rig. But this meant almost all installations required fabricating a different diameter rod. More recently, carbon fiber rigging is fabricated from multiple smaller rods, so the required strength is met by assembling rigging from smaller, standard-sized pieces.

Yet another option is known by its initials: UHMWPE. They stand for Ultra High Molecular Weight Polyethylene. A common trade name for UHMWPE marine cordage is Dyneema. While Dyneema is a high-strength, low-stretch line, it is most often used for running rigging. But some companies are changing that.

Colligo Marine, for example, takes Dyneema and pre-stretches and hardens it to form Dynex Dux line, which it markets as Colligo Dux. This results in rigging that is 1/3 the weight of stainless steel wire with similar stretch, but is less than one-third the cost of PBO rigging. In fact, the cost should be equivalent to 1-by-19 stainless wire rigging, though the rigging itself is slightly larger. It is also easier to splice than other fiber rigging.

Typical Fiber Line Construction



Paul Esterle

FABRICATION AND LIFE EXPECTANCY

High-strength and low-weight doesn't come without drawbacks, and fabrication is one of them. Don't expect to run down to your nearby marine store and pick up the fiber rigging supplies to redo your boat over the weekend. To achieve the weight-saving potential of these systems requires careful design. Most of the players in this market provide those design services for their products, and rigging is usually custom-made for the specific boat.

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Departments

End terminations for fiber rigging are a critical part of the overall design. A host of new end fittings have been designed for use with fiber rigging. Where the rigging is formed around a thimble to create an eye, you will notice the radius of the turn is much larger than a standard thimble for stainless steel wire. Other end fittings require the fibers to be trapped in a mechanical fitting or actually glued in place with epoxy adhesives. Once formed, the shroud or stay will need to be pre-tensioned to properly seat the fibers and eliminate any chance of creep.

One factor common to most fibers is susceptibility to degradation from UV rays and moisture, and fiber rigging is often encased in a protective covering to keep out the moisture and UV rays. That protective covering also alleviates chafing.

A properly designed and built fiber rigging solution presents no significant installation issues. Shrouds and stays can be tensioned with standard turnbuckles



Colligo Marine

A close-up of the fiber lashing, used to tension and secure a fiber shroud.

or by using the modern equivalent of the old-fashioned deadeyes. These, however, will be made from anodized aluminum or titanium.

One unknown factor is how long these rigs will last, given that this style of rigging hasn't been around very long. One PBO rigging manufacturer offers the following advice on its life expectancy:

"If the working load is less than 25 percent of the PBO cable rated strength, we recommend changing the cable following 26,000-30,000 miles, with a thorough inspection after three years of use if the mileage has not been obtained during that time."

Obviously, there is much to be learned as these rigs develop—and as they age. Fiber rigging may not be a cost-effective solution for your old classic sailboat this year, but as manufacturers continue to develop newer and better materials, methods and fittings, it's a technology worth watching. Fiber rigging isn't just for racers anymore. **DIY**

IT'S IN THE DETAILS



Shurhold Industries' latest tool is so intuitive it could make even Gilligan an adept boat detailer. The Dual Action Random Orbit Polisher puts waxing, buffing, polishing, cleaning, and paint defect and swirl removal into the hands of the boat owner. "It requires no skill at all to use," says Shurhold President Barry Berhoff. In addition to innovative tools, Shurhold, the most respected name in boat care maintenance, provides safe and easy-to-use products and do-it-yourself tips at www.shurhold.com. "The first thing to remember when tackling boat care maintenance at home," adds Barry, "is to avoid using these common household cleaners that may harm your boat and the environment":

- 1) **DISH SOAP** – Dish soaps can strip wax and degrade waterproofing. Use: Shurhold Brite Wash, multi-surface boat soap.
- 2) **WINDEX** – Ammonia can cause yellowing and cracking. Use: Shurhold Serious Shine, which cleans, polishes and protects in one easy step.
- 3) **PAPER TOWELS** – Paper can scratch. Use: Shurhold's Microfiber Towel, which is softer and can be washed and reused.

4) **SOFT SCRUB** – Abrasives are too strong for fiberglass and gelcoat surfaces. Use: Shurhold Serious Marine Cleaner, a multipurpose spray-on that will even clean carpet.

5) **PLEDGE** – Pledge contains solvents that can damage isinglass and cause it to yellow. Use: Shurhold Serious Shine, which cleans, polishes and protects in one easy step.



SPECIAL OFFER

Order Shurhold's Dual Action Random Orbit Polisher (\$149.98) at WWW.SHURHOLD.COM and enter code **DIY** at check out to get **\$40 WORTH OF ACCESSORIES FREE**. You'll get the Pro Polish compound (16 ounces) and Pro Polish Pad for waxing and polishing along with a Microfiber Towel for spot detailing. May not be combined with any other offer. *Expires December 31, 2009.*

Your Boat

Features | Ask the Expert | Tech Tips



Solar Solutions

It's Cheap, Clean and a Real Option—Even Without a Full System

Lakelite

By David and Zora Aiken

Boat owners with an onboard solar charging system know the benefits of clean, quiet and (eventually) free energy. But even those without a full-blown array of solar panels on the transom or deckhouse can enjoy the convenience of solar-powered products.

Vents, interior and exterior lights, flashlights, a lighted cleat, and even lights for the dock are all available in self-contained

David and Zora Aiken have been live-aboards for more than 20 years and are authors of Good Boatkeeping and Cruising: The Basics.

solar-powered models. Not only do they allow us to use the sun's energy without adding an entire solar charging system to the boat, but they also save the money once spent on disposable batteries, and they prevent more of those disposables from ending up in landfills. After an eternity of stocking throwaways, who wouldn't welcome a flashlight that could be readily recharged with sunlight?

The technology goes beyond stand-alone items and grows increasingly sophisticated. For example, the huge market in small portable electronics—mobile phones, iPods, digital cameras, hand-held GPS units and laptops—has fostered a new batch of gadgets that not only gather

and use solar energy, but store it, too. That means that modern-day necessities—from iPhones to camping lanterns—are both portable and rechargeable anywhere, thanks to the sun.

HOW IT WORKS

Ordinary solar panels can be portable and the energy they generate can be stored in batteries, so theoretically, anyone who knows how to make the connections could carry around all the necessary components and have a solar charging system at hand. Of course, most consumers don't do that, looking instead for the nearest power plug when the phone or iPod needs a recharge. Now, however,

multiple solar-powered options exist—and a charging unit that works with sunlight spells real freedom.

The stand-alone items, like lights and vents, have small, built-in solar cells that collect solar energy. Some of these items work directly from the cells, which can hold the power for the short term, at least long enough for a night or two. In addition, most of these products have a backup plan in the form of a rechargeable battery, so more solar energy can be stored for later use.

Each of these solar-charged items can make one part of boat life easier or more reliable, but a solar-powered charging unit can cover much more ground, because it is capable of recharging many different items. The unit can be charged when the sun is available, and later, it can be used to charge other devices when the need arises. These solar chargers are available in varying sizes and prices, from a pocket-sized gadget that recharges a cell phone to one that can keep a laptop running for hours.

USING SOLAR

While you may be delighted to disconnect from a world of throwaways, there are still rules. For starters, you have to get religious about charging. A solar flashlight is useless if it hasn't seen the sun.

You should also be aware of charging times, which will vary with the sun's intensity, the angle of exposure and the condition of the battery. The estimates listed on most products are based on "optimal conditions" or "peak power," neither of which is a constant.

Direct sunlight charges best. At regular intervals during the day, it's best to move the unit's panels so the sun strikes them at a right angle, or as close as is practical. To calculate the charge time, a simple formula applies, using battery capacity measured in milliamp hours (mAh).

Battery capacity in mAh/150 x 1.2 = charge time in hours

So, for example, if the battery capacity is 650 milliamp hours, then: $650/150 \times 1.2 = 5.2$ hours.

Remember, too, that many of these products are not created expressly for the marine market. Water-resistant does not mean waterproof. Be sensible with outdoor use, and keep solar panels clean by wiping them with glass cleaner and a soft cloth. Finally, don't leave a solar charging device inside a closed car or boat for a long time on a hot day. High temperatures may diminish battery life. **DIY**

Solar Options



◀ **LIGHTCAP 200** and **LIGHTCAP 300**. www.sollight.com. Dual purpose, this one. On the original LightCap 200 (\$24.95), a small solar cell is part of a cap for a standard 2-inch-diameter water bottle. The newer LightCap 300 (\$29.95) has a wider bottle and a brighter light, with four white LEDs, plus one red for a vision-saving night light.



▲ **ECOLIGHT**. \$39.95. www.solareyinc.com. Described as the "greenest flashlight on earth," the Ecolight charges very quickly—about an hour with the built-in solar panel, and a mere four minutes with an AC or car charger, the company says. It uses no batteries at all, instead storing solar-generated power in two supercapacitors that take up little more space than a pair of C batteries. In fact, the whole light is only 7½ inches long.



◀ **SOLARGORILLA AND POWERGORILLA**. www.powertravellerusa.com. The solargorilla (\$244.95) is the sun-catcher for the powergorilla battery pack (\$284.95). The combination can be an energy source for some notebooks and laptops.





SOLAR E POWER II. \$100. www.wagan.com. ▶
A small unit with two small solar panels hinged to fold in for carrying or out for sun-catching. A lithium battery stores power for charging devices, although a cell phone or other USB device could be charged directly from the sun. The unit can also be charged with AC power or a 12-volt plug.

▶ **RAILLIGHT.** \$34.95. www.sollight.com.
This solar-powered LED light clamps onto any round railing up to 1¼-inch diameter or onto a transom or edge up to 2 inches thick. Its solar panel charges an internal battery, so daytime charging provides nighttime vision.



NICRO DAY/NIGHT SOLAR-POWERED VENTS. \$269. www.marinco.com. Solar energy powers the vent all day while charging an internal rechargeable battery to run the vent at night. A single vent can be used to move air in or out, and a pair of vents (one intake, one exhaust) can keep air circulating all day, whether or not you're on board.



◀ **BRUNTON SOLO.** www.brunton.com. To run a larger laptop, Brunton recommends the Solo 7.5 (\$372) or the Solo 15 (\$648) power packs, matched to an appropriate solar charger (priced separately depending on size). Either Solo unit will power the laptop. The main difference between the two is that the Solo 15 will work longer before requiring a recharge.



◀ **LIGHTSHIP.** \$19.95. www.sollight.com. Leave the light in sunshine all day; at night, use LightShip's three suction-cup "feet" to attach it wherever extra light is needed. The low-profile light has a solar cell built into the back to charge the internal NiMH battery.

HYBRID SOLAR LITE. \$24.95. www.hybridlite.com. Solar cells in the handle of the flashlight gather the sun's energy all day, storing it in the rechargeable lithium backup battery. With an eight-hour charge, the flashlight can provide up to 10 hours of light, the company says. And it floats!

POWERMONKEY-EXPLORER. \$119.95. ▶ www.powertravellerusa.com. As part of the powermonkey-eXplorer, the "solarmonkey" panels send solar energy to the "powermonkey's" lithium-ion battery pack, which stores power until it's needed to recharge small electronics. A selection of connection tips is part of the package. The alternate charging methods are AC wall charger and USB connection.



SOLAR DOCK/DECK LITE. \$79.95. www.lakelite.com. These low-profile dock lights can line a home dock (or marina dock, with permission).

SOLAR CLEAT LITE. \$69.95. (on page 21) www.lakelite.com. 12-inch Solar Cleat Lite can ease nighttime tie-ups and prevent nighttime trip-ups.

Basic System Monitoring

Add a NMEA 2000 Network and Display for Just a Few Hundred Dollars

It's not sexy—a small gray gauge with a dot-matrix display in black and white. But the Lowrance LMF-400 can be a powerful addition to your boat. The gauge offers a NMEA 2000 network that can monitor almost anything—and it costs only a few hundred dollars to get started. We've been playing with a pair of LMF-400 gauges

for more than a year, monitoring information like fuel tank levels, and we are impressed. The system is flexible, affordable and relatively easy to install. We think the LMF-400 is a worthy addition for any boater interested in installing basic system monitoring, or simply adding a display. Take a look.

—GLEN JUSTICE

MONITORING

The LMF-400 will monitor almost anything—tank levels, battery voltage, engine data and dozens of other pieces of information. It can also display navigation data, such as boat speed, depth and GPS position. For boaters with gas engines—not diesel—the LMF-400 can monitor fuel flow. For anglers, it can display water temperatures, outside the boat or in a livewell.

NETWORKING

The LMF-400 relies on a NMEA 2000 network to gather information, meaning data travels from sensors throughout the boat back to the unit through a single cable. This “backbone” simplifies wiring substantially and makes it easier to add function. New Lowrance sensors or displays just jack right in. The LMF-400 accomplishes all this using LowranceNET, the company's proprietary network, which means sharing data with other brands may take more work.

SENSORS

Lowrance sells NMEA 2000 sensors to monitor fuel flow,

fluid levels, water temperature and other systems. Other NMEA 2000 data can be added—from your boat's existing instrumentation, for example—but it may require custom wiring to introduce this data to the LowranceNET network.

GAUGES

The LMF-400 displays data in pages, meaning one unit can read out a great deal of information. It can also present data in different formats, ranging from a simulation of

traditional needle gauges to numeric displays. Given the costs and ease of installation, repeater units are also realistic—adding extra gauges at a helm station, in a cabin or near a tank is doable.

COSTS

A single LMF-400 gauge costs about \$200, and its smaller cousin, the LMF-200, costs less. Lowrance sensors are generally available for less than \$100 each. Wiring and connectors for each sensor may present additional costs,

but how much will vary by installation. Generally speaking, a simple network can be established for less than \$500.

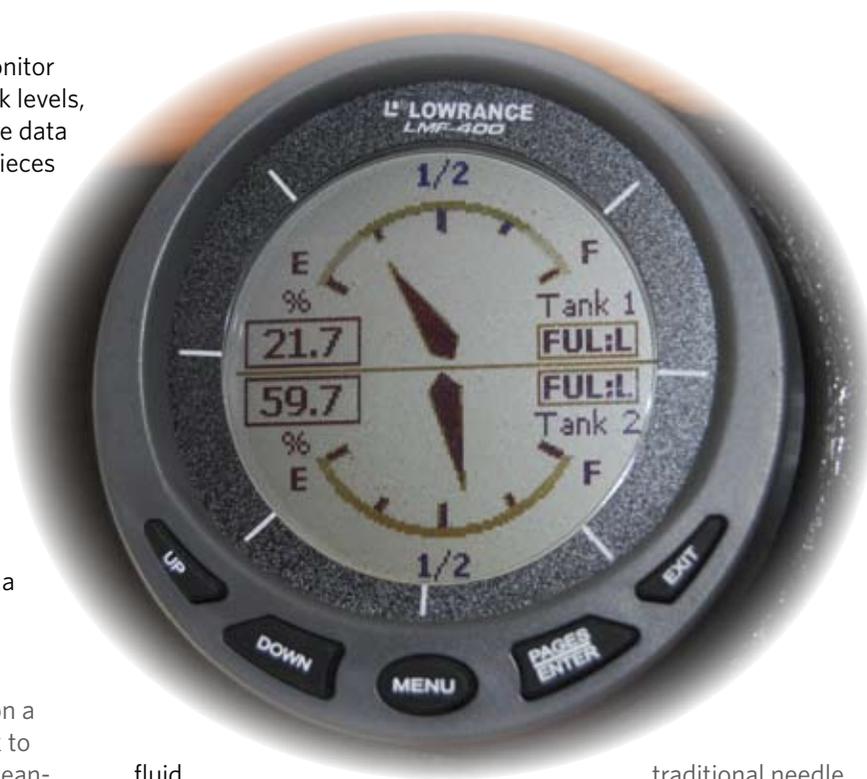
INSTALLATION

Installing the LMF-400 and a basic network is relatively simple. If it is working properly, the sensors are plug and play, though the LMF-400 requires some push-button setup. Make sure that the firmware on the unit you buy is up-to-date, or you may have to ship it back to the factory. Also, note that the LMF-400 will not monitor fuel flow on a diesel engine, which is a substantial limitation for large boat owners. Finally, remember that the NMEA 2000 network used by the LMF-400 is LowranceNET, the company's proprietary network, and that interfacing with other brands may require custom wiring.

GETTING HELP

The LMF-400 is in wide use, and there are many places to get answers. Look first to forums like TheHullTruth.com, where many boaters have posted about their own installations—and are often available to answer questions. Lowrance also has a help desk. We had to wait, but they were helpful when we got through.

DIY



Repeat Yourself

Color Displays Offer Versatility, Easy Installation

By Dan Corcoran

It's easy to like Raymarine's ST-70 color display when viewed in slick magazine advertisements. But it was also easy to dismiss it, as I originally did, believing it would be an oddball in my cockpit unless I replaced all my displays.

I was wrong. Not only did the colorful ST-70 blend among my black-and-white instruments, but it was a good functional addition that was reasonably affordable (the ST-70 can be found on sale for about \$650) and easy to install.

Repeater units like this—full color and full function—have caught on in recent years, offering an economical way for captain and crew to access more information instantly. I chose the ST-70 because I use Raymarine gear, but most major manufacturers have similar products.

The real beauty of the display isn't the color screen. Rather, the utility comes in a graphical, configurable, multipurpose machine that combines sensor data and can be positioned strategically in your cockpit or dash. This allows my crew and me to get instant feedback on performance as we adjust sail trim. It also allows me to move information formerly crowded into my chartplotter, freeing up screen space.

The key to getting your money's worth is to learn what the machine can do, set it up correctly and then use it to its potential.

SIMPLE INSTALLATION

The ST-70 is a square unit with a 3.5-inch screen, and is capable of displaying anything from depth and speed to navigation and engine data.

Installing a repeater box like this means making a cutout, mounting and wiring the unit to the network that carries the data it will display. While the ST-70 is designed to support NMEA-2000 protocol, you can also plug it into the Raymarine's proprietary SeaTalk network with an adapter that

Dan Corcoran is a freelance writer. He cruises and races a 39-foot Beneteau.



is included.

On my boat, a Beneteau 393, I was replacing an ST-60, the black-and-white predecessor to the ST-70. Both units had essentially the same footprint. This made it a drop-in replacement, with a couple of caveats. The two small holes for securing the new unit did not match the old (the larger hole aligns perfectly), so I had to drill new ones. The ST-70 also has only one SeaTalk port, while the old one had two. That means adding new units down the road might require some custom wiring.

Overall, it was a simple installation, but the difference could be seen immediately. The ST-70 was brighter and viewable from wider angles—and with less glare—than my old box.

MORE FUNCTION

The increased function was immediately evident, too. The ST-70 can display eight different pages, or views, which you can select at the press of a button. You can also alternate them in a loop. Each page can include up to six sensor readings simultaneously, though choosing fewer causes some to appear larger.

I have my ST-70 installed at the head of my cockpit programmed with seven pages, which I alternate depending on how I am using the boat. For example, the first page is the “harbor page,” with includes an extra large indication of depth. The next page is my “amateur at the helm” page,

which I use to keep an eye on heading, depth, compass and speed when raw crew are helping at the wheel. Another page is setup to provide a wind repeater, taking advantage of nifty features not found on my wind display (like a minimum/maximum wind angle that auto resets each time you tack).

I also have a screen for racing, which shows compass, true wind angle and boat speed. These can be compared with a plastic chart of target boat speeds I keep handy, to judge if sail trim is correct. I also have a screen for wind information in different formats, including a graph, so I can see trends before I leave the dock.

Because Raymarine built the ST-70 with the ability to accept software upgrades, I suspect we'll see additional function ahead. One I'd like to see is the time to go (TTG) for the entire route programmed in the chartplotter. A display like that could eliminate the friction when my daughter asks, “When are we going to get there?”

Still, even without upgrades, this is a lot of versatility for a simple afternoon installation. The unit fit right into my existing network and blends well aesthetically with my other displays, after separately purchasing a plastic sun cover for an ST-60 display. In short, there's no need to dream of a future suite of cockpit displays lined up one after the other. Adding a repeater with multifunction capability can place all that data at your disposal—and add a little color to the cockpit, too. **DIY**

Ask the Expert

by Roger Marshall

Shaft Problems. A Battery Upgrade. Our Expert Weighs In.

We have a trawler with three battery banks, and it is time to replace them. Our fridge bank is made up of six 6-volt golf cart batteries; the house bank is four 6-volt batteries and the starter bank is two 12-volt cranking batteries. Are the 6-volt golf cart batteries the best way to go, or should I replace them with 12v deep cycle batteries? We plan on using our trawler offshore and charging with our generator.

— Rod Christie

It depends if you have any 6-volt items on the boat. While you were using 6-volt batteries you may have acquired electrical gear that runs on 6v. If this is true, use 6-volt batteries.

If you decide to switch, it will require some work. Golf cart batteries are small and contain a high ampere-hour rating, usually around 240 AH. You will need to get an equally high AH rating for a deep cycle battery, which usually means a larger and much heavier battery.

Deep cycle batteries are designed for a slower, longer period discharge. Engine starting batteries are designed to crank out the amps quickly to get the engine started. If a boat has both an engine starting battery and a house battery, it is best to have a deep cycle house battery and an engine starting battery. If the boat has one battery for both uses, it should have a conventional battery.

Golf cart batteries are wired in series to get 12 volts. Do not connect the deep cycle 12-volt batteries the same way. They need to be in parallel. To accommodate new batteries, you will have to rebuild your battery trays/tie down arrangements and possibly rewire the battery system to accommodate parallel connections rather than serial connections.

Whenever working with a battery installation, especially when modifying the system, refer to ABYC (American Boat & Yacht Council) standard E-10, Storage Batteries, for guidance on the requirements for safe design, wiring and installation. ABYC A-31, Battery Chargers and Inverters, is also smart reading to get the charging system and batteries into a safe interface.



Stuffing box photo provided by Dan Tadenc

I am trying to find a replacement for a stuffing box and require your guidance. This is for my sailboat, a Celestial 48-foot centre cockpit. The stuffing box assembly is attached by 1½-inch wood lugs to a wood stringer. The shaft transits through this stuffing box through a stern tube approximately six feet to the stern tube bearing, exiting the boat to a stern assembly housing the cutlass bearing. I find this a weak point since under

motor the wood lugs loosen and eventually fall out. The shaft is 1¼ inches. I am looking for the manufacturer for this unit or something better and more secure to put in its place.

— Dan Tadenc

We contacted Dan and asked him more about his problem. He said the engine moved off its mounts, forward about 2 inches, and the shaft dropped, based on a number of pre-existing conditions.

I talked to several experts about the problem as I understand it. The guys at Evolution Marine Shaft System came up with what we think is the most logical reason why there's a problem. They say that an 11-foot-by-1¼-inch shaft may not be large enough (in diameter) to prevent it from "whipping" as it rotates.

This rotation is probably moving the bearing in the middle of the shaft. If you support an 11-foot-by-1¼-inch shaft at both ends, it will bend slightly. When it is rotated at high speed, it will probably bend even more.

The solution is to install either a larger-diameter shaft or an additional bearing, and space the two bearings about a third of the way along the shaft.

ABYC standard P-6, Propeller and Shafting Systems, contains specifics about matters related to boat shafting and props. It's must-read information before undertaking any shaft modifications on a boat.

If you need more information, I suggest you talk to The Evolution Co. at 207-593-9009 or visit its Web site at www.evolutionmarine.com.

Roger Marshall is the author of 14 books and his newest book Fiberglass Boat Repairs Illustrated will be published at the end of this year by International Marine. Marshall has written extensively on boats of all sizes for magazines in most parts of the world.

The information in Ask the Expert 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.

Tech Tips

LOW BATTERY CRANK If your battery is too low to start the engine, here is a simple trick that may get you going.

Run a set of jumper cables from the battery terminals to the engine and the starter, in parallel with the battery leads. This doubles the pathway through which current can flow and halves the resistance.

Make sure you know where to connect to the positive lead on the starter, and connect the negative lead to the block. Then crank the engine.

If the battery is dead, this is not going to work (don't even try). But if it is merely low, it might get you moving.

CLEAN WATER TANK If it's time to address your freshwater, follow the guidance in ABYC H-23, Potable Water Systems, which recommends the following timeless process for decontaminating a system. Perform the steps listed below in the order indicated:

- a. Flush entire system thoroughly with potable water.
- b. Drain system completely (lines, pumps, tanks, including water heater).
- c. Fill entire system with a chlorine solution having a strength of at least 100 parts per million, and allow the solution to stand for one hour. (Shorter periods require greater

concentrations of chlorine solution. See examples in table that follows.)

d. Drain chlorine solution from entire system.

e. Flush entire system thoroughly with potable water again.

f. Fill system with potable water.

If your water tanks are old and have not been cleaned in awhile, one expert suggests dumping several inches of ice cubes into the empty tank and then adding a little water to allow the ice to slide around (but not so much that the ice floats). Running the boat in choppy waters will cause the ice to slosh and scour the insides of the tank walls. This might work to loosen "crud" and mineral deposits—just make sure you do it before you sanitize the potable water system.

Solution in gallons	Liquid Sodium Hypochlorite (1%) in quarts
10	0.4 (½ gallon)
20	0.8 (¼ gallon)
100	4.0

Examples shown are taken from the Handbook on Sanitation of Vessel Water Points, Public Health Service Publication No. 274 - Reprinted June 1963.

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WORKABLE WORKBENCH Many new boats have a workbench built right in, a nod to the idea that maintenance and projects deserve a place of their own. But if you don't have a new boat, you have to get creative.

One solution is to look at projection tables, small portable metal tables designed for corporate presentations. Most fold to the size of a briefcase and are adjustable—perfect for use onboard.

The model pictured here is a Quartet, with a 23-by-13-inch top and legs that extend from 21 to 38 inches. We've used it for everything from sewing to chopping aluminum with a cutting wheel. Place it on a piece of carpet to minimize wobbling, and it works extremely well.

The Quartet costs about \$125, but we've seen tables on eBay for far less. Don't expect stainless steel. Rather, lay a coat of car wax on the metal and store it in the cabin when not in use. If you really want to get fancy, you can top it with plywood or Starboard—or even add a small vice. **DIY**





10

FREE PROJECTS FOR YOUR BOAT

*Upgrading Your Boat for Free Requires a Certain Mind-set.
Here are 10 Projects to Get You Started.*

By Lenny Rudow

The fuel money is burned, your bait bank is bust and the boat improvement fund dried up long ago. Don't worry, a lot of us are in the same predicament. Luckily, winter is upon us, and it can be a great time to save money by taking on projects yourself.

What you need is a list of improvements that can be made on the cheap—as in free. Sure, you can clear lockers and clean dingy places. But we are talking upgrades: either adding new capabilities, expanding or improving what you have, or restoring a piece of gear to near its original condition.

The truth is that there is plenty you can do for your boat, with little or no money. But you do have to be creative—doing things for free requires a certain mind-set. What follows are 10 projects that you can do for almost no money, if you are willing to work hard. They are designed to stoke your creativity and get you thinking—and working.

Sure, you may have to scrounge some parts or borrow an item. And we assume you have basic tools and supplies. But most can be done for no more cash than you have sitting in the couch cushions right now, and nothing here should cost more than \$50. Considering the cost of boating these days, that *is* free.

1

PROFITABLE MERGER: VHF AND GPS

You may not be able to afford a new radio or GPS, but you can certainly afford to interface the units you have and get that DSC (digital select calling) feature up and running. This allows the Coast Guard to know your vessel information and exact position when you make a distress call—a nice margin of safety.

If your VHF is less than five years old, it almost certainly has DSC and will interface with any NMEA 0183-compliant GPS unit. That includes the vast majority of those made during the same time period, so unless you're cruising around on ancient electronics, this is a project you can tackle without purchasing any new gear.

Interfacing a NMEA 0183 GPS and VHF is usually as easy as attaching the output of one to the input of the other, though if they're made by different manufacturers the plug ends may not match and you'll have to splice the color-coded wires together. If you need some instruction, check the manuals (many are now available online), talk to a dealer or post on an online forum. In a few cases, you may also have to enter the GPS menu and "tell" the unit to send out the data stream.

One new thing you will have to get, however, is an MMSI (Maritime Mobile Service Identity) number. Luckily, it's the same price as air. All you have to do is go to www.boatus.com/mmsi and follow the links. They'll assign you a number for free, and you can program it into your VHF in a matter of moments.

While You're At It: *If you have an EPIRB, check that it is registered correctly according to Coast Guard instructions. Improper registration can delay distress calls.*

3

NEW LIFE FOR OLD LINES

Your anchor rode and dock lines may be old and stiff, but replacing them would cost a pile of dough. Luckily, you can breathe

new life into these lines by following some simple procedures.

Fill a 5-gallon bucket three-quarters full with warm water, and add 1 cup of fabric softener. Then coil your line into the bucket, and let it soak for several hours. Allow the line to dry in a cool, well-ventilated area that is not in direct sunlight, and it'll come out as pliable and soft as it was new.

While you are treating the lines, it is a good time to check your anchor chain for rust and weak points. For dock lines, check the ends for fraying. If they need work and you have the materials, whip them properly. If not, tape and burn them—or cinch up a wire tie, in a pinch.

While You're At It: *Make sure your anchor rode is properly tied off at the end—and maybe even clean the anchor locker.*

2

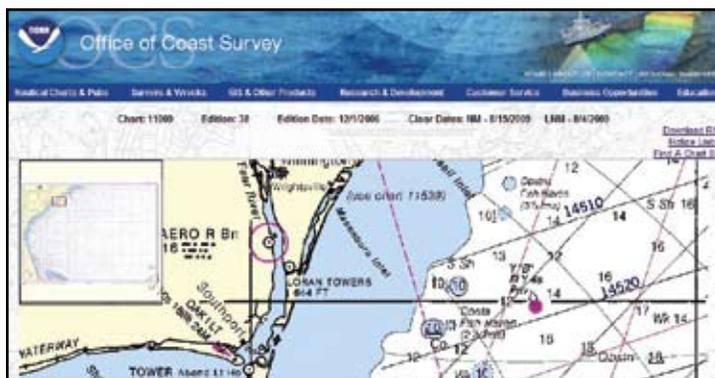
FREE ACQUISITION: CHARTS AND SOFTWARE

Most of us have a laptop and some way to access the Internet (free WiFi is still out there), and that means you can beef up your nav station substantially.

NOAA makes electronic charts available for free, and many companies offer free PC-based navigation software. Combine the two, and you have a computer-based charting system that will allow you to plan trips from home in great detail, then bring the computer onboard to augment your plotter. You may have some learning to do and it won't always be easy, but you can set up a fairly sophisticated system at almost no cost. For detailed reading material, go to www.madmariner.com/echarts, but here are the highlights.

For charts, head to the NOAA site (www.nauticalcharts.noaa.gov), where the government gives away raster and vector charts for U.S. waters. You will need software to read these charts, and you have a few options. Many commercial software companies release free demo software, which is usually a stripped-down version of their paid product (some have time limits, too). You can cruise on these for awhile and try different types. Consider it research for days ahead, when you have a few bucks to buy one.

There are also software products that are free by design. Sea Clear II will allow you to set waypoints, create tracks, plan routes and do a lot more. If you simply want to look at a chart,



Caris Easy View will do the job. One caveat: most full-featured navigation software requires connecting a GPS to your computer—and that will cost you (though perhaps not too much). You can tee into your existing unit with an adaptor, or buy a GPS that plugs into a USB port. Both are less than \$50.

Remember, too, that a computer onboard provides resources. You can access Google Earth for satellite images, visit Active-Captain.com to get advice from other cruisers and get all kinds of weather data—the list is endless. And it's almost all free.

While You're At It: *You can modernize chartplotters and other electronics by obtaining the latest factory software upgrades. Most are offered free on the manufacturer's Web site, and some represent substantial improvements. Just follow the instructions.*

4

SERVICE YOUR WINDLASS

Servicing the windlass is a job that gets neglected—but it is cheap and easy to do and can be done with tools and materials that are readily available.

In most cases, all this involves is pulling the unit apart, cleaning the parts, applying some lubricant and reassembling. Because every unit is different, you'll want to dig out the manual or download it from the

manufacturer's Web site. That will tell you how to disassemble it, which type of lubricant to use and where to put it.

While you are at it, you can inspect the mounting for signs of stress and the electrical connections for corrosion. You can exercise moving parts, such as clutches and brakes, and make sure all is in working order.

The whole thing should take about an hour—and it's time well spent. After all, this is the machine that does the heavy lifting.

5

CARE FOR YOUR CANVAS

Is your canvas top or sail covers old and dingy looking? You can actually wash canvas in a regular washing machine, so

take it off the boat and head for the laundry room (this is where those coins from the couch come in).

But remember: Set the machine to use cold water. Wash canvas in hot water, and you'll cause wrinkling and shrinking—and it will be tough to get back on. Also, add only a small amount of detergent—something gentle, like Dreft—or you'll degrade the fabric.

After drying, be sure to spray the canvas with silicon water repellent or it may leak. If you don't have any lying around, it's worth a few bucks. Another good idea is to grab an old candle and run it over zippers and snaps to keep them from sticking.

If you have tears or fraying, this is a good time to stitch them, or have someone you know do it (this is a favor most of us can cash in). Do it before you wash, to avoid further damage.

***While You're At It:** Grab that candle and rub the runners on the galley drawers. It keeps them from sticking.*



6

SEW IT ALL UP

Speaking of canvas, have you got any extra? Or can you scrounge some? If so, you can make a gear bag.

To make a 6-inch-by-14-inch bag, all you need is a single piece of 28-inch canvas or sailcloth. Go to www.frayedknotarts.com/files/dittybagbox.html, and you'll

find basic patterns and instructions.

Making a ditty bag is the traditional way to teach boaters how to sew—and it's a great skill to learn. Even better, it's a no-cost proposition. You probably know someone who sews, and you can impose upon that person for tutelage, materials—even a machine (think Singer, not Sailrite).

From there, it's a matter of practice.

The Art of Free

The (Free) Hardware Store

When pursuing free upgrades, the trash bin at your local boatyard can be a hidden trove of parts and materials—and the price is always right.

Target wealthy facilities and be sure not to trespass. Stories abound of boaters discovering hardware, line, fine pieces of wood—even electronics.

Don't believe it?

Read one sailor's very convincing account of all the loot he has found:

www.madmariner.com/dumpster

7

HELP OUT YOUR HEAD

The head is one marine system that doesn't get much love—

until things go badly. Here's an upgrade you may not have thought of: venting the holding tank properly.

Without good venting, anaerobic bacteria (which need an airless environment) will thrive while aerobic bacteria (which need air) won't. And it's the anaerobic bacteria that make the head stink. Unfortunately, many builders install a vent line large enough only to allow for pumping out the tank without collapsing it.

You'll want to increase the vent line to one at least an inch in diameter. It is true that the hose, fittings and clamps will cost a few bucks. But if you can't afford 5 feet of 1-inch hose, your problems are far bigger than a smelly boat. Measure what you have before you go to the supply store, so you know what fittings you'll need and how much hose to buy. It's tempting to salvage the rusty old hose clamps, but don't do it. These are connections you do not want to fail, or you could end up with a sewage emergency—not pretty.

Run the line to the vent as short, straight and level as possible. Eliminate sags, arches and bends, and check the rest of the plumbing, too. These can cause sewage to sit in the lines and give anaerobic bacteria another place to live—eliminate them, wherever possible.

While You're At It: *You can help avoid problems by flushing the lines with fresh water, and then lubricating the system with head lube or some mineral oil from your home kitchen. Pour it in and pump it through to keep the rubber parts supple.*



8

A PRETTY SLICK TRICK

If you're looking for a performance upgrade that costs next to nothing, and if your boat has bottom paint, grab some sandpaper and get ready to expend some elbow grease.

Actually, you'll need two different grit sandpapers, 220 and 400. Start with the 220-grit paper. Soak it in water, then lightly sand the bottom of your boat, making each and every stroke parallel to the centerline. Repeat the process with 400-grit paper to smooth out any bumps or imperfections you find. Be sure to sand the bumps, not to chip them off, or you could end up with some uncovered bottom. And remember, this is "light" sanding. The idea is to make the coating of paint smooth, not to remove it.

It's no easy job. But on most boats, this treatment will add 1 to 1.5 mph to your cruising speed and top-end.

9

BED DOWN YOUR BOAT

When's the last time you re-bedded your hardware? This is no small task, but the benefits can be huge. All you'll need is a tube of 3M's 4200 from your workbench (or you can buy it for less than \$10) and a whole lot of time and patience.

Choose a piece of hardware, unbolt it and scrape off the old bedding. If your fasteners or backings are corroded, this is a good time to clean them, using a wire wheel on a drill or bench grinder to knock the rust off (if they are really bad, replace them—it's worth the money). Then, reseal it—don't be stingy with the goop—and tighten it three-quarters tight. Clean up the mess, and move to the next piece of hardware. Let them all dry thoroughly and then come back and tighten them up.

This will be time-consuming but will help prevent water intrusion, stress cracking and freeze damage. Warning: You will almost certainly get frustrated, defeated by a stripped this or an out-of-reach that. Relax and go slowly. This is one job you want to finish if you start.

While You're At It: *Swipe some petroleum jelly from your bathroom at home and wipe down the seals on your hatches. It will prevent cracking.*

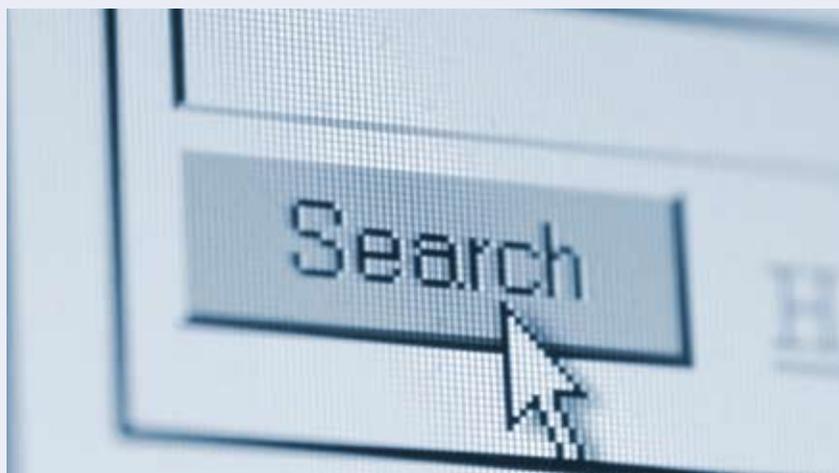
Scour With Power

To upgrade your boat on the cheap, you need an online strategy. It has never been easier to scour for bargains—even freebies—if you know where and how to look.

Start with a list of tools, materials and gear you need, then regularly check Web sites that may provide them. The sites will vary depending on what you want, but there are some obvious targets.

Freecycle.org, for example, lists items available for free. In water towns like Annapolis, you'll see boat materials—or even entire boats. Craigslist.com also lists free items in many cities.

If you are willing to settle for low cost over no cost, the world opens up. Boating suppliers like Sailorman.com and BaconSails.com sell used gear (though they know what it is worth). Charityboatsales.org rou-



tinely auctions boats for a few hundred dollars—cheap enough to carve up for parts.

The granddaddy, of course, is eBay. The auction site is so large that you can reasonably expect to find very specific items, and many people are just getting rid of stuff, as opposed to pros selling their wares (though there

are plenty of those, too). Either way, you have to know how to compete.

Read how one DIY boater bought sails, rigging, safety gear, plumbing and electrical parts, a life raft, an outboard—even a small sailboat—and saved thousands of dollars:

www.madmariner.com/ebay

10

UPGRADE YOURSELF

If you are simply not in a position to work on the boat—perhaps you live in one of those truly frigid climates—maybe you can upgrade the crew who runs it. Make the captain and crew smarter, and by

definition you have made the vessel safer.

There are many ways to do this, whether it is reading up on skills, learning the systems on your boat or scoping out future projects.

Start with books, which are easy to obtain for free by borrowing from friends or hitting the local library. Reading up on heavy weather handling, diesel mechanics or any system you have interest in is time well spent. Manuals are another great source. Let's be honest: We all have something on our boat that we don't quite understand. Locate the manual, or pull one from the dealer's Web site, and have at it. The same can be said of other documents surrounding your boat, such as your insurance policy or your marina agreement. They are not exactly page turners, but they do contain important information that you

should probably know.

Classes may cost money, but conversation does not. Chatting up the local rigger or mechanic—or even watching them work—can increase your knowledge dramatically. So can time spent with sales people or factory reps. Boat shows are a great place to connect with people like this, get product demonstrations and even get aboard boats and see how things are put together—all for very little money. In fact, you can sometimes scrounge free tickets. Local dealerships often get a handful to dispense to customers, so before you buy a ticket check with the guy who sold you the boat.

Many marine professionals will spend large amounts of their time—complete with demonstrations—if they think you might someday be a buyer or a client. Don't abuse their hospitality. Be honest about your intentions—and don't be surprised if they help anyway. Most are boaters themselves—and we all understand the value of a freebie. **DIY**

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.



Raymarine Depth Sounder

DEPTH 4.9

Raymarine AIS

AUTO 359
H 359.9
P 2°

Raymarine AIS

26 29 317
82 00 773

Raymarine Chartplotter

26° 29.317' N
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Life on Auto

How to Choose an Autopilot Drive Unit, Control Head, Heading Sensor and All the Rest

By Lenny Rudow

I never thought I needed an autopilot until I had one.

If you've never captained a boat equipped with an autopilot, you simply don't know what you're missing. The benefits are huge: no more manipulating the wheel for hours at a time; straight line steering saves time and fuel; distractions don't lead to wandering course lines; trollers can fish and steer at the same time; your hands are freed for additional tasks; and back problems arising from hunching over the wheel or being stuck in the same sitting position for hours are history.

Of course, there are pluses and minuses to everything. You still have to maintain a watch at the wheel. There will be times, like transiting heavy traffic lanes, when an autopilot isn't useful at all. And yes, an autopilot can get you into trouble if you fail to use it properly.

Yet many boaters consider an autopilot as essential piece of safety equipment, like having a full-time crew member who does nothing but steer—and is very, very good at it (and never ever complains). The technology has also matured so that many units are now rich with features and priced more reasonably.

Though an autopilot will no doubt making cruising more enjoyable, you will face one big problem even before you begin an installation: figuring out which automaton belongs on your boat is a serious challenge. But as you will see, a little methodology goes a long way.

THE SYSTEM

The vast majority of autopilots consist of several different units working in conjunction. The first part of the system is the muscle power, the drive unit. The



GARMIN/Garmin's GHP-10 autopilot.

brawn needs a brain to control it and this is achieved courtesy the second component of the system, the control head. In some cases, the control head will be a single unit and in others it will be split between a black-box unit that mounts out of sight and a dash-mounted control panel. The third main component of the system is the electronic eyes. The brain can't tell the brawn what to do unless it knows where you are going, and that's what the heading or compass sensor, rate compass and rate gyros do.

Naturally, there are some other pieces and parts to the system. Many require a rudder feedback sensor, which tells the brain where the rudder or drive unit is at any given time. Some network with your GPS (most are NMEA 0183 or NMEA 2000 compliant, in these cases). Some also have optional wireless remotes, so you can steer from anywhere on the boat.

THE BRAIN

When choosing which unit to install on your boat, make the judgment based on the size of the drive unit. Once you have the meat of the package nailed down, you can work on matching the brains and eyes.

In the case of a relatively small sailboat, your unit's muscle can be as simple as a "linear arm," which pushes and pulls a tiller from side to side. Be careful, though. Most of these units are rated for light craft up to 10,000 or 15,000 pounds. Plus, their on-deck location means they are often subjected to salt spray and weather.

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.

If you have a boat with hydraulic steering, you're in luck, because choosing the proper drive unit is as simple as matching the pump size to the size of the steering arm cylinder. The cubic inch displacement of the cylinder is the key factor, and the autopilot manufacturers will list each unit's capabilities to match it.

For example, let's look at an inboard boat with a hydraulic steering system that displaces 16 cubic inches. Now say you want to add a Simrad AP24. Two versions are available, one for hydraulic steering systems that displace up to 11 cubic inches and another for units that displace up to 22 cubic inches. You'll have to opt for the beefier version, which includes the RPU 160 drive unit and the AC42 computer. The price difference? More than \$500.

If your boat has a mechanical steering system, it may be a bit tougher to figure out exactly how much muscle you need. A lot of autopilots simply aren't made with mechanical options. Those that are commonly come in size ratings according to the boat's displacement. Raymarine's Smartpilot kits, for example, go up in 10,000-pound displacement increments. As long as your vessel fits the parameters it will work fine, but make sure you consider your boat's fully loaded wet weight, with full fuel and water tanks, gear and people aboard. If you're not 100 percent sure a drive unit will make the grade, go for a larger one. If it's close, say the au-

topilot is rated to handle a boat with up to 20,000 pounds of displacement, and your boat is 19,000 fully loaded, you'd be well advised to go for the larger unit. In fact, if you're even considering upgrading the unit, do so. You won't likely regret it.

THE BRAIN

Once you know what type of drive unit you need, picking out its brain will be a lot simpler—in many cases, you can simply choose the package that fits. When purchasing that Smartpilot, for example, if you narrow your needs down to a

14-cubic-inch displacement hydraulic ram, then the Smartpilot kit that matches comes with Raymarine's X-30 Core Pack (a course computer designed to work with the ram, which includes a fluxgate compass sensor and a rotary rudder transducer). Using a kit like this kills two birds with one stone, because it includes the fluxgate compass your system needs for its "eyes." Since this is a below-deck brain, however, you'll need a separate control display for the dash. Again, Raymarine makes it an easy choice by including one in the kit.

Which you choose will affect the kit's pricing, but all of the ST series controllers include plenty of features to get you steering without your hands.

Some manufacturers, like Garmin, take the individual-parts approach as well as the package deal. Go with Garmin's GHP-10 and you can choose from a range of different systems and/or kits. It won't be

Manufacturers won't want to admit it, but most of the autopilots out there have most of the functions you may ever want or need.

terribly difficult to choose, however, because a PDF on Garmin's web site details what you need to accommodate different engines and steering systems, allowing you to create a highly customized system. With an NMEA 0183 interface, you can even design it to do complex functions like tying into the chartplotter's nav and overlay screens.

Though your judgment should first be based on the size of your hydraulic system's cubic inch displacement, or the boat's displacement for mechanical systems, there are also other factors to consider.

Although the majority of the autopilots out there do stand alone—Furuno, Si-TeX, Northstar and others all make units—matching your current electronics system is always a good move. That will allow you to interface the systems more easily, gaining advantages like navigating via GPS to go to waypoints, MOB marks or along multi-leg routes.

You should also look for a control head that is easy and convenient to use. Furuno's Navpilot 520, for example, is a corded control head that

has a 3.3-inch-by-3.3-inch LCD display, allowing you to kick back in the helm seat and steer with your fingertips. Wireless controls, offered by Simrad, Raymarine and Garmin, are also incredibly convenient, as an add-on. For small boat owners, wireless won't offer much advantage—but it will add complexity to the system. If you have a single helm station and an easy-to-reach dash, consider a simple display and control; you'll save both money and installation time.

THE EYES

Once you know the strength and intelligence requirements of your system and have picked out a control system, you may want to consider upgrading your system's eyes.

One of the least understood and most under-appreciated parts of your autopilot is its heading sensor. Most of the kits on the market include functional, but relatively low-grade, heading sensors. Upgrade yours to a digital fluxgate heading sensor

like KVH's Autocomp 1000, and your system will be able to automatically compensate for heel and rolling. It also allows for complex features like automatic heading compensation to GPS chartplotters, radar and computers, so long as they're NMEA 0183 compatible.

Another choice would be Maretron's solid-state electronic rate gyro compass, the SSC200, which is both NMEA 0183 and NMEA 2000 compatible. This unit claims better than one-degree accuracy even during 45-degrees of roll or pitch, and it updates heading info 10 times per second.

Upgrades in the system's heading sensor are worth considering because an autopilot has a hard time dealing with the same problems that confront you and I when we are at the wheel. Big seas shove us off course. A strong heel, set and drift, crosswind, or increased rudder deflection

caused by these problems, all add up to less stable course lines. But high-quality heading sensors can account for some of these issues and will make your autopilot more accurate. In many cases, installing a high-end sensor like those mentioned above can make the difference between S-curves and zigzags and a straight line.

Another upgrade worth considering is going to a unit with virtual rudder feedback, eliminating the need for a separate rudder feedback sensor. Though the ultimate function is the same, fewer parts mean less chance of failure at any give time, plus a less-complex installation.

Display is another upgrade opportunity. Color displays, a relatively new development in autopilots, are now available from Northstar and Raymarine. But the primary upgrade most folks will want to consider is simply going bigger. Larger display units mean you can easily read the larger digits from father away—a nice feature if you have to leave the helm.

COMPLEX FUNCTION

Though the autopilot manu-



Furuno

facturers won't want to admit it, the truth of the matter is that most of the autopilots out there have most of the functions you may ever want or need. The exceptions are tiller pilots. These tend to be a bit simpler in the brain department. Autopilots made for powerboats, however, are expected to handle a wider range of more complex functions.

Those used by anglers, for example, often have a way for trollers to go in a pattern other than a straight line, without losing sight of their overall course. Raymarine's Smartpilot addresses this need with a programmable fishing pattern function. Simrad's AP units feature depth contour tracking features, and zigzag patterns. Furuno's NavPilot and Garmin's TR-1 both have cloverleaf, orbiting and spiraling patterns to assist you in your search for fish.

The bottom line? Once you determine which manufacturers make a unit that has the brains and brawn to appropriately steer your boat, look to usability, ease of installation and the ability to interface with the electronics you already have onboard. Choose the right unit and have it properly installed, and one thing's for sure: You'll feel like it's your best friend—except that it never complains. **DIY**



Raymarine



SIMRAD/ Simrad AP28

Projects

Lifelines | Bathroom Anchor Flaker | Fuel Polishing

New Lease on Lifelines

If Your Lines Are Going, Don't Wait to Replace Them

By Charles Husick

Most sailboats are equipped with lifelines, usually vinyl-coated stranded stainless steel wire, and regardless of how well they are made, they will eventually have to be replaced. Obviously, this isn't a project to delay—the life you save may be your own.

As with most maintenance projects, there are two ways to go: You can have new ones made at a rigging shop or do it yourself, which can be done with some careful planning, a few hundred dollars in parts and a couple hours of work.

Whatever you do, you will need to know the diameter of the existing lines— $\frac{1}{8}$ -inch and $\frac{3}{16}$ -inch are the most common—and decide if you want the new lines to be bare wire or encased in vinyl.

The choice is yours, unless you plan to race your sailboat in an event sponsored by the International Sailing Federation (ISAF) or the Offshore Racing Council (ORC), both of which prohibit the use of coated wire. That's because vinyl coating can trap moisture and create an oxygen-depleted environment, which may cause the "stainless" steel wire to corrode, reducing its strength. You can use coated wire and still be safe; just keep a close watch on the vinyl covering for signs of rust at a cut or abrasion, especially near the end fittings.

To build your own, you will need a few tools: a shear or another means for making a clean cut in the tough wire; a crimping tool made by the same company that makes the fittings to be crimped; and a quality wrench that precisely fits the bolts on the crimping tool. If you use vinyl, you'll also need a sharp knife to cut away the covering and a short

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

Projects

rings that attach the lifeline fittings to the welded rings on the boat's pulpits and stanchions. The new fittings came with these parts, but you can never have too many on board.

The next step was cutting the new wire and crimping on the end fittings.

CUTTING AND JOINING

A note about swaging and crimping: while a machine-swaged fitting will provide the greatest strength, a properly done hand crimp will provide 65 to 70 percent of the strength, with a breaking strength of about 3,700 pounds for $\frac{3}{16}$ -inch stainless wire.

The end fittings I chose use closed cylindrical rigging screws (turnbuckles) that are locked in place with jam nuts. Chrome-plated, forged bronze, open-body turnbuckles locked with wire locking rings are also an option.

To join the cable to end fittings, the cable must be cut straight. Making a clean, 90-degree cut in the lifeline is best done using one of the special cable cutters sold by Johnson and other companies, but we decided to try cutting the cable with a cut-off disc in our Dremel tool. The disc sliced through the wire easily, leaving the clean and square end required for the fitting. Wear safety glasses when working with the fragile cutoff discs, which can fracture and send pieces flying off in all directions. (Figure 1)

The Johnson products are packaged on cards with instructions printed on the back. Following the instructions, the vinyl covering on the wire was cut back $1\frac{1}{16}$ inches from the end. The first try at removing the covering proved how well the vinyl is bonded to the wire. Use a very sharp knife with the cable held down against a flat surface.

The wire was test fitted into the end of the fitting, and it was just the right length. The fitting was very lightly clamped in the large hole in the tool with the chamfered side of the hole upward. (Figure 2) The stripped end of the lifeline wire was inserted into the fitting (Figure 3) and the process of tightening the two clamp bolts began.

It takes only a few minutes to tighten the bolts to the point where the tool's die blocks are firmly in contact with one another. (Figure 4) There won't be any doubt about when the tool's jaws are fully closed.

Figure 2



Figure 3



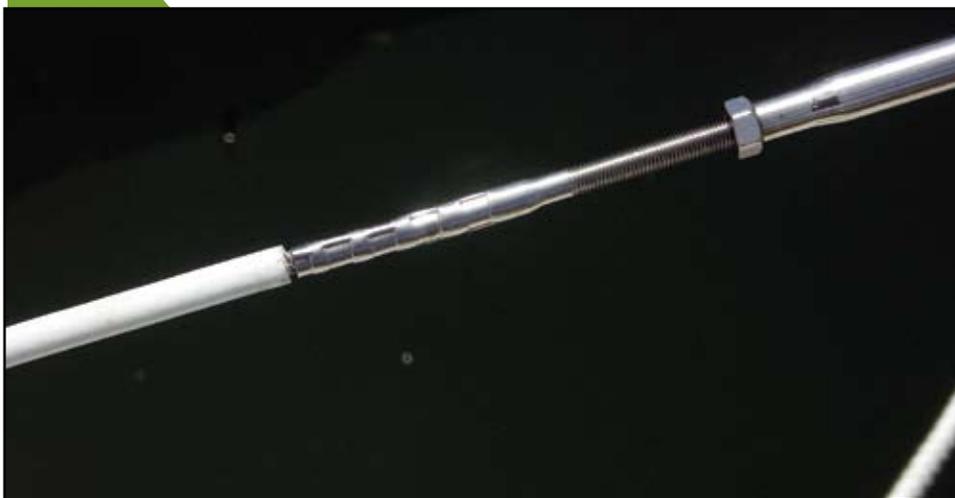
Figure 4



Completed



Installed



The force needed to turn the bolts will become more than you can exert.

A quick counterclockwise turn of the two clamp bolts and the fitting and wire will be loose from the tool. You can then repeat the process until five crimps have been completed. Apply the crimps in a line, and do not rotate the fitting. On my boat there were 19 more fittings waiting to be swaged in place. It was good exercise, if a bit repetitious.

With the end fittings in place, all that was left was adjustment. The fittings have an adjustment range of 3 inches, more than enough to achieve the desired tension in the finished lifelines. Offshore racing rules recommend that the lifeline deflect no more than 50 mm (2 inches) when a force of 5 kg (11.2 pounds) is applied to the middle of a length of lifeline.

All told, the project took about three hours to complete. **DIY**

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The Anchor Flaker

A Simple Project Ensures That the Chain Lays Properly

By Harry Hungate

We have been living aboard our Corbin 39 cutter *Cormorant* for more than a decade, but it was in the early years, after a sail from the U.S. to New Zealand, that we realized we had to solve a problem recovering our anchor chain—before our good luck ran out.

After recovering 50 feet or so, the chain would simply bunch up and stop feeding into the chain locker. The only remedy was to leave the helm, dash below to the vee-berth, lift the mattress, open the locker and pull the chain aft. This was bad enough under good conditions, but in a tight anchorage or in adverse conditions it was simply too risky.

During a major refit in New Zealand, we enlarged our chain locker to move the chain further aft and modified the chain pipe from the windlass. The result was a locker that was larger and placed well, but the repositioned chain pipe had a curve that was almost horizontal near the exit point.

After three weeks of trying to get the chain to feed properly into the locker—and nearing despair—we finally hit upon a low-tech, highly reliable device that flakes chain inside the locker almost perfectly. It is so simple that must have been thought of before—but so elegant that it's a project worth noting.

THE ANCHOR FLAKER

The device is made up of a 16-inch square board, which we cut from an old fiberglass water tank (plywood would work just as well); about 5 feet of 1-inch diameter stainless steel tubing, which we cut into pieces; and some rail hardware, including two “T” shapes and two handrail fittings.

The tubing was used to suspend the board from the ceiling of the chain locker,

Harry Hungate and his wife, Jane Lothrop, live aboard their Corbin 39 cutter Cormorant. They are cruised along the western coasts of Malaysia and Thailand in 2008.



Photos by Harry Hungate

With a little ingenuity, the author created a chain flaker out of 1-inch diameter steel tubing, rail hardware, a fiberglass board and a piece of rope. The board is suspended from the ceiling of the chain locker and helps direct the chain, which was previously getting jammed when pulling up the anchor. Below, you can see the anchor locker full (left) and empty of chain.



just forward of and centered on the chain pipe outlet, allowing it to swing freely against the hanging chain and flake it as the windlass pulls it up.

To assemble the device, we cut three pieces of tubing: one piece 24 inches long to serve as what we called the “axle” and two pieces 14 inches long that we called

the “uprights.” No welding was required, just a hacksaw or tubing cutter. We mounted the uprights to the board and connected them to the “T” fittings, which became hinges. These swung the entire assembly on the axle, which was mounted using the handrail fittings. Two hose clamps on the axle, one on each side of the board, keep

it centered on the chain pipe. The tubing was drilled for 3/16-inch bolts and we used self-locking nuts with an application of Loc-tite to assemble all of the pieces.

We then drilled a hole in the bottom corner of the board and attached a pull rope. We routed the pull rope through a hole in the chain locker bulkhead and led it as directly as possible through the cabin and to the helm.

With a little practice, a series of smart pulls on the rope while the windlass is raising the anchor will cause the flaker to lay the chain fore and aft in the locker just as evenly as any human could. There is no need to rush below to manipulate anything, and the rope is stowed below near the chain locker when not in use.

It took us the better part of a day to cut and assemble the pieces. Mostly the parts came from our "junk bin," but if purchased new, the cost would come to around \$190. This easy-to-build project has served us faithfully for more than six years. It was worth every penny. **DIY**



The author operates the anchor flaker, a simple rope-powered device that with a little practice lays chain as well as any human could.

{Projects Wanted}

If you would like to share one of your own boat-tested projects, send your articles to *DIY Projects* via e-mail or mail. Include a brief explanation and photos and/or sketches. Also, please include your mailing address, e-mail address and/or a daytime phone number. **E-mail: info@diy-boat.com**



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Counter Intuitive

A Wood-Laminated Sink Top Highlights a Bathroom Remodel

By Barry Luke

The front bathroom in our old wooden trawler, a 36-foot Grand Banks, was in need of a face lift. The original painted plywood floor was covered by a repulsive piece of carpet, and the little sink was set in a painted wood top that had seen better days.

The bath is a tiny thing so our options were pretty limited, but we made the best of what we had. The original cloth ceiling was removed and a stripped wood ceiling was added, and the painted plywood floor was covered with wood. I decided to fabricate something special for the tiny counter—a custom curved sink top of laminated wood.

Roughly 25 hours and \$100 in materials later, I had something that is both pretty and functional—and you can, too, whether you are remodeling a bathroom or some other part of the boat.

CREATING THE COUNTER

The bath is so small that leaning onto the sink for support is a given, no matter which way you are facing. So I thought curves would be better than corners. The original size of the sink top was about the most the counter could protrude into the room, and since the walls the top are mounted on are not square—it is a boat—I used the old top as my pattern.

I set the old top on a flat piece of plywood and marked out the front curve and the straight lines for the walls with wooden clamping blocks, making sure the counter would sit flush against the bathroom walls. The old top was then removed, and the surfaces were covered with blue tape to keep the new top from being glued to the template.

I made the sink top out of pine, thanks in large part to some very nice stuff with beautiful straight grain I had stacked in

Barry Luke is a weekend woodworking warrior who enjoys the never-ending battle of restoring, maintaining and upgrading his 36-foot Grands Banks.



Photos by Barry Luke

as many clamps and clamping blocks as were necessary. I cut pairs of male and female curved clamping blocks where necessary, to better support the new counter.

To bond the pieces, I used yellow exterior grade glue, which is strongest when clamped tightly. I know

my shed. I ripped strips long enough to reach from one end to the other, about an inch tall and 1/8-inch thick. It didn't take long for several of them to break. The pine was just too brittle to bend to the required radiuses, and I probably could not have picked a more difficult wood. But I had plenty, and each failure was just a fraction of a board material.

The technique that worked for me was to rip the strips very thin. I glued three strips at a time, pulling the strips tight to the template and to each other with

epoxy is better, but this would be an interior structure that would always be heavily varnished. I was good with the yellow glue on this one.

After enough of the difficult strips were glued to cover the area between the front and the sink hole, the hard part was done. I started adding wedge-shaped strips to the left and right of the sink hole to gradually swing the direction of the strips to a parallel line. The wedges were cut freehand on the table saw and cleaned up with a belt sander. The rest of the top was now easy. I

allowed the strips to be as thick as ¼ inch, with aesthetics being the only constraint, and made sure the strips ran long on both ends.

FINISH WORK

The thing looked pretty rough at first. But an hour or two with the belt sander had it all flattened out and looking better. After the belt sander came the random orbital sander, working down to about 150-grit sandpaper.

Next came the sink hole cutout. I prefer sinks hanging from the bottom, to eliminate the lip. However this meant the edge of the cutout would show. If one were good with a jigsaw and patient with a sander, the cutout could be dealt with by sawing. But I am not, so I used a big circle cut in a scrap of plywood to guide my router. Even with this method, the circle for the template had to be cut with care and sanded true or the router would not run smoothly.

Having set the circle template over the sink top, and checking things out several times, I nailed the template down to the parts of the new top that would be cut off later. Making very shallow cuts over and over, the router cut its way through the top. The final cut was so shallow that nothing exciting happened when the plug was free. After removing the circle template, I trimmed the back edges of the top with a skill saw.



The pine strips were ripped very thin, glued and clamped three at a time to prevent breaking.

Running a round over bit around the sink hole made things look better. The holes for the faucet were then drilled (if you are working away from the boat, make sure there are no obstructions to limit faucet location). Final sanding came next, which went to 220-grit sandpaper.

Three coats of Clear Penetrating Epoxy Sealer followed by the first coat of varnish on the same day ensured a good base for finishing. I have always had trouble getting good results with gloss varnish, but this project came out pretty well after five coats I reused the original stainless steel bowl, with some modifications—I drilled holes in the sink lip, allowing a drop-in bowl to be mounted under the counter.

DIY

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Portable Polisher

Clean Your Fuel Without Cleaning Out Your Wallet

By Dan Martin

I wanted a way to filter my diesel fuel without having to pay someone or press my primary filter into use. The solution was to build a portable fuel polisher that could be added when needed, then stored out of the way.

The system is simple: a Racor FG500 filter mounted on a board serves as the portable polisher; some additional plumbing on my fuel system provides a connection point for the polisher; and a DC-powered portable transfer pump from Northern Industrial Tools moves the fuel.

The total cost was about \$450, and the installation was relatively simple, though you do have to have the skill and confidence to cut into your fuel system.

I began with the plumbing, installing a T-fitting in front of the existing filter so fuel could be diverted. I ran a separate fuel line from

Dan Martin, once the holder of a 100-ton captain's license, restores and repairs boats in his free time.



Photos by Dan Martin

Seven Seas Cruising Association

What do Nigel Calder, Jimmy Cornell, and Beth Leonard have in common?
They're all members of Seven Seas Cruising Association.

With nearly 10,000 members, Seven Seas Cruising Association is the largest non-profit organization of voyaging cruisers in the world. Founded in 1952, the goals of the original founders are still the goals of SSCA today: sharing cruising information, camaraderie, and leaving a clean wake. After 50 years of launching cruising dreams our passion for cruising has stayed the same, but you'll be surprised at the extensive benefits that have been added to SSCA membership and the ease of accessing these benefits from anywhere in the world. Membership is very affordable and SSCA warmly welcomes sailors, power boaters, and dreamers who've yet to buy their boat.

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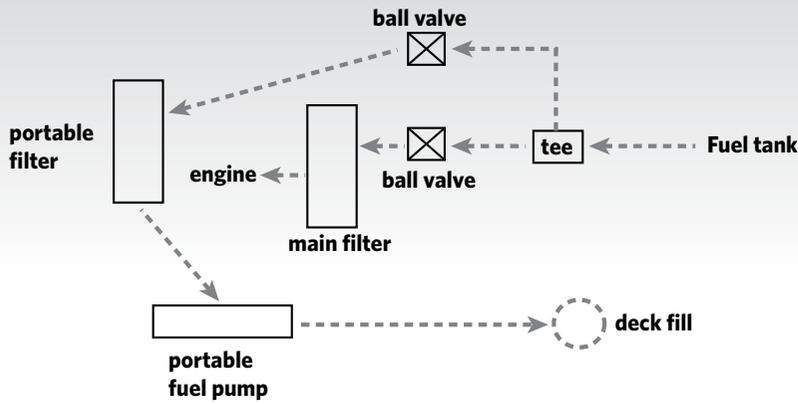
~ Nigel Calder

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the fitting to a shut-off valve, where I would add the portable polisher. I used a plug on this valve instead of a hose barb, to keep from allowing air into the system.

To polish the fuel, I remove the plug and install the hose barb, connect my portable polisher and close off the main filter using a valve already installed on my system. I then connect the pump to the output side of the portable polisher and run the other line from the pump to the

deck fill. Note that the pump comes set up for 3/4-inch fittings, which I set up for 3/8 inch to fit my fuel system. You also have to add enough hose to reach the fill. I used about 20 feet.

The result is a circular system that pulls fuel from the tank via fuel lines, runs it through the Racor and then adds it back to the tank through the deck fill. Running time will depend on the size of your fuel tank—and the condition of your fuel.

DIY

A fuel filter mounted on a board, right, makes an easy and relatively inexpensive fuel polisher that attaches to your system at the valve pictured on the left.



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Success Stories

The Home-Grown Boat Builder

Bruce Dillahunty Is Building His First Boat. A 28-Footer. In His Own Backyard.



Bruce Dillahunty spent years thinking about the boat he was going to build. His wife, Melanie, figured it was little more than a midlife fantasy. Then, in May 2007, he took the plunge and spent \$110 on plans for what would become hull number one of Mark Van Abbema's V28.

Since then, Bruce, 41, has been using his spare hours to build the river cruiser on the lawn in his Atlanta backyard. Yes, it takes up quite a bit of space, at 28 feet long with a 7-foot, 6-inch beam. No, it does not yet have a name.

Armed with some rudimentary carpentry skills, a set of basic shop tools and the resources found on the Internet as a guide, Bruce has followed the laws of trial and error to complete about half of the vessel. He is aided by his 9-year-old son, Dane, who loves to sand the hull (and Dad is grateful).

Last summer, after logging 255 hours of work on the boat, Bruce and his crew flipped the 1,500-pound hull right-side-up, a seminal moment that Dillahunty says made the project come alive.

As he put it, "It was really kind of a turning point and made me feel like I'd really got something."



Follow Bruce through hundreds of hours of work and thousands of dollars in materials. You can track his progress by visiting:

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