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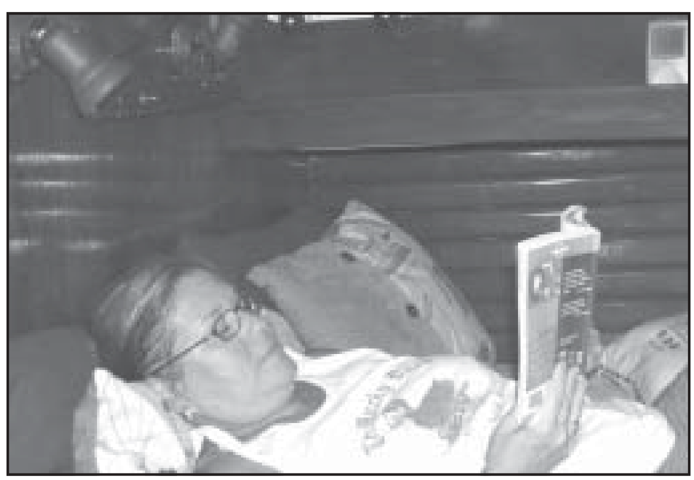

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Keeping Watch

Not so long ago we received an e-mail from a reader—Michael Shea—who shared a saga that speaks volumes about corporate responsibility and the consumer advocacy role that *PS* must play on behalf of its readers.

Shea wrote to relate his particular circumstances regarding the McMurdo EPIRB and PLB situation that we reported on in our June 1, issue (Riprap, "EPIRB Test"). After reading that piece, he contacted McMurdo via e-mail about his Precision 406 Mhz GPS EPIRB. He wanted to express his concern about the unit's GPS self-locating problems (as mentioned in that piece), and he was also seeking advice: "What action does McMurdo recommend...to ensure our safety?"

Shea and his wife frequently cruise their Morris 40 out of Long Island Sound, along with their infant son, and at the time he was planning on participating in the Newport-Bermuda Race. Safety, he told us, was his No. 1 concern.

As *PS* readers recall, findings from the independent tests conducted by the Equipped to Survive Foundation prompted West Marine (a co-sponsor of those tests) to suspend sales of two McMurdo units and offer a full refund or exchange for a comparable product. Shea had purchased his EPIRB from a smaller local chandlery; unfortunately, he wasn't getting that kind of support from his retailer. The people there told him that the unit was fine, "only the GPS portion is defective," they said. Astounded, Shea then sought assistance from McMurdo.

Via a lengthy and cordial e-mail correspondence with McMurdo's Sales and Marketing Director Kevin Robertson, Shea learned that the manufacturer would offer free software upgrades for the units in question. Robertson described this "collection and return" program as customary, something a responsible company should offer its consumers, particularly one operating in a fast-moving technological field.

With imminent sailing plans, Shea didn't want to wait for his unit to be sent out, upgraded, and returned. He had purchased a GPS-enhanced EPIRB, and that's what he intended to use, so he obtained one from a competing company and retired his McMurdo unit.

It's encouraging that McMurdo reacted to the findings of those independent tests, ostensibly, by offering free upgrades. We at *PS* are a little less sanguine about the company's insistence that the beacons worked acceptably even if the GPS aspect didn't function as promised, and even less enthusiastic that these upgrades were characterized as optional. Though McMurdo "strongly encouraged" owners of these devices to take advantage of the upgrades, the company stopped short of instituting a recall.

Safety at sea is an extremely important issue, about which there can be no compromise. We know McMurdo takes all this very seriously. Yet it's hard not to agree with Mr. Shea—a GPS-enabled EPIRB that is advertised as more accurate and having a quicker alert capability than one without this feature, should deliver on that promise. We all put immense faith in the safety devices we carry with us, and as technology evolves, that faith tends to deepen. A manufacturer building devices upon which people's lives depend carries an added responsibility.

To learn more about the status of this important issue, turn to our EPIRB update on page 34.

On another note, this issue marks the final regular contribution from Editor-at-Large Nick Nicholson, who after 25 years with *PS*, is departing to join marine industry legend Ted Hood at Portsmouth Marine, where Nick will be coordinating the development of a new line of long-range, offshore cruising boats. Fear not. Nick isn't getting off the hook that easily. His name will continue to sit on our masthead, and from time to time, his work will grace these pages. So, it's not good-bye, it's good luck.

—Dan Dickison

Practical Sailor®

Editor
Dan Dickison

Executive Editor
Dale Nouse

Editors at Large
Nick Nicholson, Doug Logan

Contributing Editors
Ken Delavigne, Richard Greenhaus, Chris Landry, Ed Lawrence, Doug Ritter, Robby Robinson, Scott Rosenthal, Rick Strand, Dan Spurr

Publisher
Timothy H. Cole

Editorial Offices
2124 Wappoo Drive
Charleston, SC 29412
practicalsailor@belvoirpubs.com

Subscription Department
800/829-9087
pracsailor@palmcoastd.com
www.practical-sailor.com - click "Subscribers Only"

Box 420235
Palm Coast, FL 32142-0235

for Canada
Box 7820 STN Main
London, Ontario N5Y 5W1

Web, Back Issues, Fax Service, Other
Customer Service
PO Box 2626
Greenwich, CT 06836-2626
800/424-7887
customer_service@belvoir.com

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Contact Mona Kornfeld, Belvoir Publications, 203/422-7343

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Sears and Co.

It is always interesting to read Where Credit is Due in *PS*. Sad to say, no credit is due to the Sears Company and their Craftsman tools. Although the company guarantees that "if a Craftsman tool fails to provide complete satisfaction, it can be returned for repair or replacement," apparently this does not extend to tools used by sailors.

My Craftsman tools were purchased two years ago, and last week when I opened the plastic molded storage box, I noticed that three Craftsman tools were severely rusted. Apparently Craftsman will not warranty its products against rusting if they are stored in a dry place on board a boat. Since your magazine has evaluated Craftsman tools in the past, I think your readers should know about this.

Martin Gruss
New York, NY

Jackline Safety

Nick Nicholson's "Trickle Down Safety" (July 1, 2004) was well done and worth a year's subscription alone, and practical for me, even though I am mostly a near-shore cruiser. Still, I have a question regarding his statement "...a piece of rope run along the deck from one end of the boat to the other is no substitute for a proper jackline."

Why won't a suitably sized (for strength) length of de-cored double braid attached to dedicated padeyes and other strong points fill the bill? After warring with webbing systems, I find a de-cored line not only lays flat, but it also is convenient to stow, quick to belay, does not flap in wind, and is easy to untie. Further, one can use tensioning knots in this system, which sometimes is desirable. I'd not classify myself as lazy, but I find the ease with which I can handle jacklines is consistent with the frequency they get put out. Considering my favorable experience with rope, I'd like to hear more explanation as to why Nick holds fast to the "tried and true."

William K. Solberg
Los Angeles, CA

[Re: "Trickledown Safety, July 1, 2004] Going forward to the foredeck under sail can be risky even in light air. You normally wear a harness and you clip on to a jackline. You typically clip on to the opposite side of the deck you plan to work on. But if you are knocked off balance by a wave and fall over the lifelines, getting back on the boat can be problematic.

In December of 2002 in the ARC, a rally for cruisers racing across the Atlantic from Las Palmas to St. Lucia, two brothers were sailing when one fell off the boat while working on the foredeck. He was hooked on to the jackline, but his brother could not get him back on board as he was being dragged by the boat. If the line is short you might be left hanging over the side like this, and there might not be enough time to attach the spare halyard and winch you up. This was a tragic event that might have been avoided if the following procedure was used:

The system is to use the spinnaker halyard or a spare halyard and a second harness line to keep you securely on the boat. First premeasure the halyard by going forward with your harness on. Adjust the length so you can move around the foredeck but when you lean over the lifeline you are prevented from falling by the halyard. Attach the halyard to the lifeline or another point so it is always ready. And adjust the length of both harness lines so you can move from side to side.

When necessary to go forward, attach the jib halyard to your harness and clip one harness line to the port jackline and one to the starboard jackline. If needed, the crew aft can then adjust the halyard as you move around the deck. With the two harness lines attached, you have three attachment points keeping you on the boat in rough seas. If you are singlehanding, using this system secures you to the boat, ensuring your safety. If the wind is light and the seas flat, using the jib halyard alone will keep you from going overboard and should allow you to move around easily.

Practicing with this redundant system while sailing in light winds will give you confidence when going forward in a rough weather.

Roger Marshutz
Via e-mail

Both Mr. Solberg and Mr. Marshutz's suggestions are interesting. Regarding the former, Nick Nicholson voiced two principal concerns about using line cover as jackline material: 1. Would a polyester line cover be strong enough and still offer the right degree of stretch that's needed in jacklines to diminish the chance of internal injury from shock loading while still not letting the user fall too far from the point of attachment? 2. Would this option be cost-effective?

We checked in with some line experts to get their take on this. Andy Howe at Yale Cordage told us: "There are pros and cons to making jacklines from standard polyester cover material. On the plus side, compared to polyester webbing, size for size it should have higher strength and more energy absorption, be easier to splice if desired, easier to untie when loaded, and will be easier to pick up off a wet deck with cold fingers. On the downside, compared to webbing it will look just like every other line snaking across the deck, and may not lay quite flat."

For Kevin Coughlin of New England Ropes, cost really isn't the issue: "There are three problems with that idea: 1. You get a 50-percent decrease in strength when you remove the core of any line, so the cover would have to be quite large to begin with; 2. Covers don't actually lay flat, they take more of an oval shape; and 3. Covers have a looser weave than webbing so in this application they would be subject to abrasion and having the strands pull or snag." Coughlin also cautioned that when knotting the cover (or the webbing), there's a 50-percent loss in the strength of the product just due to the knot.

Regarding the use of halyards in conjunction with jacklines, we're hesitant to recommend this without first putting Mr. Marshutz's technique to the test, so we'll report on that at a future date.

AA Battery Tests

[Re: "Battle of the Rechargeables," July 15, 2004] Battery capacity isn't rocket science, but with a little technology, it is eminently measurable. More readily so than, say, miles-per-gallon automobile performance. Nevertheless, battery industry participants eschew the publication of objective data in favor of advertising glitz.

Your article was just the ticket. Good background, solid methodology, succinct recommendations.

One suggestion: in future tests, you might do well to put more batteries from each brand to the test. In the testing I've done with a similar apparatus on a few brands, I have found that the variability in measured performance between batteries from the same package is so great that averaging the results of just four may not be enough for the purpose.

But come to think of it, promulgation of good information such as your article, might compel the battery industry to become more competitive, resulting in more consistent product quality.

Bill Thiers
Hilton Head Island, SC

Motor Mount Innovation

When it's truly calm, I can rock my J/22 from side to side using crew weight and that motion propels the boat along at a knot or so. However, for distance work, I needed a motor in these conditions, but I didn't want the weight or noise of a traditional bracket mount and outboard. I have a small deep-cycle battery for the nav lights and such, so I bought a used, 36-pound-thrust electric trolling motor.

A traditional mount presented problems because I wanted something lightweight and non-fouling. (We have been known to troll our chute and recover it over the stern from time to time.) So I bought some 2 x 4 aluminum box-channel and mounted a 6-inch piece horizontally on the stern. I whittled down a 20" piece of wooden 2 x 4 to fit tightly into the 2x4 channel recess, cutting dados to clear the mounting bolts which held the back of the channel to the stern. When we need it, the wooden 2 x 4 is inserted, held in place mostly by friction and by a small top-mounted pop rivet (un-popped). The motor mounts to the outboard end of the wooden 2x4 and we zip merrily along. This lightweight rig (including motor) cost less than $65 and has saved the day several times, especially on night sails when the wind lays down before we can make it in.

John Norris
Longview, TX

Flaring Up

On July 4, we traditionally fire off a few old flares at night just for fun, but this year we decided to test a bit more systematically.

We took a box of Olin 25 mm flares with expiration dates in the mid '80s, and fired them all off the seawall into the ocean. Of six such flares, one worked perfectly, one worked moderately well, and the remaining four launched with a loud noise, but did not ignite. So we called those duds.

Next we lit some handheld flares with similar expiration dates, and found that although they were a bit hard to light, once going, they flamed brilliantly. We called those good.

Our conclusion was that there is a very good reason for keeping up-to-date flares in the emergency kit on board, although there is no reason to discard the old ones. In an emergency, more total flares will be better. And God help any mariner who chances on the rocks on the Fourth of July!

Mark Van Baalen
Rockport, ME

Waterline Stains

{Re: "Waterline Stain Remover Test" July 1, 2004] Your test of waterline cleaners missed the mark in two respects:

1. No mention was made of how the cleaners affected a good wax job. You did mention that some of the cleaners affected the "luster," but did the cleaners remove wax or did they actually attack the gel coat?

2. Next time, just use any good off-the-shelf toilet bowl cleaner. These do a great job with little effort and cost a fraction of the products you tested. I just looked at the product I'm using (they all work) and noted that the primary ingredient is hydrogen chloride, the same ingredient in the Aurora product that you rated highly in your test.

Roland Borchers
Lake St. Clair, MI

In your July 1, 2004 issue you tested all the popular waterline stain removers except one, which I find to be less expensive and environmentally friendly. I use concentrated lemon juice to remove the "waterway smile" and waterline stains. Just spray or wipe it on and rinse off the stain.

Bob Kramer
Callao, VA

You omitted at least one product that I use successfully for waterline stain removal: Zud and its twin Bartenders' Friend. Both are oxalic acid in a powder form for cleaning stainless sinks. No bleach, but in the same form and can size as Comet. Just shake some on a wet sponge and wipe on the waterline, wait a minute or so and wipe off. Rinse with water, there's little or no scrubbing. Heavy stains need some light scrubbing, but they come clean. I also use it for cleaning brown spots off my stainless, which requires a little scrubbing and a hose rinse. But the price is right, less than $2 a can in the supermarket cleaner isle.

Dick Booth
Treasure Island, FL

We're always interested in more economical and environmentally safe means of maintenance than might be possible with products made expressly for marine applications. Though we didn't include concentrated lemon juice, off-the-shelf toilet bowl cleaners, or Zud in our test, it's possible these might be reasonable alternatives. Keep in mind, however, that several of the products we tested also contain hydrogen chloride and/or oxalic acid, but they didn't work nearly as well as Aurora.

As to the query regarding wax, yes,

those products we tested will remove a good wax job. How they affect gel coat depends upon the specific product. None we tested appeared to diminish the sheen on our hull, but repeated use might ultimately make the gel coat more porous. Remember, once you've removed the offending stains, it's important to once again protect the gel coat with a good coat of wax.

Sportrak GPS

Regarding Peyton Perkins' letter about Magellan map software [July 1, 2004], a couple of weeks ago I bought a Magellan Sportrak Color GPS and a CD with Magellan MapSend Streets & Destinations software. I'm happy with the GPS receiver but, like Mr. Perkins, I've noticed quite a few weirdnesses in the map software. Specifically in my neighborhood I notice streets, and the (navigable) creek I live on, and the river it feeds into, misnamed. The reply from Thales Navigation issue says that they're "always looking for beta testers." I volunteer.

Stephen Troy
Via e-mail

Corrections

In our response to one reader's comments about Bristol Finish ("Mailport" July 1, 2004) we wrote that "We presently have a test of the current formulation of Bristol Finish underway." That was incorrect. In the test we are currently conducting of teak treatments, we *do not* have the latest formulation of Bristol Finish under test. We regret the error. The one-year results of that test will be revealed in an issue later this fall.

In our wax test article ("Wax On" January 1, 2004), we mistakenly printed the website address of a dealer for Poli-Glow, and not the company's website. The correct address is www.poliglowproducts.com.

And, in the Value Guide chart that accompanied that article, we reversed the gloss ratings for Collinite's Liquid and Paste waxes. The paste (#885) should have carried an Excellent rating and the liquid (#870) a Good rating.

...WHERE CREDIT IS DUE

To Foss Foam, Williston, FL: "Last year I needed to replace the rudder on an '89 Catalina 30. I purchased the rudder from Foss Foam. When I received the new rudder there were a few minor dents in the shaft. Obviously FedEx had done the damage during shipping. I immediately notified Foss and they agreed to build a new rudder, although they didn't think the dents would affect the performance.

"Due to time considerations I decided to have the yard go ahead and install the slightly damaged rudder, with a promise from Foss that if it didn't work out, they would make good in the fall. The boat was so difficult to steer that we hardly used it. Later, at a local marine show, I showed some pictures of the installation to the folks at the Edson booth. They immediately told me not to use the boat, that the rudder had been installed incorrectly. I sent the same pictures down to Foss Foam, and they responded in the same way. The yard didn't bother to line up the rudder shaft inside the radial drive wheel. They just drilled the holes blindly, so the rudder and the drive wheel never lined up. The rudder was binding inside the rudder tube all that time.

"Despite this obvious mistake by the yard, Foss made good on their promise and delivered a new rudder this spring. They could have easily placed the blame on Brewers (the yard), but took responsibility and made me a customer for life. I decided to install the new rudder myself, and both the folks at Foss and Edson could not have been more helpful. The new rudder is now on, and performs perfectly. It's hard to find companies who are willing to stand behind their products even when the fault lies with a bad installation and not the product itself."

—Warren Jaffe, Long Beach, NY

To Pope Sails and Rigging, Rockland, ME: "At the end of the last sailing season, I found that the fabric near the leech of my two-year-old jib was literally coming apart in strips. I returned the sail to Doug Pope for evaluation/repair. He sent samples of the material to the cloth manufacturer, who did extensive testing but was unable to diagnose the cause of the failure. Doug said he could not repair the sail in good faith, not having been able to find the source of the failure. Instead, he built a new jib and presented it to me—free of charge—despite the fact that I had two years use out of the original sail. That type of integrity deserves recognition."

—James Love, Pittsfield, ME

To Mystic Valley Foundry, Somerville, MA: "This company recently cast new aluminum frames to replace the severely corroded inside frames that held the four large fixed ports aboard my 1969 Allied Seabreeze Yawl. The four outside frames which are threaded to receive stainless steel mounting screws were also reconditioned [welded, retapped and refinished]. The total cost, including new stainless screws and the casting template, was just over $700. The turn-around time was one week. I had an option to go with all eight frames in cast bronze for just over $1,300, but I didn't.

"Before I discovered this foundry, I was frustrated because I'd removed the leaky ports and had no viable way to replace them (three of the inside frames were in pieces). The owners, Arthur, Jr. and Sr., are skilled craftsmen and honest businessmen. They did everything they promised to do and more. I highly recommend them for any serious metal fabrication and reconditioning. They were recommended to me by a fellow Allied SeaBreeze Association member."

—Peter C. Lawrence, Via e-mail

Entry-Level LCD Radars

Our field test of seven relatively inexpensive radar systems (average price around $1,500) reveals Furuno's 1712 as the top choice among monochrome displays. For color, we prefer the Simrad RA30.

The 7" display on Furuno's 1712—our overall top pick—has clearly labeled function buttons and a simple cursor pad; it offered the best menu navigation and system control among the units we tested.

For almost any vessel over 20 feet there are three groups of marine electronics that are valuable to have on board, not only for efficient navigation, but also for safety. Collectively, these systems not only serve to protect your investment, but might also save your life. They are, respectively, devices for communication, location, and collision avoidance.

In the first product group, the top item is a VHF radio. Every vessel should have a fixed-mount, 25-watt VHF, as well as a handheld VHF as a backup. In the second group—location devices—the top gadget is a GPS. All sailboats of this ilk should have a fixed-mount GPS unit, and a handheld GPS as a backup. And in the final essential product group (collision avoidance), the best way to avoid running into an object or avoid being hit by another vessel is to have a radar reflector and a marine radar system.

Marine radars, like GPS units, have improved in quality, power consumption, and price in recent years. Gone are the days of the "stick your face in" radar. Those systems were initially replaced with brighter monochrome CRT (Cathode Ray Tube) radar systems that consumed power greedily. And these days, CRT radars are being replaced by LCD (Liquid Crystal Display) display systems.

A Little Background

Radar is an acronym for "**RA**dio **D**etection **A**nd **R**anging." A radar system operates in the microwave part of the radio-frequency spectrum used to detect the position and/or movement of objects.

In 1887, Heinrich Hertz, a physicist, began experimenting with radio waves in Germany. He found that radio waves could be transmitted through different materials. Some materials reflected these radio waves. He developed a system to measure the speed of the waves. The data he collected and his experiments generated much interest and led to further development. Hertz's experiments were the first steps in the development of radio communication, and later radar.

Radar works in a similar fashion to your voice echoing in a large open room or in a valley or canyon. Essentially your voice is the transmitter. When the energy from your vocal cords hits an object, some of it is reflected back. That reflected energy is perceived by your ears. The longer the sound takes to return, the farther away the object is from you. Also, the louder the return echo, the bigger the object that the energy hit.

With most radar systems, position is determined in two dimensions: compass bearing and distance. The display presents position information in polar coordinates commonly referred to as PPI or Plan Position Indicator. A rotating antenna transmits pulses at specific intervals known as a duty cycle. The time delay between a transmitted pulse and the echo, or return pulse, determines the distance of the target for each azimuth direction on the display. The greater the echo delay from a particular object, the farther from the display center that object appears.

When you are choosing a radar system for your boat, there are a couple of specifics you should keep in mind. While transmitting range and power are important, they are not the only factors that should influence your decision. The range of a radar system depends on several variables, and the height of the scanner above the waterline is chief among them. Radar range is directly related to height—the higher up the radar is, the farther it will see. Mounting your scanner well up in the rig can be a great asset. Keep in mind, however, that by doing so you're creating a greater circle around the vessel that the cone-shaped energy beam issued from the scanner will not see. Thus any targets in this circle will not return echoes. Of course these are close-in targets and they're the ones that are most important for you to be aware of. Who cares if you can see a passenger ferry 48 miles away? You want to see that powerboat screaming towards you in the fog on your two-miles-or-less scale.

Typically, sailboat installations have the radome—the unit that houses the rotating antenna—mounted near the first set of spreaders or around 20 feet above the waterline. In powerboats, the radar is either mounted on a radar arch or on a deck above the pilothouse. If you mount the antenna higher than 22 feet above the waterline, you will not gain much in range, but you may lose more close-in targets. Another critical consideration regards the installation of the scanner. It should be put it in a location where the beam that it issues will not pass through GPS sensors, Loran or weather fax couplers, and most importantly, people. Keep the antenna at a minimum of two feet above and least five feet from where you, your crew, and your passengers spend the majority of your time on board.

When you are looking at the power output of radar systems, in most cases a 2kW radar system can give excellent target imaging for inshore applications on 20- to 50-foot vessels. Higher power ratings like 4kW and 6kW systems may have a longer "range" than a 2kW system, however, the real performance gain is seen when the weather conditions are bad.

Rain and snow have a tendency to reflect and absorb radar energy. When the energy is reflected we are able to see the size and the pattern of the storm. Because rain and snow absorb radar energy, they can block your view of targets and land masses. This is where additional power becomes an advantage. The increased energy punches through the weather and allows you to see the targets. Fishing vessels, for example, like to use higher power radars to see indicators like birds working an area of bait.

The LCD revolution has helped with the lower power consumption.

Overlooking two of the test targets—New London Ledge Light and Black Rock—the radomes we evaluated are, from left: Furuno 1623, Furuno 1712, JRC 1000 Mk II, JRC 1500 Mk II, JRC 1800CP, Raymarine SL72 Plus, and Simrad RA30.

The CRT displays wasted a lot of power just in heat dissipation alone. Older styles of radar generate high voltage to keep the magnetron "heated" and ready to operate in the displays. Via the scanner cable, they supply the voltage, and more importantly the current, to the scanner assembly. More current is required to carry the voltage to the scanner. Modern marine radar systems generate the high voltage required for heating the magnetron in the scanner assembly, but there is no power loss as the high voltage is generated and consumed in the same location.

Power consumption of current marine radar systems is surprisingly low, when you consider small vessel radars range from 2kW to 60kW. This is the case for two reasons. This power rating is a peak power rating, and that amount of energy is being used for an extremely short time, typically less than a millionth of a second. This pulse will repeat many thousands of times per second. Most small vessel radar systems usually consume less than 75W of power when operating.

The size of the radar antenna is another important variable to look at when choosing your radar system. The antenna transmits the energy at a "wide" vertical angle to cover the entire target range area with radio waves. The antenna also transmits at a "narrow" horizontal angle. This allows the system to see targets that are close together, so that the targets are perceived as individual items as opposed to one large mass. This discrimination of targets is called resolution. A vertical beam angle of about 25 degrees is common to most systems. The length of the antenna determines the horizontal beam width. The longer the antenna, the more narrow the beam's horizontal width, creating greater target discrimination or resolution. Short length antennas (18" and 24") typically housed in domes provide approximately 6 to 3 degrees of horizontal angle. Open-array antennas, typically 2' to 12', produce a horizontal beam from 3 to 1.9 degrees.

Test Parameters

We wanted to look at marine radar systems that a majority of boaters could afford and install in about a weekend. So, we evaluated entry-level, stand-alone radar systems. The products that interested us most were 2kW radar systems with monochrome and color displays. We chose those with list prices under $2,000 for the monochrome systems and under $3,000 for the color systems.

Among the monochrome systems we selected are the Furuno 1623, the Furuno 1712, the JRC RADAR1000 MKII, JRC RADAR 1500 MKII, and the Raymarine SL72 Plus. We tested two color systems: the JRC RADAR 1800CP, and the Simrad RA30.

We conducted our tests along the shores of Long Island Sound at Avery Point, close to the University of Connecticut Avery Point Campus. We chose this location for several rea-

Value Guide: LCD Radar

Manufacturer	Furuno	Furuno	JRC	JRC	JRC
Model	1623	1712	RADAR1000 MKII	RADAR1500 MKII	RADAR1800 CP
Display Size/Type	6" monochome	7" monochome	6.5" monochome	6.5" monochome	6.5" TFT color
Average Price (Internet)	$1,092	$1,396	$949	$1,049	$1,761
Power Output	2.2 kW	2.2 kW	1.5 kW	2 kW	2 kW
Range	16 nm	24 nm	16 nm	16 nm	24 nm
Antenna	15" radome	18" radome	12" radome	18" radome	18" radome
Radome Weight	10.1 lbs.	10.8 lbs.	8.8 lbs.	11 lbs.	11 lbs.
Beam Width	Hor. 6.2°, Vert. 25°	Hor. 5.2°, Vert. 25°	Hor. 7°, Vert. 30°	Hor. 5.2°, Vert. 30°	Hor. 5.2°, Vert. 30°
Rotation Speed	41, 31 or 24 rpm	24 rpm	32 rpm	32 rpm	32 rpm
Power Consumption	36 watts	36 watts	30 watts	30 watts	50 watts
Scanner Cable Length	32 feet	32 feet	49 feet	49 feet	32 feet

Common to all systems: Display resolution, 240(H) X 320(V); pixels (except Simrad RA 30), 480(H) X 640(V) pixels; Warranty, 2 Years; Display Construction, waterproof; Voltage supply, all but the JRC models could operate on 12 or 24 VDC.

sons: It allowed the tests to approximate actual use on a sailboat because all the scanner domes were affixed at approximately 15 feet above sea level. Also, this site sits in close proximity to two sets of fixed radar targets. The first is the New London Ledge Light House, and the second was a set of rocks closer to the water—Black Rock. This is also a high-traffic area for automobile and passenger ferries and other large vessels moving in and out of New London Harbor, giving our units lots of targets in motion.

We evaluated the systems with the following concepts in mind: product construction, installation and set up adjustments, menu navigation, functional control, and target resolution. All of the systems evaluated have NMEA 0183 inputs. This is a valuable feature to have in your radar because you can interface the unit with your position finder and view your own vessel's position on the radar screen. And this interface will give you range and bearing to a waypoint, if you have one selected. If you have NMEA-capable instruments on board, you can also display that information on your radar display.

Display and Construction

The most evident improvements in marine radar have come in the displays. All of the radar systems we evaluated had waterproof displays, which is the biggest improvement of LCD systems vs. CRT systems. Now you can mount these newer displays in exposed areas, like on a cockpit steering pedestal. The systems we evaluated also allowed for mounting in a dashboard or hanging down from the overhead of a pilothouse. Two of the systems—the JRC RADAR1800CP and the Simrad RA30—are color LCD display systems with 256 colors and high resolution. These offer much greater detail and target discrimination than is possible with 8, 12, or 16 shades of gray. We also found the viewing angles of the color LCD displays much improved.

Radome technology is another area where critical improvements have been made. Radomes are now lighter and more powerful, with tremendous capabilities in a small package. The radomes we examined weigh from 8 to just over 14 pounds, and all of them make very little noise when they are working. This enhanced quiet while transmitting is due to better electronics driving the pulse circuitry. And all the units we tested had good seals where the fiberglass dome meets the base. Additionally, all these radomes have drip holes to drain off condensation. (An important aside about installations: Do not block or caulk the drip holes in a radome. Your efforts to stop moisture getting into your dome will likely backfire. Blocking the drip holes will cause condensation and salt to build up in the radome and probably lead to a system malfunction.)

Installation and Set Up

After installing your radar system, three parameters need to be addressed for the system to be considered operational and reliable. For our test, we carefully followed the system manuals to properly complete each adjustment and evaluate the navigation of the menus.

Tuning control: All of the systems we looked at had automatic tuning control. Control of the receiver circuitry by this system processor has taken a lot of the guesswork out of setting this parameter. You no longer need to adjust the tune after the antenna electronics warm up or cool down. We wanted to test how well the Auto Tune function worked with the products so we manually adjusted the tune controls and found that the factory presets were almost always on the mark.

Bearing Alignment: This process is completed to ensure that targets appear at their correct bearing relative to the ship's bow. As with the tune adjustment process, the factory presets were very close to what we ended up with after the manual adjustments were completed.

Display Timing Adjustment: The length of the cable used to connect the display unit to the scanner can affect the display timing, which in turn can have an effect on the short-range target accuracy. If you have extended or reduced your antenna cable, you will need to complete this adjustment. Incorrect timing is most noticeable on the 1/8- or 1/4-mile

Raymarine	Simrad
SL72 Plus	RA 30
7" monochome	7" TFT color
$1,458	$2,755
2 kW	2 kW
24 nm	24 nm
18" radome	18" radome
14.3 lbs.	13.2 lbs.
Hor. 5.2°, Vert. 30°	Hor. 5.9°, Vert.25°
33 rpm	24 rpm
38 watts	45 watts
49 feet	49 feet

range scales. Long targets like bridges or breakwaters may appear to be curving away (timing is early) or pulling in (timing is late) from the vessel. When you complete your installation, check out the timing parameter to be sure you have the proper antenna timing. For our review, we completed a tune adjustment and bearing alignment on the systems. Because we did not modify the original scanner cable, there was no need to adjust the system timing.

Menu Navigation

Current marine electronics controls fall into two groups: dedicated function control buttons (direct entry) or multi-function control buttons (menu driven controls). Both styles of control have advantages and disadvantages. If a system has all direct, entry controls, there are more buttons on the display and it can be confusing. A system with menu driven controls has fewer buttons, but each button contains more controls and this can be just as confusing. We like a little of both, which allows the operator to easily control the display with the fewest button pushes.

Target Resolution

All of the displays we reviewed returned decent targets. We can happily report that none performed poorly. They all returned targets giving us our location in relation to the shoreline and the fixed targets of New London Harbor.

Additionally, all but one of the displays we tested had a resolution of 240 x 320 pixels; the Simrad RA30 had double that (480 x 640), so its target information showed up more brilliantly. All of these had varying levels of brightness and contrast, with adjustable backlighting. We evaluated the displays in bright sunlight and the target information on all of them was easily viewed.

Furuno 1623 and 1712

The 1623 radar system offers a high-contrast, 6", silver bright, LCD display and the 1712 system has a 7", silver bright display. Both systems have four gray-tone levels to display target intensity. The 1623 system has 13 ranges 0.125 to 16 nm and the 1712 system has 14 range scales from 0.125 to 24 nm. Both systems offer a watchman mode, which intermittently takes the system out of standby and transmits for a number of sweeps to save power. This mode allows the 1623 and 1712 to only use about 8W of power.

The 1623 system has a 15" dome weighing a little over 10 pounds. The antenna has a 25-degree vertical and 6.2-degree horizontal antenna beamwidth with 2.2kW of transmit power. This system has a feature that none of the other radars have. The rotation speed of the antenna is variable. The 1712 radar system has an 18" radome weighing almost 11 pounds. The antenna has a 25-degree vertical and 5.2-degree horizontal beamwidth with 2.2 kW of transmit power, and rotates at 24 rpm. It is also wind load rated to 100 knots. Both systems come standard with a 10-meter antenna cable.

The best combination of menu navigation and system control goes to the Furuno 1712. This system had the most direct entry style menu control of the most vital functions What we liked the most about the Furuno 1712 was when you wanted to increase or decrease range gain, or use the EBL and VRM controls, they were easy to initiate and control. This is a great feature to have on a pitching deck or nav station. Even while navigating the various menus during the installation setups, this system was consistently easy to operate.

The Furuno 1623 system beat out its sibling for the best target resolution of all the systems we evaluated. The target returns were very consistent and strong, and there's a good reason for the strong returns. As we mentioned, this system is the only one evaluated that has variable antenna rotation speed. The scanner rotates 24 rpm on the 3-16 nm scales, 31 rpm on the 1 to 3 nm scale and 41 rpm on the 1/8 to 3/4 scale. What does this mean? At the lower ranges, (the range that you should be using for collision avoidance), the antenna is transmitting energy and receiving echoes at a faster rate. This keeps the system receiving target information at a faster rate and displaying that target information with greater resolution or detail.

The NMEA interface cable for these systems is not standard like the other systems we evaluated. The interface cable for the 1623 has a $45 list price and the NMEA cable for the 1712 system is $35.

JRC 1000 MKII & 1500 MKII

Both the 1000 MKII and the 1500 MK II systems offer a 6" monochrome display with a resolution of 320 x 240 pixels, 9 range scales 0.125 to 16 nm, joy stick control for menu functions, a jog dial to operate range sea clutter, gain and rain clutter, and a power-save transmission mode. The JRC 1000 MKII and 1500 MKII have plastic, four-way mounts making it easy to dismount the display on and off with the touch of a release button. This is a handy feature for those boat owners who want to stow their display below decks. All of the JRC models have rubberized covers over the scanner-display connector.

The 1000 MKII has a 12" dome weighing less than 9 pounds, making it the lightest dome we evaluated. This unit has a 30-degree vertical and 7-degree horizontal beamwidth antenna with 1.5 kW of power. The transmit power of the 1000 MK II was

Performance Ratings

Manufacturer	Model	Target Display	Ease of Operation	Overall Rating
Furuno	1623	Excellent	Good	Excellent
Furuno	1712	Excellent	Excellent	Top Choice
JRC	RADAR1000 MKII	Fair	Fair	Fair
JRC	RADAR1500 MKII	Fair	Fair	Fair
JRC	RADAR1800 CP	Good	Fair	Good
Raymarine	SL72 Plus	Good	Good	Good
Simrad	RA 30	Good	Fair	Good

the lowest of all the systems tested, and the antenna rotates at 32 rpm.

The 1500 MKII has an 18" radome weighing about 11 pounds. It also has a 5.2-degree horizontal and 30-degree vertical beamwidth and a 2kW transmitting system. The rotation speed for the 1500 MK II is 32 rpm. In standard transmit mode, both the 1000 MKII and the 1500 MKII have the lowest power consumption of the systems evaluated. And both systems come standard with a 15-meter scanner cable.

In our test the JRC 1000 MKII and 1500 MKII had mostly a menu-driven control system. We found this a little awkward when completing the system adjustments. You need to pay close attention to the parameter you are adjusting such as range or gain and sea clutter. JRC models feature J-Dial and joystick controls to work you through the menus. This is where a couple of dedicated buttons would help.

As we mentioned previously, all of the systems we evaluated displayed our test targets and an outline of the shoreline well. With 1.5kW of power, we found the 1000 MK II target returns the weakest of the systems tested. There was more target fading than with the other systems and the consistency of the shoreline information detail that was displayed again was lacking in comparison to the other products tested. The 1500 MK II did offer better target displays than its sibling, but in this facet, the other systems evaluated performed better.

JRC 1800CP

The 1800CP from JRC has a 6.5″ color LCD, sunlight viewable, water-resistant display, with a display size of 320 x 234 pixels, 9 range scales 0.125 to 24 nm, joystick control for menu functions, a jog dial to operate range sea clutter, gain and rain clutter, and a power save transmission mode similar to the 1000 MKII and 1500 MKII systems. The 1800CP is also a C-Map NT+ chartplotter. Although this product was not evaluated for its plotting functions, that feature adds to its value as a collision-avoidance system.

The 1800CP has an 18″ radome with 32-rpm rotation speed. It weighs 11 pounds and has a 5.2-degree horizontal and a 30-degree vertical beamwidth, with 2kW of transmit power. This system comes standard with a 10-meter radar cable.

Like the other JRC models tested, the 1800CP has a menu-driven control system with other direct entry function keys for the chartplotting features. The system displayed good target information, and like the 1000 MK II and 1500 MK II, there is an NMEA interface built into the power cord.

The target display and resolution of the 1800CP was the best among the JRC systems we evaluated. The 2kW of power is complimented by high-quality, front-end receiver circuitry. This put it equal to the Simrad RA30 and just below the Raymarine SL72 Plus system for target resolution.

Raymarine SL72 Plus

The Raymarine SL72 Plus system has a 7" monochrome display with four gray scales for target discrimination. The resolution of the display is 320 x 240 pixels, and there are eight levels of display backlighting with three levels of keypad backlighting. The system can operate on 10.7-44 VDC and only consume 10W of power with full back lighting turned on while in standby mode. There are two variable range markers and electronic bearing lines and there are 9-range scales from 0.125 to 24 nm.

The SL72 Plus system comes with a standard 15-meter radar cable and an 18" radome. The antenna rotates at 32 rpm and has a 5.2-degree horizontal and 30-degree vertical beamwidth with 2 kW of transmit power.

The SL72 Plus was a close second for its combination of menu navigation and system control. The Raymarine manual was useful and easily comprehended. Dedicated hot keys at the bottom of the display can bring up commonly used functions, so adjusting through the system menus was smooth. The SL72 Plus also includes a handy laminated bridge card with a quick guide for navigating the system menus while underway.

The constant and full target returns gave this unit a Good rating in that part of our evaluation.

Simrad RA30

The RA30 radar system is the second color system that we evaluated. The RA30 has a 7" color TFT display. The display has a resolution of 640 x 480 pixels, higher than the JRC 1800CP. Target information is presented on the display in four different intensity levels. This provides a crisp display of the information. The RA30 radome measures 18" and has a horizontal beamwidth of 5.9 degrees and vertical beamwidth of 25 degrees. The antenna rotates at 24 rpm and has 2kW of transmit power. The radome comes with a standard 15-meter antenna cable. Like the JRC system, the RA30 unit had rubberized covers over the connector of the scanner to the display.

The Simrad RA 30 has a feature that none of the other systems offer. The RA30 is the only system that allows the operator to use the standard PPI display of targets as well as a semi-3D mode. The first is in a standard circular display around a center position (PPI mode), and the second in a semi 3-D mode. The latter allows you to see the height of the targets off the water.

When you activate the semi 3-D

How to Speak Radar

Beamwidth—The angular width, horizontal or vertical, of the path taken by the radar pulse.
Echo Stretch—This function stretches small echoes to make them easier to see on the display.
EBL—Electronic Bearing Line is a bearing line on the display starting at 12:00. This line can be moved to determine the bearing from your vessel to the target. This control is used with the VRM control to obtain a range and bearing to a target.
Gain—This control adjusts the receiver's sensitivity. It acts similar to volume control for the targets being displayed. Typically, for long-range target viewing, this control is adjusted high enough to just show background noise on the display. On shorter ranges, this setting is higher. On most current models of marine radars this can be a manual or automatic process.
Guard Alarm—This function identifies an alarm zone around the vessel. It can be set up for 360 degrees or for a specific quadrant or zone around the vessel. When a target enters that zone, an alarm will sound. After the target leaves the zone, the alarm will stop.
IR—Interference Rejection is a control that allows radar systems to block errant radar waves from other systems. This control is useful in a high-traffic areas where other vessels are using radar or there is a large land-based radar system transmitting in the area.
Magnetron—This device generates the RF radar energy used to hit the targets. It is constructed with a magnet and a coil of wire wrapped around it that is supplied with high voltage that keeps the magnetron warmed up waiting for the pulse circuitry to excite it to release a burst of energy.
M.I.C.—A Microwave Integrated Circuit is the front end of the receiving portion of a radar system.
Modulator—This circuit sets up the timing to release the energy from the magnetron. This circuitry is called a pulse modulator or pulse board.
Off Center Control—The off center control allows the radar operator to look further ahead on the display without changing ranges.
Pulse Repetition Rate—This denotes the number of RF pulses that are transmitted in one second. This timing takes place in the modulator circuitry. The pulse length and detecting range determines the pulse repetition rate. In short range transmission, the pulse length is short and the pulse repetition rate is high. On longer ranges, the pulse width is longer and the repetition rate is low.
Rain Control—This allows the operator to cancel out the reflected echoes of precipitation. It is sometimes called FTC or Fast Time Constant.
Range Rings—Range rings provide the operator with a rough estimate of the distance a target is from the vessel.
Resolution—This describes the ability of the system to display two targets, which are close to each other. There are two types of resolution: range and bearing.
Sea Clutter—This control cancels out the reflected echoes of waves in rough seas. This is also known as STC or Sensitivity Time Control.
Tune—Tune control adjusts the receiver's frequency to maximize the echo return signal. This allows the targets to be clearly displayed. As with gain control, most current models of marine radars allow for automatic or manual tuning.
TX/STBY—The transmit and standby control allows users to put the system in a power saving mode. When the system is in standby, the antenna stops transmitting and rotating, the electronics in the scanner are asleep (with the exception of the circuitry running the magnetron heater voltage). The system will start to transmit, rotate, and display targets after the transmit button is activated.
VRM—The Variable Range Marker control paints a single range ring that starts from the center of the display (the operator's boat) and can be increased in size to meet the target for range data. This control is usually used in conjunction with EBL.

mode the screen will split between the standard PPI view and the semi 3-D mode. All controls like the EBLs and VRMs affect both display screens. That's a nice feature, but we think that the RA30 could use some menu simplification. The multiple keypad buttons for navigating the menus and installation sets were a bit confusing and the manual needs to be referred to much more frequently than the other systems while being setup and tested.

Target resolution was good and consistent, and the semi-3D mode allows the operator to evaluate the targets' relative height off the water.

Bottom Line

Because of its easy function control, menu navigation, and superior target resolution, our overall top choice is the Furuno 1712. Subsequent to our testing, Furuno discontinued its 1712 and replaced it with a model that has identical specifications. Except for a larger radome, the differences between the new Furuno 1715 and the 1712 are cosmetic. These changes, say company representatives, were made so the new system better fits the design of other products that the company makes for the helm station.

We'll reiterate that the products evaluated here are entry-level radar systems, but their function should be sufficient to suit the needs of most midsize sailboats. We should also note that after purchasing and installing a new radar system, it's vital that you spend some time learning how to use it properly. The operation manual that accompanies the unit is a valuable resource, as are the many aftermarket instructional videos available. After that, practice using the radar unit in good conditions, especially when transiting in and out of harbors. This will help you learn to recognize land masses and key targets that can be important landmarks later on when you find yourself out there in the soup. ■

Furuno, *360/834-9300, www.furuno.com*
Japan Radio Company (JRC), *206/654-5644, www.jrcamerica.com*
Ray Marine, *800/539-5539, www.raymarine.com*
Simrad USA, *425/778-8821, www.simradusa.com*

Headings

by Nick Nicholson

The Academy of the Sea

Closing out 25 years of regular contributions, our Editor-at-Large bids adieu with sage advice from this year's Newport-Bermuda Race.

The 2004 Newport-Bermuda Race was one of the more complex, weather-driven races we've sailed in the last 25 years. A combination of low-pressure systems, high-pressure zones, and a late-season cold front of unusual strength presented navigators and tacticians with a difficult challenge. Throw in a tantalizing southerly meander of the Gulf Stream—and a potentially race-killing area of foul current north of Bermuda—and you had a true navigator's nightmare.

I sailed as navigator and tactician on board Rob Mulderig's *Starr Trail*, a 72-foot sloop out of Bermuda. With her Bruce Farr pedigree and four-spreader carbon rig, you might expect *Starr Trail* to be a flyer, but she's actually a fully-fitted cruising boat. In fact, the boat recently completed a four-year circumnavigation, fulfilling a dream for her owner.

We've raced aboard *Starr Trail* in venues as diverse as the Caribbean, Thailand, and the English Channel for the America's Cup Jubilee in 2001. She epitomizes the true modern cruiser/racer, though her 85,000-pound displacement and relatively small sail plan aren't the best combination for a predominantly light-air race such as this year's Bermuda Race.

For most boats, the first part of this year's race featured painfully light air, followed by some 24 hours of strong northerly winds associated with a frontal passage, followed by a dying easterly. Accurate weather forecasting during the race played a key role in determining success or failure.

The Swan 45 Alliance, shown here in delivery mode, was the overall winner in the 2004 Newport-Bermuda Race.

Weather Access

There was a significant increase in the number of boats using the Internet for weather updates. The rules governing Internet access during racing are evolving at a slightly slower rate than the technology itself. In general, however, access to information on publicly available websites is permitted, while information available from password-protected or subscription-only websites isn't.

There is a huge amount of really good information available via public sites such as www.opc.ncep.noaa.gov, NOAA's Ocean Prediction Center website. The problem for sailors is connection speed. In a day when 56K dialup connections on land are archaic, the 9.6K speeds of commonly used satellite systems such as Globalstar are positively Jurassic. With older protocols such as mini-M, Internet access for anything other than simple e-mail is impractical.

Most weather websites are graphics-intensive: it's simply part of the appeal, and is not an issue with land-based connection speeds. Slow down the access speed dramatically, however, and many programs will stall out.

You simply cannot use web browsers in the same way at sea that you can at home. Instead, it is important to know the exact page address for the information you're seeking. A lot of research is critical before a race to know exactly what you'll need while racing.

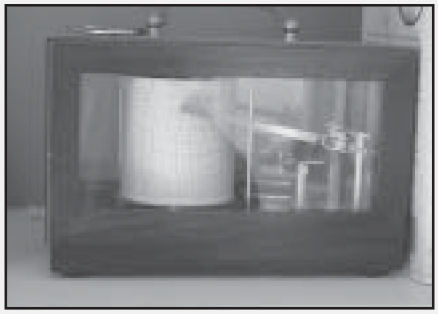
Ironically, we had trouble down-loading weather maps from opc.gov that were identical to the same maps transmitted by conventional weatherfax. Of course, with conventional weatherfax, you have to wait until the maps are transmitted via SSB, while Internet access allows you to grab the maps as soon as they are posted on the website, rather than waiting for a specific broadcast schedule.

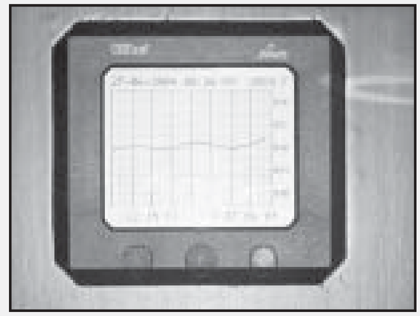
You also have to remember that forecasting is still an imprecise science, particularly when it comes to the exact timing of system movements. Yet this is exactly the type of information that is critical in making tactical decisions while racing offshore.

During the 2004 Bermuda Race, a slow-moving, weak, high-pressure system was the major tactical problem for the second half of the race. South and east of the new high, the gradient winds would remain predominantly easterly, weakening toward the center of the system, then strengthening from the southwest after the high passed southward over Bermuda. As the high overtook the fleet, the winds would gradually clock through southeast, south, then southwest as the high merged with the usual summer mid-Atlantic high pressure that normally occupies a large portion of the Atlantic basin south and east of Bermuda.

The question then became: do you hold to the west in anticipation of the clocking breeze as the high passes, or do you go east to try to retain the last of the easterly breeze on the final approach? Complicating the question was a large, somewhat circular area of poorly defined but significant current straddling the rhumbline. The favorable current was east of the rhumbline, the foul current west.

Conventional wisdom for the Bermuda Race says that in the absence of strong evidence to the contrary, you stay west. Any increases in wind velocity are likely to come from systems moving off the east coast of the US and colliding with the mid-Atlantic high, compressing the isobars along the western side of the high. Staying west ordinarily keeps you in stronger winds, and gives you a better angle of approach with any winds that are west of south.





The traditional barograph (left) is a valuable tool for navigation, but it can fluctuate wildly in rough seas. An electronic barograph (right) isn't affected by the boat's motion. The one aboard Starr Trail *was pivotal in the boat's success.*

This year, however, following conventional wisdom would potentially place you bow-on to a significant amount of foul current: over two knots in some places, as it turned out. Sailing around the eastern side of the current, however, was a gamble that placed you in the area known as the "Death Zone" to experienced Bermuda Race navigators. In my 18 races to Bermuda over the last 25 years, only once has it paid off to be significantly east of the rhumbline during the last 200 miles of the race.

Aboard *Starr Trail*, strategy was dictated by the need to keep this heavy boat sailing at its fastest possible wind angle at all times, particularly in a dying breeze. With the remains of the northeasterly gradient clocking slowly, we sailed southeasterly across the top of the current feature, following the wind direction as it slowly headed us and diminished, changing from heavy spinnaker, to light spinnaker, to headsails.

The slowly clocking wind was not a good sign. If it continued to veer, boats on or east of the rhumbline could be caught in a dead beat to the finish in light air, while boats to the west brought down the new breeze.

We elected not to foot to the anticipated new breeze, and instead held high, hanging as far to the left as possible while staying marginally cracked off to keep the big boat moving in decreasing winds.

This was not a blind call. The key to this strategy was a modern version of one of weather forecasting's oldest and most reliable tools: the barometer.

While the rate of motion of weather systems is not easy to predict accurately, the actual pressure gradient within the system is well-known. Watching the barometer, and recording its rate of change, will tell you with remarkable precision just how quickly a weather feature is approaching.

Changes in barometric pressure over time are most easily tracked using a recording barometer, or barograph. The traditional barograph looks much as it has for the last 150 years or so, with an ink pin connected via a linkage to an aneroid system. The ink pin draws a line on a calibrated paper chart mounted on a clock-work-driven rotating drum, giving you a trace of pressure against time.

The traditional barograph works well, but the pen even on marine-damped versions can jump around dramatically in a heavy sea. A simple barometer does a good job, but it requires discipline to record and plot changes in pressure, and does not so easily show rates of change.

Modern performance instrument systems such as those from Ockam can add an integral atmospheric pressure sensor, and electronic strip charts to record pressure against time on the computer, just like a traditional barograph.

For those without integrated instrument systems, self-contained electronic barographs have been the answer. The German-made Meteoliner, formerly marketed by Vetus, has been the standard electronic barograph for offshore racing since

When a mainsheet traveler is this close to the helm, the pedestal and any guards must be designed to avoid snagging the sheet during a jibe.

its introduction, but we can find no source for it today. It was not cheap at around $800, but it is worth its weight in gold to those of us who race offshore. This is what we had aboard *Starr Trail*.

An intriguing new electronic barograph is the Meteograf, marketed in the US by Robert E. White Instruments, one of the country's premier dealers in weather instrumentation for mariners. The Swiss-made Meteograf is in some ways a cross between a traditional barograph and a modern electronic baroscope. Its electronic pressure sensor is not affected by the boat's motion, and its compact flush mount fits easily into a bulkhead.

A digital readout shows real-time pressure, and a scaled paper chart records pressure over time like a traditional barograph. The waxed paper chart is etched by a stylus rather than a pen, and a single chart is good for a year, unlike conventional barographs that require a weekly paper-changing ritual. You can also connect the Meteograf directly to your computer to record pressure over time in permanent electronic fashion. At about $1000, this is a serious tool for serious, weather-oriented sailors.

And how did a barograph help us in our strategic call? The key was the rate of change of the pressure, as well as its absolute value.

The central pressure of the new high was about 1020 millibars. When our pressure, which had been slowly increasing as expected, dipped from 1016 to 1015 (adjusted for diurnal variation), and stayed there with little tendency to rise, it seemed likely that the new high had slowed down somewhat, and the old gradient would prevail.

The easterly breeze—a notoriously unstable breeze around Bermuda—wavered and oscillated, but ultimately held until we crossed the finish line. Those to our west died, and those to our east gained.

Internet weather is great, weather charts are extremely important, but ultimately, one of the oldest weather forecasting tools for sailors was the most critical part of our weather-driven strategy this year.

Jibe-Ho!

Jibing any sailboat in heavy air is no picnic. Strategy and weather in the 2004 Bermuda Race dictated a jibe in the middle of the night in the Gulf Stream for the faster boats, and the result in some cases was a surprising amount of damage.

Aboard *Starr Trail*, we were running as deep as possible to position ourselves properly—virtually dead downwind after the frontal passage in winds averaging almost 30 knots, gusting into the high 30s—when the time came to jibe to port down the axis of the Gulf Stream. Our boatspeed was averaging about 13 knots, but surging regularly into the high teens with the gusts.

Speed through the water peaked at 21.8 knots, and we had several knots of positive current. It's not often you see 24 knots over the bottom in a displacement sailboat, even if it's only for a few seconds. This, mind you, is in a 43-ton boat, not some lightweight flyer.

It happened to be about 0330 in the morning, and pitch black—not the easiest of conditions for a jibe. Even in daytime, it would not have been a simple job.

During the jibe, the helmsman, who is an Olympic-caliber sailor, lost track of his position relative to the wind—easy to do in total darkness, with only the instruments to rely on—and crash-jibed the boat twice after the initial, more controlled maneuver. It is no joke when a 1,200-square-foot mainsail on a 27-foot boom comes whistling over your head, out of control. Luckily, no one was injured, although the stops on the mainsail track were damaged.

Other boats were less fortunate. The steering pedestal guard on one boat—and with it the compass and other electronics—was demolished during a similar maneuver. Even with pedestal guards that are tapered and supposedly snag-proof, the load of a mainsheet bearing against the guard before freeing itself can do a lot of damage in a very short period of time.

Whether racing or cruising, jibing any boat in heavy weather requires careful coordination between helmsman and sail trimmers. The mainsail should be trimmed in hard amidships (easing pressure on the preventer as you trim), before turning the boat through dead downwind. The preventer should be led to the boom from the new leeward side before easing the boom out on the new jibe, and must be taken up as the mainsheet is eased. "Total control" should be the operative phrase.

If you don't have a main boom preventer rigged any time you are more than about 70 degrees off the true wind, go directly to jail, do not pass Go, and do not collect $200.

Of course the spinnaker and pole are being jibed at the same time as the mainsail, so things can get pretty busy on a racing boat, where the primary goal is to keep the spinnaker flying and the boat moving at top speed. The relatively "easy" job of jibing the main sometimes gets lost in the shuffle until something dramatic occurs.

Most boats lack sufficient mainsheet winch speed to trim the sail hard in at a rate that suits the helmsman during a jibe, so the boom comes crashing over when partially trimmed. This may work inshore in flat water, but we do not recommend it when sailing offshore in heavy air, especially at night.

Aboard *Calypso* during our circumnavigation, Maryann and I developed a more or less idiot-proof jibing procedure that bears repeating. We used this in winds up to 35 knots or so, generally running with a headsail on the pole rather than a spinnaker.

First, roll up the headsail (assuming it is roller-furling) by easing the pole forward as you grind in the furling line. With the headsail furled, leave everything under tension in the foretriangle—foreguy, topping lift, and sheet—until the main is jibed, so the pole can't bang around.

I would then go forward to the rail to control the preventer using its four-part purchase. Maryann—all 100 pounds of her—would overhaul the mainsheet using only its 6:1/24:1 multi-speed tackle, which in a strong breeze, was just powerful enough for the job.

To jibe the main, ease the preventer while trimming the main in hard amidships. This requires constant communication, and, depending on the location of the mainsheet and preventer controls, is often a two-person job. On our boat, we then transferred the primary preventer tackle to the new leeward side, leaving it attached to the boom during the maneuver.

Needless to say, both of us were wearing safety harnesses during this process, as the chance of recovery if one of us went overboard was close to zero.

When we say "trim the main hard amidships," we aren't joking. That means zero slack, so that the main is virtually completely stalled. The boat will slow down, but should still have plenty of way on if you do the maneuver reasonably efficiently.

We generally brought the boat onto the new course by bumping the autopilot five degrees at a time until the top of the main filled on the new jibe. The rest of the mainsail quickly follows the top across, which is the point at which things can turn to custard in heavy air if the boom isn't under complete control, as the boat will tend to heel hard over and round up.

We would then over-compensate to the new course, reaching up slightly, just to make sure that a re-jibe was unlikely. At this point, the main is slowly eased against the preventer, which is taken up at the same rate.

With the main nailed down on the new jibe, the secondary preventer is hooked up, and the new weather running backstays taken back into position. The boat is snuck down to the proper course, once again easing the main while taking up on the preventer.

Note that the preventer will only keep the boom under control if it has a reasonable pulling angle. A preventer led to the bow from the outboard end of the boom is pretty much useless once the boom nears amidships.

Our primary preventer would have been called a vang in older times, as it consisted of a heavy four-part tackle attached to the boom halfway along its length, led to the rail. With the boom eased off, the pull of the preventer was pretty much down as well as forward, and the load on everything was considerable, even with only 400 square feet of mainsail. The boom, preventer tackle, and points of attachment all need to be up to the job for this arrangement to be practical.

The secondary preventer was what is more normally considered a preventer—a line led from the end of the boom to the bow. Both types of preventer are essential on a cruising boat running downwind during offshore passages.

Because of *Calypso*'s fixed inner forestay and over-length spinnaker pole, jibing the gear in the foretriangle and re-setting the headsail takes longer than jibing the main, but unless I did something stupid—which happened on several occasions—there was little risk of damage to the boat or crew.

Mind you, this two-person jibe procedure is too time-consuming for the average offshore racer, but here's a lesson to take to heart. During the Bermuda Race, a number of crews facing this same heavy-air jibe chose to take down their spinnaker, jibe the main and pole, then re-set the spinnaker on the new jibe. Several boats took this opportunity to change down to smaller spinnakers, which proved to be the right call.

Aboard *Starr Trail*, we decided to jibe the 1.5-ounce spinnaker and the main simultaneously, which in retrospect was the wrong call. A half hour later, the hard-pressed 1.5-ounce chute decided it had had enough, and God called for a spinnaker change. The log records laconically: "blew out 1.5, set 2.2."

Conclusions

Starr Trail didn't win this year's Newport-Bermuda Race, but our 11th-place finish overall out of over 100 boats in the IMS cruiser/racer division was an excellent performance in conditions that clearly favored lighter, more modern boats. In fact, the boats that beat us on corrected time—three new Swan 45s, a J/125, a pair of Santa Cruz 52s, and several purpose-built lightweight cruiser/racers—all had significant advantages in the light air that characterized most of the race.

We beat all the more "traditional" maxis and mini-maxis on both elapsed and corrected time.

If there's such a thing as a moral victory—and it's not as sweet as holding the winner's trophy, I assure you—we scored one, thanks to a hardworking crew, a well-prepared boat, and more than a little bit of good fortune. It's just the type of finish that keeps you coming back for more, year after year. ■

The Load on Your Rode

Our time spent testing anchors has prompted some important musings; we offer the following thoughts regarding the forces and factors to be considered before purchasing anchors and rodes.

Without really meaning to, over the past six years, *Practical Sailor* has acquired a considerable reputation for testing anchors and anchoring gear. On more than a dozen occasions anchor makers have sent anchors to be included in these *PS* tests. Inventors, too, have sent prototypes. (The notion of a perfect anchor is so intriguing that inventors are, we're positive, out there working right now.)

When *PS* first looked at this situation back in 1997, there had been dozens of tests run by manufacturers (and testing organizations in their pay), other magazines, independent authors of books on the subject, and even government-allied groups. Among these were the French APAVE, the U.S. Navy tests, the RNLI (Royal National Lifeboat Institution) in England, the Boat/US-*Cruising World* magazine strength tests, the Dutch tests (done in a huge sandbox), the on-going tests by naval architect and author, the late Robert A. Smith, and the extensive "Seattle Tests" co-sponsored by the Safety at Sea Committee of the Sailing Foundation and West Marine.

Close examination of the results of these tests, plus careful readings of books, like Earl Hinz's *Complete Book of Anchoring & Mooring*, Don Bamford's *Anchoring*, and the revered *Chapman's* (probably the best-selling marine book of all-time), suggested to *PS* that the tests were too omnibus (in most cases, the bottom was not even known or varied). The tests tried to do it all.

In our due diligence, we also checked a new book, International Marine's *Small-Boat Seamanship Manual*. It came out in 2002 and is "Based on the *U.S. Coast Guard Seamanship Manual*." All the many photos were supplied by the Coast Guard. Only six pages are allotted to anchoring and the only table is a very small one supplied by Danforth, giving three anchor sizes for boats 10, 30 and 40 feet in length.

There are more criteria for choosing the right ground tackle than simply your vessel's size and displacement.

Another book we examined was *Staying Put*, by Brian Fagan, who enjoys a strong reputation on the California coast. The book has a minimal table showing boat size (20 to 50 feet); the recommended size of chain (both proof coil and high test) and nylon rode, and what size anchor, as long as it is a CQR, Delta, West Danforth type, or Bruce.

One of sailing's acknowledged authorities, John Rousmaniere, in his tome *The Annapolis Book of Seamanship*, uses tables from both the American Boat & Yacht Council and the Earl Hinz book mentioned above. The Hinz table deals only with Danforth-type, plow, Bruce, and yachtsman anchors, but does make chain and line rode recommendations. Rousmaniere also makes the puzzling statement, "Nylon rode should be half-inch in diameter for every nine feet of boat length overall." Going by that prescription, a 40-foot boat needs a hawser more than two inches in diameter!

Another authority, Steve Dashew, in his huge (1,232 pages) *Offshore Cruising Encyclopedia*, tap-dances for a half dozen pages around the subject of anchor loads, but summarizes with: "You should carry the largest possible anchor and use it for everyday anchorages." He also "suggests" as a main anchor "the largest Bruce you can carry, twice the size of what everyone else suggests…," and a big Fortress as a second anchor. He likes a chain rode. We think it's good, conservative advice.

Dealing with the Conflicts

Because of all the conflicting and imprecise data, *Practical Sailor* concluded that anchor testing should be broken into small sections that can be assembled by a boat owner to suit his or her needs. It was determined that the predominant "sections" were:

1. Setting (if an anchor doesn't set, it isn't an anchor).

2. Holding (with dragging as a derivative).

3. Re-setting (or holding) when veered.

PS settled on four other factors to be considered, *after* the above three. They are: (1) the difficulty of breaking out; (2) weight on board; (3) quality of workmanship, as it pertains to long-term utility, and (4) ease of handling and stowage, either at the bow or in an anchor locker. For some owners, self-launching and automatic retrieval might be added to the list.

The next question is, of course, in what? Fine sand, coarse sand, that crusted sand found in tropical waters, good solid mud, gravel, the deep thin mud found in Massachusetts' Nantucket Harbor (which was from 1800 until 1840 the whaling capital of the world), or the soupy ooze encountered in the tributaries of the Outer Banks of the Carolinas? That question led to the decision to conduct separate tests in clearly identified bottom conditions.

Next question: What kind of boat and what wind and water conditions? Along with bottom composition, these factors are vital.

After winnowing wearily through the possibilities for testing, *PS* settled—because we had to settle on something—on a 30- to 32-foot sailboat, in sheltered water, with no more than 40 knots of air (which is classified as the top end of a "fresh gale" or Beaufort 8).

Boat length and wind velocity are the two components in the tables usually seen in marine catalogs, manufacturer's data, and general marine reference books. And a few include the boat's beam.

The real questions for any boat owner are:

A. In what kind of conditions—wind, bottom and waves—do I expect to anchor?

B. For the conditions, how much of a load, or "pull," will be exerted on the components (anchor, rode, shackles, etc.) in my anchoring gear?

Getting to that single figure isn't easy. But without it, how can one select an anchor? Or a rode, or whether it should be nylon line or chain? And it's even more difficult to reconcile this quandary with the customary tables that are intended to help you select an anchor.

West Marine's 2004 catalog has an "Anchor Selection Guide" featuring tables that specify different styles of anchors (fluke, plow, Bruce, etc.) and specific models relative to boat length from 0 to 120 feet LOA. There's also a full-page Advisor on anchor rodes.

(A pause here, if you please, in defense of such tables, which can't possibly place on a single grid all the conditions that affect anchoring. The worst omission, however, is leaving out wind strength, a vital factor that could be stated in a single line.)

The 2003 Defender catalog has half a dozen tables supplied by manufacturers, such as Fortress, Guardian, Danforth, and Simpson Lawrence. The Fortress and Danforth charts show holding power in pounds, but only the Danforth data supplies wind strengths (20 knots and 60 knots).

The 2002 Boat/US catalog uses boat length and holding power in pounds for anchors made by Suncor, Danforth, CQR, Bruce, Fortress, Delta, and others. Stating the holding power is admirable, but for what wind strength?

"Holding power" (Item B above) is at the heart of anchor and rode selection. Put another way, it begs the question, just how hard does your boat pull on that anchor? And an integral part of the problem is (Item A above), "In what bottom and with what wind and waves?"

ABYC Ground Tackle Loads

LOA	Beam		Wind Velocity (knots)			
	Sail	Power	15	30	42	60
20'	7'	8'	90	360	720	1440
25'	8'	9'	125	490	980	1960
30'	9'	11'	175	700	1400	2800
35'	10'	13'	225	900	1800	3600
40'	11'	14'	300	1200	2400	4800
50'	13'	16'	400	1600	3200	6400
60'	15'	18'	500	2000	4000	8000

Abbreviated from the ABYC version, this table shows the load in pounds exerted on all elements of a ground tackle system. For a given LOA, if the beam is greater than those shown, the ABYC says to be governed by beam. Only you can decide what will be the most extreme conditions in which you will anchor. The chart makes it clear that if you're aboard a 40-footer and you want to escape from a harbor grown dangerous by unexpectedly high winds after you anchored—say 60 knots—there is no yacht windlass available that will (unassisted by the engine) pull the boat up to the anchor against that load of 4800 pounds. Windlasses are not engineered for such heavy duty.

The ABYC vs. Robert Smith

The American Boat and Yacht Council calls holding power "Typical Design Horizontal Loads in Pounds." Robert Smith, a naval architect and engineer who spent many long days testing anchors, calls it "Calculated Rode Tension in Wind and Waves."

The ABYC data comes in a table reproduced in abbreviated form above. Smith's table is on page 18. A cursory examination will tell you that they are wildly dissimilar.

For wind strengths, the ABYC table gives a set of figures for "Lunch Hook," "Working Anchor" and "Storm Anchor," which corresponds to winds of 15, 30, and 42 knots. If you expect to anchor in 60 knots (typical in summer thunderstorms), you multiply the "working anchor" value by four.

Along the other side of the table are boat lengths from 20 to 60 feet, in five-foot increments, but modified by a

Robert Smith Ground Tackle Loads

LOA	Wind Velocity (knots) 21	30	42	60
21'	46	94	184	375
24'	60	123	240	490
30'	94	192	375	765
36'	135	276	540	1102
42'	183	376	736	1499
51'	271	554	1085	2211
60'	374	767	1501	3060

From the second edition of the respected book, Anchors—Selection and Use, *this table, selected to match as closely as possible the catergories in the ABYC table, shows actual 'anchor cable tension' figures based on many tests done by the author Robert Smith, on the Columbia River. The values are for sloops and cutters. The author says to add 15% for yawls and 25% for ketches and schooners. Powerboats would call for an even greater factor. The anchor rode scopeis specified as 5:1.*

second column giving a boat's beam (for both power and sail). A footnote says that for your boat, use whatever combination gives the highest load.

The ABYC data is good, conservative stuff, which is where one should be positioned when buying an anchor and a rode that will stand up to the extremes. The selection should be made on a thoughtful pre-determination of the worst conditions in which one expects to anchor. The problem is, of course, that after building an anchor system based on 42 knots you find yourself stuck in a rather open anchorage during a two-day gale that wasn't supposed to happen.

In sharp contrast to the ABYC data is the data published in the table of the third edition of Robert Smith's 1983 book called *Anchors—Selection and Use* (see table above).

Smith told *PS* (a year or so before he died in June of 1997) that he obtained his data from testing in a level area of the Columbia River that has a fine sand bottom and a fetch of four miles to windward. He used several boats, both power and sail. With a 30-foot boat anchored in 30 knots of wind, the ABYC says the load on your anchor system will be 1,200 pounds. Using Smith's figures, the load will be only 341 pounds. The figures, if used to help you determine what size anchor and rode to use, will produce radically different choices.

One more example: if you have a 30-foot sailboat and get caught on a night when a 60-knot squall goes through the protected harbor in which you're anchored, the ABYC says the pull on your anchor rode will be 2,800 pounds. Smith says it would be 765 pounds. The ABYC figures are about 3.5 times greater than Smith's. When asked to explain these wild discrepancies, Smith said, "I don't know how they got their figures; mine are real, developed by actual testing."

As originally explained by Tom Hale, then the ABYC's technical director, the ABYC data was developed in the 1950s to indicate the strength required of an anchor bitt or cleat. Hale said it is not unreasonable to apply the figures in the chart entitled "Ground Tackle Loads" to the entire anchor system (as has been done in various catalogs and books). Hale said the ABYC tests (done with a 40-foot boat by Bob Ogg, who developed the Danforth anchor) assumed a "worst case" situation, including sea state and surge. Hale also said the figures were subjected to a hefty, but now unknown, safety factor that over the years has made the table a trustworthy guide.

Philippe Ras, the ABYC technical director until 2003, said the much-used Table 1 in H-40 of the "Anchoring, Mooring, and Lifting Section" of the ABYC's voluminous standards now is entitled "Design Loads for Sizing Deck Hardware."

Feel Like Some Tough Math?

If you want information that's less general, something more specific to your boat, you can calculate the load (or drag) on your ground tackle—that is if you're very patient, meticulous, and mathematically inclined.

It's all based on Isaac Newton's wind-drag data, developed in the late 1600s, which became highly refined after the precision of aviation research subsequently improved.

As presented in Don Bamford's book, *Anchoring*, the formula for drag (D) in pounds per square foot remains:

$$D = C_d \frac{pV^2S}{2}$$

C_d is the coefficient of drag, p is the density of air, V is the wind velocity in knots, S is the boat's cross-sectional area (in square feet) taken at right angles to the wind.

You can, for p, substitute the U.S. standard atmospheric air density of .0023779.

For S, you'll have to measure and do some geometry on your hull, mast, cabin, boom, dinghy, lifelines, stanchions, pulpit, and everything else (including any pretty girls you habitually carry up on the bow) that creates wind resistance. You then need to increase some of the figures for however much your boat yaws at an anchor.

For C_d values, Earl Hinz, in his book, *The Complete Book of Anchoring and Mooring*, supplied some general guidance with this table:

Angular tramp steamer	1.2
Cabin cruiser	1.0
Morgan OI-41	.9
Oil tanker	.85
Cruising trimaran	.55
Racing trimaran	.45
Airplane	.09

Even better, Bamford says a sailboat with a "really sleek" superstructure will run as low as .70, but a blocky pilothouse or even a dinghy strapped on deck would push the figure to 1.00. He simply suggests using 1.00.

If you anchor in a current—say five knots, with a 40-foot boat, Hinz says to add 300 pounds to the load. Bamford says to add 10 percent.

For surge loading from wave action, Bamford says it isn't important in normal anchoring, if you have a sure-fire way to prevent snubbing. Hinz says that in severe conditions, the up-and-down jerking can double the load, especially if the boat is heavy displacement.

Both Bamford and Hinz are emphatic in noting that the load increases as the square of the wind velocity. In other words, if the wind doubles from 30 to 60 knots, the load is four times greater.

Intimidating, isn't it?

Simple redundancy—as displayed above—is one way to enhance holding power, but it's rarely the most efficient approach to anchoring.

Further Beclouding the Issue

Neither the manufacturers' data nor the Smith tables mention wave action; presumably, you're supposed to anchor in very sheltered water, as we'd all prefer to do.

And in none of the data is there any mention of the bottom conditions, which is probably the greatest variable of all. Despite that getting the hook to "grip" is sometimes the most difficult facet of anchoring, the tables simply presume that you've induced the anchor to take a very firm hold on the bottom—be that sand, soft mud, hard clay, rock, shingle, coral, sawdust, or an old shipwreck—and that it will not drag in any wind shown on the table. (Perhaps the most surprising fact that emerged from *PS*'s many anchor tests is that an anchor never, ever stays put exactly; even a light load "works" an anchor in the direction of the pull.)

We firmly believe that anchors should be tested under different conditions to derive useful data. Good engineering practice holds that tests must support theoretical or calculated data (an anchor's "holding power" often is calculated as "frontal area" by the manufacturer.) And with anchors, testing is not easy, not only because of the many variables, but also because it's plain hard work.

As mentioned, there is no dearth of tests. Some are independent tests; more often they are sponsored by an anchor manufacturer or inventor. We've never seen a sponsored test that did not come out favoring the sponsor's anchors; those that don't must get unpublicized burials. Peculiarly, even the independent tests never have produced results that point a shining light on the perfect, all-purpose anchor, the one that sets every time and holds better than all others, in all bottoms. That has led most experienced sailors to conclude that you should carry two, or even three, different types of anchors.

Even the French-made Spade does not top all others in all of the *PS* tests.

The Bottom Line

So, what's a body to do? What size anchor do you need? And what size nylon or chain rode should you use to hook it up?

It depends, of course, on what kind of anchoring you expect to do. If you never venture out in anything even slightly resembling threatening weather, you can go with the recommendations of most manufacturers and those based on Robert Smith's tables. Generally speaking, this data would appear to fall in the minimum category. Remember: You're going with the minimum and there'll be trouble if you get caught in any conditions other than that.

If you're the type who prefers to be prepared for anything, you'll need powerful gear based on the ABYC tables, which, compared with other advice, call for much heavier gear—both anchors and rodes.

Even when so equipped, there are places so notoriously bad for anchoring (such as off some of the California islands and the old, ooze-filled whaling harbor at Nantucket, south of Cape Cod) that savvy sailors don't even attempt to anchor in these locales; they pick up moorings, go into docks, or leave.

In the final analysis, consistently successful anchoring calls—most of all—for good judgment based on knowledge and experience. And, here and there, a goodly helping of pure luck. ■

SPREAD AD: "BOAT BUYING 10 THINGS"

PMS 207 AS NEEDED

SPREAD AD: "BOAT BUYING 10 THINGS"

PMS 207 AS NEEDED

Etap 37s

This Belgian-built sloop offers style and comfort—as well as a nice turn of speed—in an 'unsinkable' package, but its high freeboard and low lifelines give us pause.

Several unique features distinguish the Etap 37s, among them a removable mainsheet traveler, and the option of a tandem keel. Also, the teak on the cockpit seats and coaming is bonded to the deck, not fastened.

Unlike the bastions of this industry that were founded by sailors interested in manufacturing boats, Etap, the parent company of Etap Yatching, was formed in 1948 by Achilles Daelmann, who initially operated out of a small shed. At the outset, Daelmann earned his living by manually rewinding electrical motors, eventually venturing into the manufacture of light fittings, which is still the company's primary business.

The firm eventually entered the boatbuilding industry for the purpose of experimenting with the uses of fiberglass, which was then an untested, newly emerging material. The first Etap offered to the public was a 22-foot, trailerable sloop designed as an affordable, safe daysailer for families entering the sailing world. With surprising insight, Etap promoted her as speedy and lightweight, and safe, since blocks of foam were inserted between the hull and inner liner, which allowed the boat to be categorized as unsinkable. After producing 1,800 of that model, the company followed with a 28-footer in 1977, and 20-footer in 1980. The Etap product line now includes eight models ranging in size from 21 to 39 feet. With more than 6,000 boats built to date, the company's boatbuilding division—100 workers strong—now produces 200 boats per year.

Design

Still a family operation, the company is managed by a group of engineers who hire architects to convert their concepts into working drawings. The Etap 37s was designed by Mortain and Mavrikios, a European firm that has created several other models for Etap, as well as Dufour, Feeling and Locwind.

"The target was a fast, safe, comfortable cruiser for sailors seeking quality, safety and performance," according to Dane Somers of Sail La Vie, the U.S. importer. "It will especially appeal to sailors who are committed to making extended passages."

The hull presents a relatively low profile, especially since she is considered a pilothouse sloop. With a nearly plumb bow and flat sheer that leads to a reverse stern over which towers a high-aspect rig, the Etap 37s carries her beam well aft. In many cases "pilothouse" equates to an unsightly box sitting atop the deck; not so with this vessel, which sports three broad plexiglass ports on the front of the cabin. The boat's underbody complements that by way of a rounded section with little chine and plenty of volume below the waterline, both of which contribute to headroom and storage capacity down below.

On paper, she ranks as a performance cruiser; her D/L is 161 and the SA/D 17.61 with a 100-percent foretriangle, placing her in the fast-to-moderate classification. Based on our test sail, we estimate she will sail to those numbers.

Deck Layout

We give the company two gold stars for the manner in which the traveler system has been designed, but we also award one demerit for not making available on this model the innovative steering system that they do offer on their 32-footer.

It's no secret that we prefer end-boom mainsail sheeting because it produces better mainsail shape. It's also no secret that most manufacturers now place the mainsail traveler atop the cabin so that it won't interfere with crew comfort, and makes it easier and safer to move about the cockpit.

In this case, the manufacturer offers end-boom sheeting as well as a fine-tune on the mainsheet that significantly reduces the muscle power necessary to trim the sail, and a solid vang, as standard equipment.

Etap also has designed a novel system that solves the traveler-in-the-cockpit problem: the traveler on the 37s can be removed by releasing two pins; it's a one-minute exercise, whereafter you can secure the mainsheet tackle to a padeye in the cockpit sole. The traveler is then stowed out of the way in a lazarette. The result: the ability to trim the sail properly and a cockpit free of clutter, since the cockpit table also is portable. In most conditions, the combination of mainsheet and vang will offset the reduced flexibility when the traveler is stowed. Additionally, padeyes located on the toerails on both sides of the cockpit allow the boom and mainsheet to be secured out of the cockpit when at the dock—the boating equivalent of wide open spaces. It's a wonder it took decades for designers to perfect and produce this sensible arrangement.

The yang of the cockpit is a 40-inch-diameter wheel that, like most, interferes with movement since it diminishes the space between the wheel and cockpit seats. Because the benefit of a large wheel is that it eases steering, and tillers on boats this size have proven to be unmarketable in the U.S., it is a mystery that more companies aren't installing pivoting wheels (like Beneteau), or folding models like that recently introduced by Lewmar.

This is where the tiller installed on the Etap 32 and 34—a marvel of creativity—would come in handy (see photo and explanation on pg. 26). To the company's credit, the emergency tiller on the 37 is secured close at hand under the helm seat, rather than buried in the recesses of a lazarette.

In Europe, where boats are often tied stern-to ("Med style"), cockpit access commonly takes place via boarding steps on the stern, as is the case with this boat. Swimmers use a stern-hung stainless steel boarding ladder that is standard equipment. However, in most marinas, the boat's 48-inch freeboard may necessitate the purchase of a step that will ease loading stores when docked beam-to.

Etap 37s

LOA: 36' 11"
LWL: 32' 6"
Beam: 12' 7"
Draft: 6' 5"
Displacement: 13,987 lbs.
Ballast: 4,405 lbs.
SA/D:161
D/L: 17.61
Mainsail: 389 sq. ft.
Genoa: 427 sq. ft.
Fuel: 30 gallons
Water: 65 gallons
Waste: 20 gallons

Once aboard, we found that the 16" (wide) by 14" (high) cockpit seats (with backrests sloping outboard) provide good support when heeled, though beyond 15°, when sitting to leeward, they are less comfortable. The seats are finished with solid teak recessed into the framework, a good idea since it eases housekeeping. The helm seat swings up to ease access to the stern. The propane locker is located in the transom aft of the helm seat, a plus when loading a full bottle from a dinghy.

Cockpit storage reflects the boat's bluewater pedigree: the starboard lazarette is 36" deep and 42" wide, large enough to store a six-person life raft, seemingly a redundancy in an unsinkable yacht. An aluminum frame built into the lazarette houses hatchboards, an excellent idea since they invariably seem to end up under settees or berth cushions. The port lazarette has storage in a 21" wide, 33" long, 14" deep area that is adequate for dock gear and miscellaneous spare lines.

Two other aspects enhance onboard safety: the high toerail and an aggressive TBS non-skid pattern that allowed our deck shoes to grip firmly when the deck was covered with dew.

The toerail on board the Etap 37s is constructed of long sections of extruded, brushed aluminum elevated two inches above the deck; making it high enough to keep the crew aboard while still allowing water to flow underneath and overboard. Cleats are built into these sections, which we think is a nice consolidation of function. Brushed aluminum grabrails on the cabintop are located where they are most needed, and 24" wide decks amidships (more than most boats this size), proved to be a real plus on the day we sailed the boat. The one drawback of all this, however, is that the upper lifelines are only 22" off the deck—five inches shorter than we prefer for optimum safety.

The mast is a Selden 9/10th rigfitted with double spreaders. It's stepped on deck because the company believes that method produces a watertight seal without compromising on strength, since a stout compression post is laid on the keel. Deck-stepped masts have pluses and minuses, but are becoming more common on larger boats since chainplates are commonly glassed into the hull. Etap leads all wire cables through a stainless steel tube in the mast to protect connections from weathering. Standing rigging is stainless steel wire; and the backstay is tensioned mechanically with a winch handle.

Our test boat was equipped with an in-boom mainsail furler that operated smoothly; the Elvström mainsail carries two full battens in the top sections, and two partial battens farther down that produced good sail shape, especially compared to battenless furling mainsails. Like most furling mainsails, however, this one suffers a loss of some power as a byproduct of its small roach. The sail is built with three reef points, and the boat was commissioned with a continuous reef line running through blocks at each reefing eye.

Halyard and sail controls are led aft so they're close at hand and operate easily. Sheet stoppers port and starboard of the companionway are Antal Grip 10, through which halyards are led to Lewmar 40 self-tailing winches. Headsail track is located inboard at

The pilothouse integrates nicely into the deck design on the Etap 37s, but the lifelines seem too low.

the base of the cabin, with sheets led to Lewmar 44 self-tailing winches that were large enough for easily handling the 135-percent genoa, which carries 427 square feet of Dacron.

Belowdecks

Though the configuration of spaces belowdecks is typical of the genre, we found several attributes that stand out when compared to competitive models. For instance, the on-watch crew can sit atop the companionway step and have an fairly clear, 360-degree view through ports on both sides of the cabin, and the large Plexiglas ports on the front of the cabin. The solid cherry and cherry veneer wood surfaces below enhance the feeling of spaciousness, and handrails port and starboard in the saloon are an absolute necessity for an offshore passagemaker.

Standing headroom in the main salon is 6' 6", sloping down to 5' 11" at the forward bulkhead. The saloon measures 11' 6" on the centerline, with 86" of clearance between port and starboard settee backs. Settees are 6' 7" long, and fitted with leeboards as standard equipment. Storage areas are beneath the settees, and outboard on the hull, which is lined with cabinets.

Perhaps the most clever—and sensible—design feature is splitting the galley into two sections, rather than constructing the typical L-shape. On the Etap 37, the Eno two-burner stove and a 24" x 28" counter over the refrigerator are located along the hull to port. A recessed cutout in the cabinetry provides space for a microwave; storage is offered in three drawers aft of the stove, and below the stove, where pots and pans will live.

Particularly interesting is an island at the foot of the companionway measuring 18" x 38" that is finished with a Corian countertop and two 12" diameter x 8" deep stainless steel sinks surrounded by wooden fiddles. The arrangement adds form to function since one end of the island houses storage and space for a waste basket, as well as providing access to plumbing manifolds. In this configuration crew can move fore and aft on either side of the island, which also serves as a support for the cook when heeled. This arrangement actually adds counter space, since the area between the countertop to port and the island may be spanned by dropping in a custom 17" x 20" cutting board. It's a nice, novel arrangement, but we'd have to spend some time living with it before rendering a final opinion.

The dining table is a drop-leaf affair on the centerline that produces a 42" long x 40" wide surface, seating for four, and a cubby for wine bottles.

The nav station is located aft of the starboard settee, and fitted with a 24" x 30" chart table, large enough for a folded chart, and 25" x 18" seat for the navigator. Four drawers reside below the chart table. The electric panel has adequate space for VHF radio, chartplotter and repeaters, as well as a storage area outboard. On balance, it is more functional than nav stations we see on similarly sized boats designed for coastal cruising. And located under the navigator's seat are a 70 AH starting battery and a 108 AH 'house' battery, both standard equipment—off the centerline, but handy.

A single head large enough for average-sized adults is a sensible arrangement on a 37-footer intended for bluewater passages. Located aft of the nav station, it is equipped with typical appliances, as well as an area designated for hanging wet gear near an opening hatch. Though a holding tank is an option on European boats, it is standard equipment on U.S. models. The builder located the tank aft of the head, which frees space to add a large closet in the head designated for the storage of tool boxes; the location of the tank also minimizes odors in the head and saloon.

The owner's quarters are aft to port in a stateroom with 6' 5" of headroom, allowing the skipper to stand and dress comfortably, and space to bed down on a double berth measuring 6' 7" on the center and 5' 6" at the head., with lots of room for feet. Access to the steering quadrant is via a panel at the end of the cabin.

The forward cabin is smallish—just large enough for two adults—but it's a sensible compromise because it increases space in the saloon, where most time will be spent anyway. Crew will bed down forward in a V-berth measuring 80" on centerline, and 59" at the head. The area below the V-berth is filled with foam and a water tank; fuel tankage is located amidships aft of the engine.

On balance, spaces down below combine a level of creativity while attaining the goal of producing comfortable living areas and adequate storage areas, plus water and fuel for the cruiser.

The innovations continue down below, beginning with a centerline island that houses two sinks and ample stowage. Just above that are the boat's broad portlights that offer light and easy forward visibility from the companionway.

Construction

The most unique aspect of the company's construction methods is that it results in boats that are certified by the French *Marine Marchande* (merchant marine) as being "unsinkable." The process involves production of a hull and liner bonded to the hull that stiffens the boat and provides the base for furniture and other attachments, a fairly standard method. However, in this case, the space between the hull, liner, as well as other voids, is large enough that it can be injected with closed-cell foam to form blocks of flotation.

The process involves spraying the outer skin of the hull with an osmosis-resistant, ISO-NPG gelcoat, followed by two layers of a 35-percent fiberglass roving and 65-percent resin blend that is hand-rolled to eliminate voids. Additional layers of woven roving are added to reinforce the bow, keel, and chainplate areas. Once the outer hull is constructed, the main bulkhead is installed, after which wiring runs and spare runs are installed in conduit. The liner, which is constructed in two pieces, is then sprayed with a two-part polyurethane closed-cell foam, and bonded to the hull. Additional foam is then injected into shaped cavities in the hull, all of which have exit holes through which excess foam can flow without adding pressure to the bond between hull and liner. Flotation, however, is not installed in the bottom to increase righting ability in the event of a capsize.

"The outer hull is as strong as a conventional boat," Somers says, so, except as a home for the foam, the liner functions like those on most production boats.

Similarly, closed-cell polyurethane foam is laminated in the deck, along with plywood stiffeners. Hardware is attached to aluminum plates bedded in the deck areas, a solid method when executed properly.

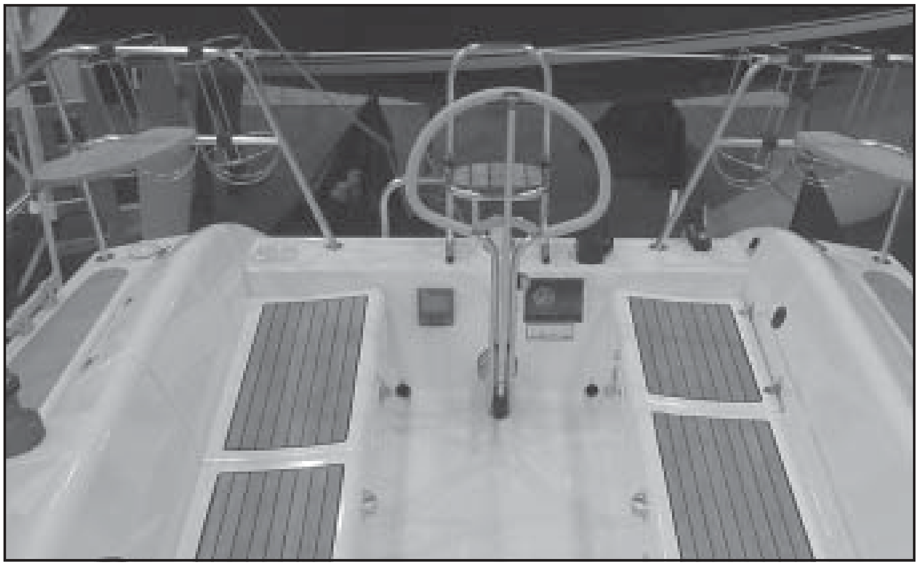
The hull is bonded to the deck with resins and mechanically fastened with rivets and through-bolted on 4" centers, then covered by a rubrail. The close attachment points produce a leak-resistant seam.

To receive French certification, the boat was required to pass four tests: a) when flooded, freeboard was not less than 3 percent of its overall length, so the water level was at the height of a settee cushion and the cook could work in the galley; b:) the flooded yacht floated in a near horizontal position; c:) the flooded yacht and a crew of eight righted itself from 90 degrees of heel; d:) the flooded yacht is capable of being sailed.

The company has added one more wrinkle to the purchase decision: the standard fin keel is a cast iron section with a draft of 6' 5". However, a tandem keel similar to that seen on some America's Cup yachts is an option. In effect, two short keels are mounted to the hull and a wing-bulb is connected to each. The result is an improvement in performance produced by maximizing lift when sailing upwind, and a shallower draft. Priced at $1,604, the option isn't cheap, but it will improve weather performance while reducing draft, and that's a real plus. The downside is that it's more prone to snagging something, and cast iron appendages require assiduous maintenance to avoid corrosion.

Performance

With Somers at the helm, we tested the boat on Lake Michigan on an early spring day in winds ranging from 3 to 12 knots. We initially sailed with the mainsail only and found that she will go to weather at 3.75 knots in 8 knots



Etap's innovative EVS system (Etap Vertical Steering), seen here aboard the company 32-foot model, represents a strong evolutionary step in steering systems. Rather than steering by moving the tiller through a horizontal plane, this system has a half-circle 'wheel'—attached to a strut and gear—that swings through a vertical plane to steer the vessel. Etap reps say their system is more intuitive than a tiller because you simply move it to the right to make the boat turn right, and vice versa. We think the real value is that it saves space in the cockpit. Unfortunately, Etap sources say the EVS isn't suitable for the 37 because of the additional structure that one this size would require to control the increased forces acting on the 37's larger rudder.

of wind. The Selden-Elvström combination produced better sail shape than we are accustomed to seeing with furling mainsails.

With a full main and 135-percent jib, the boatspeed immediately increased to a steady 6.75 knots, the helm so well balanced we abandoned it while sailing hard on the wind into gentle, two foot rollers. Then, with the wind dying in advance of an approaching thunderstorm, we ghosted at 3.5. to 4 knots in 5 knots of wind. Though not nimble, she does not stick to the water in those conditions. However, one caveat: we sailed the boat when she was dry, so a potential owner should consider the effect on performance of full tanks and stores.

A practical option for the offshore sailor will be an inner forestay onto which can be hanked a non overlapping jib. In heavy winds and seas the smaller sail will produce a more comfortable ride, avoid beating a genoa to death or the need to change the sail on the furler.

At the end of the test, as we approached the marina we experienced several 50 to 60 knot gusts that caused her to heel to 40 degrees, despite having doused the sails. The Etap 37's high freeboard adds windage while preventing the rail from dipping below the surface.

These gusts allowed us to test her performance while motoring with the Volvo 2030, three-cylinder diesel, with 28 rated horsepower at 3,600 rpm. She passed with flying colors. The boat maneuvered smartly in the marina under propulsion provided by a Volvo Saildrive with fixed, two-blade prop. One final unique feature among the mechanical aspects of this boat is an electric fan blower in the engine compartment that operates automatically when the engine is running; this is common on powerboats, yet we rarely see them on sailboats.

Conclusion

Priced at $199,900 FOB an East Coast port of entry, the Etap 37 occupies a spot at the high end of the market when measured against most production boats of similar size. However, she is priced competitively compared to quality boats designed for offshore passages. Buyers will pay a premium for her unsinkability.

Somers explained that "this construction method adds 20 to 30 percent" to the cost of construction, which raises a question about a) the necessity of an unsinkable boat, or b) the veracity of CE category A. The CE certification (required of all recreational boats sold in the European Union) does not hold offshore cruisers to an unsinkable standard, or require construction methods as stringent as a Lloyd's certification. Most sailors are aware of the risk of going to sea, but assume that a liferaft affords a great degree of protection in the event of a holing. Ultimately, then, a prospective owner may be forced to weigh the risks of an offshore catastrophe with the additional cost of an unsinkable craft. As with any monohull, if the keel falls off it will turtle, though this boat will be more buoyant than a conventionally constructed sailboat.

Ignoring that issue, this is a well-conceived boat that performs well over a broad range of wind speeds. It is also well-equipped, and user-friendly. The designers added some innovations that will improve performance and comfort (like the tandem keel and traveler arrangement), and features like the galley island that make sense.

The boat is targeted to experienced sailors with a bent for extended offshore passages. We think it's a better candidate for that kind of buyer than the casual weekend sailor, or beginner. But even the experienced sailor will need a footstool to clamber aboard. ■

***Etap Yachts, Sail La Vie**, 207/865-1855; www.etapyachting.com*

Cabin Lights

The Alpenglow fluorescent is still a top-flight area light, and a good bet for a dome-light retrofit. Taylorbrites's new cold cathode lamp is a winner over the bunk, but new LED lights from Imtra and D.R. Smith are bright, not too cold, and easy on the power.

Among all the energy demands aboard a modern boat—electronics, pressure-water systems, watermakers, autopilots, refrigeration, and so on—it's simple DC cabin lighting that's often the largest factor in overwhelming the storage batteries. Turn on three measly 20-watt incandescent lamps and leave them on from dusk until bed time—say, four hours —and you'll take 20 amp hours out of your system (3 x 20 watts = 60 watts; 60 watts / 12 volts = 5 amps; 5 amps x 4 hours = 20 amp hours.) That's comparable to running an anchor windlass, under a working load of 40 amps, continuously for half an hour. The same is true at home, of course, where parents since the days of Edison have adjured their kids to turn the lights off when they leave a room. The difference is that on shore we notice the carelessness when the bill comes. On boats, we notice when the house battery dies. If the battery switch has been left on "Both," or there's only one battery for all duties, including engine-starting, that carelessness can spoil your day.

The power demands of lights are so important aboard boats that for this article we initially intended to cut to the chase and review only LED-based cabin lights. We had in mind a scenario in which a boat owner wanted to use LEDs to replace reading lights in the forward and main cabins, and dome lights in the main cabin and galley. We think of dome lights as spreading a wide angle of illumination, and bulkhead reading lights as more directional, although these, too, are often used for general illumination, and aren't as strictly directional as a chart light in the nav station.

Area lights, top row, left to right: Perko incandescent; Guest halogen dome; Alpenglow fluorescent. Second row: West/ABI xenon 2x10 watt; West/ABI xenon 20-watt; Thin-Lite 2x7 watt fluorescent. Third row: West/ABI stainless LED dome light; Imtra/Cantalupi halogen "Chip;" Perko LED utility light; Imtra/Cantalupi LED utility light; D.R. Smith LED cluster "Montserrat."

Would such a wholesale move be possible for both area and spot lighting? Yes. Would it be advisable? Not yet. In any case, LED lights really need to be compared directly with the other types of lights on the market, especially since most of the makers and purveyors of LEDs tell us that the technology is changing rapidly and markedly, and that what might be a decent cabin light now will be much better, and cost less, in a matter of months. So we decided to expand our scope and survey a wide sampling of cabin lights on the market, including LEDs.

Light Terminology

Some basic concepts and definitions are in order, so that we can make reasonable comparisons.

A **lumen** is the measurement unit for **luminous flux**, the quantity of lamplight cast in all directions.

A **lux** is the measurement unit for **illuminance**, the quantity or density of light cast on a surface. One lux equals one lumen per square meter. (Illuminance can also be expressed in foot-candles, which measure light on a square foot of surface, but the foot-candle measurement is becoming obsolete.)

These definitions are intertwined with those of candelas, luminance, luminous intensity, and several more that help people get a grip on artificial light. For the purposes of this article, we'll be speaking in terms of lumens, and measuring in lux units.

Of particular concern is the relationship of lumens and watts. For example, a 60-watt incandescent household light bulb rated at 840 lumens produces 14 lumens per watt. On a boat, a 10-watt xenon bulb might typically perform about the same, while a fluorescent bulb would produce a much higher ratio of lumens per watt.

The apparent "warmth" of a lamp's color can be expressed through its **color temperature** in degrees Kelvin (K). The lower the color temperature, the warmer-looking the glow of the light. A candle flame has a color temperature of about 1800K. Sunlight at dawn or dusk is around 2000K. A 100-watt standard incandescent (tungsten) lamp is about 2800K. A standard "warm white" fluorescent would be about 3000-3300K. Direct sunlight at noontime is around 5000-6000K, and "daylight" fluorescents are in that range or somewhat cooler. And so on—up to the high numbers represented by various levels of sun/cloud combinations and cool blue northern skies.

Color temperature can be metered and measured, but we found it easy enough to eyeball the lights for any remarkable warmth or coolness. Those remarks are in the chart on pages 30-31.

Light Types—Pros and Cons

We'll make the assumption that all of us are seeking pretty much the same ideals in cabin lights aboard sailboats: 1. They should provide a large number of lumens per watt. 2. The light they cast should be warm and welcoming. 3. They should produce little heat. (There are, of course, people who sail in colder weather who often prefer a bit of extra heat when they can get it.) 4. They shouldn't cost much. 5. They should last a long time.

Obviously, no single light type can offer all of these things. So there are trade-offs to consider.

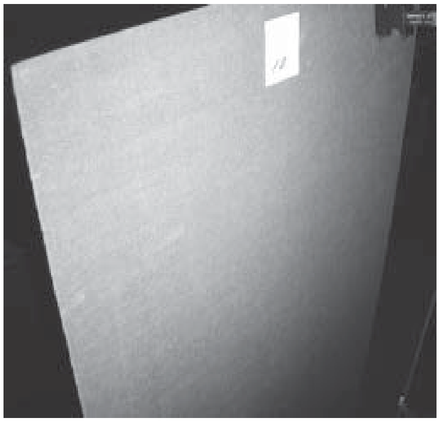
LEDs are narrow-beamed and directional. They don't spread light, so if you want to use them as area lights, you have to arrange them in a cluster so that individual LEDs shine outward in a pattern. LEDs deliver long life (forever, for most practical purposes), hardiness (no fragile glass or filaments to break), very low power consumption per diode, and low heat per diode. On the downside, they're still quite expensive, and while red LEDs are good as night-vision lights in the nav station and cockpit, white LEDs emit a cool, bluish light, which few would say makes for pleasant company. Individual LEDs vary in quality, and are culled and graded by manufacturers before they leave the factory.

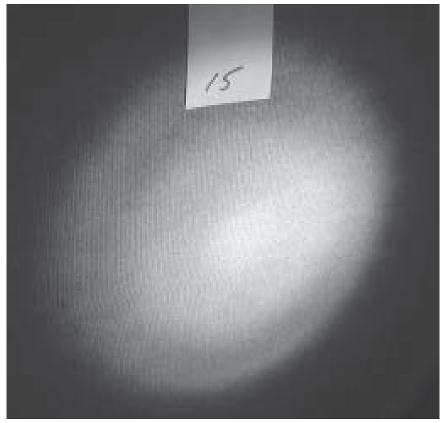
If this sounds like faint praise, it isn't. The long lifespans of LEDs eventually justify their cost. They're extremely versatile and hardy, and with the technology developing almost hour-by-hour, they're becoming both warmer and less expensive (see *PS* Advisor, pg. 36).

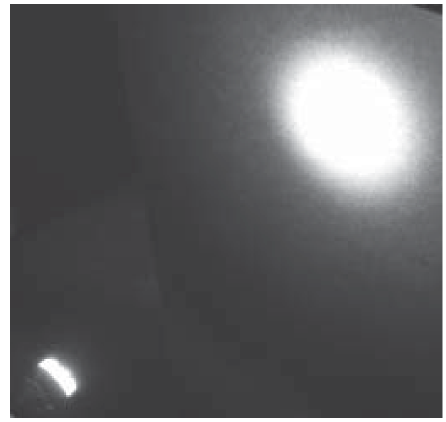
Fluorescent bulbs come in several varieties, such as standard, compact, and cold cathode. Color temperatures vary from about 2700K all the way to 5000K and above, depending on whether the tubes are standard, "warm-white," "daylight," and so on. The advantages of fluorescent bulbs are long life, excellent lumens-to-watt ratio, low heat, and reasonable cost. The downside of the typical fluorescent lamp is a color temperature that's too blue and cool; however, some fluorescents are quite warm, as we shall see. Also, all fluorescents run on AC power, which means that they must be adapted to DC power systems by means of a built-in inverter. Sometimes this can cause radio frequency interference, so be careful if you mount a fluorescent light near sensitive electronics and communications equipment.

Incandescent lights of the familiar tungsten-filament variety cost less than any other type, and offer a warm glow. Bulbs are readily available. The downsides are that they burn out relatively quickly, offer the lowest lumens-per-watt ratio, and produce heat. Interestingly, it's getting harder to find stan-

Reading/spot lights, top row, left to right: West/ABI xenon cabin light; West/ABI xenon brass berth light; Gator Opal bulkhead light; Aqua Signal halogen mini-spot. Second row: Imtra Touch LED reading light; Taylorbrite CCF fluorescent; Imtra/Cantalupi halogen "Patty"; Hella halogen reading light. Third row: Weems & Plath Mini Yacht Lamp; LED clusters for bulb replacement; D.R. Smith LED reading light "Little Inagua"; Imtra surface mount LED reading light; Imtra recessed reading light with 'warm white' LEDs (prototype).







Three widely different spreads of light from a distance of 12". Left, the wide, even coverage of the Alpenglow fluorescent. In the center is the contained, directional light from the West/ABI Xenon Swivel Cabin Light. At right is the intense spot beam from Sailor's Solutions' LED19.

dard incandescent bulb lamps in marine stores these days. (Replacement bulbs are available, but new lamps are scarcer.) Most light makers are now going with halogen and xenon bulbs.

Halogen and **xenon** bulbs are closely related to the standard incandescent. The difference is that the inert gas inside the bulb contains halogen, which helps return tungsten particles to the filament, slowing the burn-out process as well as enabling the filament to be heated to a brighter temperature without. In order for the process to work, the bulb has to be very hot. This, in turn, means that the bulb needs to be made of thick, heat-resistant glass or a quartz-based crystal.

Some bulbs contain high-quality xenon as the inert gas. This enables a more efficient process of returning tungsten to the filament, increasing brightness and bulb life still further.

Aside from cost, the downside to all this is—you guessed it—more heat, which can not only make it uncomfortable for people inside the boat in warm weather, but cause fire if a light is thoughtlessly installed. Nils Nelson of D.R. Smith & Associates told us some hair-raising stories of people who insisted on installing high-wattage halogens in non-fire-resistant headliners and other areas where their heat couldn't be dissipated properly. "Just because a fixture will accept a higher-wattage bulb doesn't mean you should install one," he cautioned.

Even so, halogen bulbs are an excellent balance of cost with effective light. They typically show a whiter, higher color temperature than standard incandescents; about 3200K versus 2800K. This can be harsh in some situations, but makes great task lighting. And they have a good lumens-per-watt ratio of about 15.

Decisions, Decisions

As standard-issue sailors, not experts in lights and lighting, we admit being a bit flummoxed by the prodigious amount of science involved in the study of light—its color, intensity, warmth, concentration, etc.—as well as by the large number of artificial lighting products available for boats, and the variations and overlapping characteristics of many of them. Add to that the fact that several of the light makers and light experts we talked to are in disagreement over the finer points of both science and light engineering, and it was difficult to figure out how to bite off a digestible amount for this article. When we were griping to our friend the shellfisherman about the vastness of this topic, he said: "Hey, people don't need to know all that. What they need to know is, when you're down in the cabin, trying to make some time with your honey, do you light the oil lamp and turn it down low—or flip on the halogen?"

The man, of course, is entirely correct. It's not so difficult to define what kind of light serves what purpose best. Consider what Al Johnstone of J/Boats had to say when we asked what kind of lights his company preferred in different locations aboard: "In general, we use halogen lighting in main cabin areas for reading lights and red/white domes, and fluorescent fixtures in head areas. Ninety-eight percent of the lights are sourced from Imtra (Cantalupi) and Hella Marine (including domes and nav lights). On a boat like the J/105 we'll use very simple plastic-finished self-contained halogen lights, whereas on the J/42, J/46 and J/160, we'll go for a complete dimmer system for ambient lighting in the main salon and galley areas, in addition to chrome-finished self-contained reading lights. We occasionally will still use incandescent lighting, depending on the application and available fixtures/style. We continue to watch with interest the developments in LED lighting, due to the low energy requirements. We have little experience yet with xenon fixtures."

These views would be typical, we think, of many sailors—we lean toward warmer lights for area lighting, and fluorescent for galley, head, and engine-room areas. When we can substitute LEDs without sacrificing too much warmth or dramatically increasing cost, we will.

And so it remained for us to gather the sampling and try to find lights that we'd actually like to buy. The only way to get to the bottom of that essential question was to line 'em up and shine 'em. The results of our explorations are shown in the big

(continued on page 32)

Value Guide: Cabin Lights

	SOURCE	MODEL	NAME	BULB	WATTS	WARRANTY	LIST
AREA LIGHTS	West Marine (ABI)	Model 298168	White Aluminum Interior Dome Light	Xenon	2 x 10	1 year	$22.39
	West Marine (ABI)	Model 260786	Brass/Mahogany Dome Light	Xenon	20	1 year	$32.99
	Guest (via West)	West Model 398190; Guest Model 8218-5	Halogen Dome Light	Halogen	10	2 years	$47.09
	Perko (via West)	West Model 281584; Perko Model 0300DP1CHR	Surface-Mount Dome Light	Incandescent	12	5 years	$36.49
	Thin-Lite (via West)	West Model 3669215	800 Series Dual CF7 Dome Light	Fluorescent	2 x 7	2 years	$70.59
	West Marine (ABI)	West Model 5007463	LED Dome Light stainless 7" dome	LED; 18 white	3.0	1 year	$94.19
	Perko (via West)	West Model 3732906 Perko Model 1156DP112V	Utility LED Light, Ceiling Mount (flush)	LED, 12 white	2.5	5 years	$169.99
	Imtra/Cantalupi	LED Utility Light, white, flush-mount	"Bob/L"	LED, 10 white	0.4	1 year	$172.00
	Weems & Plath	Model 600	Mini Yacht Lamp (paraffin/oil fueled)	Wick & fuel	0	2 years	$110.24
	Alpenglow	7-watt w. dual West Model 3402443;	Alpenglow	Fluorescent	7	2 years	$114.00
	Imtra/Cantalupi (via West)	Imtra Model CN20401R	Surface Mount Interior Light (stainless), "Chip"	Halogen	10	1 year	$88.29
	Daniel R. Smith	12-LED cluster w. prismatic lens	"Montserrat" stainless steel area light	LED, 12 white	2.4	Lifetime	$72.96
DIRECTIONAL LIGHTS	Gator Lights (via West)	West Model 2662971; Gator Model 8000-WH	Opal Bulkhead Light	Xenon	10	1 year	$38.89
	West Marine (ABI)	Model 2660900	Xenon Swivel Berth Light Surface Mount	Xenon	10	1 year	$58.89
	West Marine (ABI)	Model 129421	Xenon Swivel Cabin Light Surface Mount	Xenon	10	1 year	$35.29
	Imtra/Cantalupi (via West)	West Model 3406469; Imtra Model CN40701R	Multi-Directional Reading spotlight (chrome), "Patty"	Halogen	10	1 year	$147.99
	Taylorbrite (via West)	West Model 3731858; Taylor Model R1DM001B	CCF Marine Fluorescent, "Euro Brass"	Cold Cathode Fluorescent	6.6	1 year	$94.19
	Aqua Signal (via West)	West Model 381913 (white) Aqua Sig. Model 15061-7	Halogen Mini-Spot	Halogen	5	1 year	$47.09
	Hella Marine (via West)	West 373985 (black) Hella 2AB004532-101	Halogen Reading Light/ Chart Light	Halogen	5	1 year	$44.69
	Imtra/Frensch	F1 White Recessed Reading Light (prototype)	"Warm White"	LED, 8 warm white	0.8	3 years	$94.00
	Imtra/Frensch	FI Black Surface Mount Reading Light	ILF1-4456	LED, 8 white	0.8	3 years	$94.00
	Imtra/Frensch	Touch LED, Shiny Chrome, w/ Touch Red	IL-4500	LED, 16 white	1.6	3 years	$199.00
	Daniel R. Smith	12-LED cluster w. prismatic lens	"Little Inagua" chrome reading light	LED, 12 white	2.4	Lifetime	$89.96
LED CLUSTERS	Imtra	LED Cluster Bulb #1142-trade number	IL-B15D	LED, 12 white	1.5	3 years	$19.51
	Sailor's Solutions	LED 19	Cabin Light Replacement Bulb	LED, 19 white	2.0	1 year	$19.95
	SeaFit (West Marine)	Model 4811022	LEDCluster Lamp (replaces Davis 3351)	LED, 7 white	0.8	1 year	$42.99

BRIGHTNESS RATING	LIGHT CIRCLE @ 12"	HEAT @ 6"	CURRENT	COMMENTS	OVERALL RATING
Intense (hi) Medium (lo)	44" 38"	80°	1.72 A 0.87 A	Somewhat uneven light direction and spread w. 2 bulbs. '50s kitchen style white aluminum. Heat vents. Good price.	Good
Intense	44"	86°	1.78 A	Nice mahogany base, warm light. Really bright, with even spread. Would be good with a dimmer.	Excellent
Bright	20"	79°	0.87 A	Basic, white plastic. Warmish light, somewhat uneven through lens but pleasant. Not a great value.	Fair
Medium	64"	80°	1.01 A	Pleasant, medium-warm light, even spread through lens. Retro-look chrome trim, quite warm to touch. Good warranty.	Good
Intense	60"	77°	1.18 A	Quite bright and widespread. Cool temp, but also cool light, typical fluorescent. Slight RF interference @ 12". Spare lens.	Good
Medium	6" w. separated beams to 30"	77°	0.25 A	Well made; quite bright, but directional. Lens seems to add some yellow warmth to light, but it's still pretty icy. Decent price.	Good
Dim	32"	77°	0.21 A	Billed as a utility light, not a dome light. Wide, nice and even spread of cool, dim light. Very high price.	Fair
Dim	12"	75°	0.03 A	Good-looking, well-made flush-mount light, billed as utility. Low power. Brighter, narrower beam than Perko. Pricey.	Fair
Dim	16"	80°	0	Good-looking, sturdy brass lamp, swings happily in a seaway, but strictly for some warm ambient light.	Fair
Bright (hi) Medium (lo)	62" (hi) 48" (lo	76° (hi) 76° (lo)	0.54 A (hi) 0.51 A (lo)	Two white settings, two red LED settings. Nice warm color, even spread. Slight RF interference at 18". Good value.	Excellent
Low	52"	79°	1.00 A	Well-made; even, warm light w. 10W G4 bulb. Bright stainless trim, smooth lens. The quality is costly.	Excellent
Low	16"	76°	0.20 A	Comparatively wide spread of even, cool, white light. Good combination of spot and small-area light.	Good
Low	38"	79°	0.89 A	Warm, even, wide light, w. white-frosted glass shade; good combination of area and spot. Full swivel. Good price.	Excellent
Bright	30"	80°	0.89 A	Attractive brass fixture; wide, fairly even spread of bright light. Good swiveling. Non-tarnish plating. Nice price.	Good
Low	10"	82°	0.86 A	Utilitarian white metal. Somewhat uneven light pattern, quite directional. Good swiveling. Decent price.	Fair
Low	22"	81°	0.91 A	Small-size w. shiny chrome finish, smooth lens, reflector inside. Well-made. Full swiveling. Bright, warm, even spread.	Excellent
Low	26"	76°	0.56 A	Medium-bright/warm light w. even pattern. Attractive design. Long life and durability at fair price. No RF noise detected.	Excellent
Low	10"	82°	0.36 A	White plastic fixture. Swivels sideways, but not up and down. Clear, smooth lens makes whiter, brighter light than Hella.	Fair
Dim	14"	77°	0.38 A	Black plastic task light, nice design. Swivels up/down, not sideways. Comes w. red lens. Directional; best for chartwork.	Fair
Low	6"	75°	0.07 A	Low power and warm, yellow cast for an LED light. Dim; best for bunk reading and accent light. Swivels down only.	Good
Low	6"	75°	0.07 A	Same basic design as previous, but vertical, w. normal white LEDs showing brighter, cooler directional light.	Good
Bright	7"	75°	0.13 A	Clever cluster in chrome gooseneck fixture. Touch LEDs to turn on one red or 16 white diodes. Cool-colored, spot only. Pricey.	Good
Low	20"	75°	0.20 A	Atttractive chrome fixture. Cool, white light, cast evenly and comparatively wide. Best dedicated LED bunk light.	Excellent
Intense	6"	76°	0.13 A	Bright, highly directional cluster. As with other clusters below, question is "What if the socket is sideways?	Good
Intense	6"	76°	0.17 A	Biggest bang for the price. Maker advises not to leave on for more than 8 hrs. at a time to avoid dimming diodes.	Good
Dim	8"	76°	0.07 A	Slightly wider spread of dimmer light than previous two. Low power use, but high-priced. OK for reading light socket.	Fair

chart on the preceding pages.

What and How We Tested

We went shopping at West Marine and ordered a pretty fair sampling of what's on their shelves. We also solicited lights from several of the big light purveyors and talked to experts about the state of the art in DC cabin lighting.

Generally, the lights we evaluated were in two categories—overhead dome-type lights with wide light spread for area illumination, and bulkhead-mounted reading lights. Also included are a few LED lights that could go either way, and LED replacement clusters for incandescent bulbs.

We powered the lights with a 12-volt power supply, dimmed the office to an ambient light of two lux, and turned on the lights one by one. We measured the spread of each light from 12" away, and took photos for comparison. We took a multitude of light meter readings for each light from different angles and distances, using a Meterman LM631. Then, because handheld light meter readings can fluctuate so much, we took into account the spread of readings, did some averaging, added some Kentucky windage, and came up with the rather simple ratings shown on the chart—Dim, Low, Medium, Bright, and Intense.

To measure heat produced by the lights, we used a Raytek Mini-Temp infrared temperature sensor to report the surface temperature of a piece of brown particle board held 6" from the front of the lens for 10 minutes. (In each case, the ambient office temperature was kept at 75°.)

We measured current draw using a Radio Shack digital multimeter.

Over the course of about six weeks, we spent quality time with each light in an otherwise darkened space, reading and contemplating the mysteries of the universe.

The results of all the measurements, along with ratings and subjective comments, also appear in that mammoth chart.

Noted in Particular

The **Alpenglow** compact fluorescent light has received words of praise several times in this publication over the years, and we see no reason to stop now. The fixture is trimmed in attractive wood; the light is warm and adjustable in four levels (two for the red LED light, two for the white fluorescent), and the light it casts will pleasantly fill the typical saloon aboard a big variety of boats. And, we think it's fairly priced (see chart).

The cold-cathode fluorescent lights from **Taylorbrite** (Taylor Made Products) deserve a very positive mention. We looked at the self-contained bulkhead-mounted reading light and were impressed by its design and the warm, even light it cast. It's expensive, and you would have to replace the whole fixture—but it should have a very long lifespan. Consider these if you're thinking of replacing reading lights in the master cabin.

Among the incandescent dome lights, we'd buy the mahogany-based **West/ABI 20-watt xenon model 260786**, and put it on a dimmer, or the **Imtra/Cantalupi halogen "Chip."** For an incandescent bulkhead light, we'd go with the **Catalupi "Patty"** model.

As for LED lights, in our view they're still a bit too cool-colored and directional to be used where a warm mood is a must, but if you can use a coolish, medium-widespread LED for reading in the bunk, **Daniel R. Smith's "Little Inagua"** would be a good bet. Another strong contender for that job would be **Imtra's F1 "warm white" cluster,** which at this writing is just going to market. The former is more of an whole-bunk light, the latter more for directing right at a book. **Imtra's Touch LED** would do very well on its gooseneck over a nav table.

Other Considerations

Lamp shades, lens types, and interior reflectors can make a big difference in the intensity, spread, and color warmth of any light. So can the depth of the bulb in the socket, and the color and reflectivity of the surrounding areas. Light will behave differently on a white Formica surface than it will on mahogany—and differently on the mahogany, depending on whether the wood is varnished in a glossy or matte finish. Dimmer is often better than brighter, and narrow better than wide.

Filament-based cabin lights can be adjusted for both light output and power demand with dimmers, which can be a simple rheostat type (an energy-waster and heat-producer) or a more sophisticated dimmer such as that made by Reddford Technology (www.reddford.com), reviewed in the January 1, 2000 issue of *PS*. ■

ABI, *800/422-1301, www.abimarine.com.*
Alpenglow*, 406/889-3586, www.alpenglowlights.com.*
Aqua-Signal, *011 49 421 4893-224-205, www.aquasignal.de.*
Daniel R. Smith & Assoc., *561/842-5704, www.drsa.com*
Deep Creek Design*, 615/646-2532, www.deepcreekdesign.com.*
Gator Lights, *941/355-4488, www.interconmktg.com.*
Guest, *800/767-8541, www.marinco2.com.*
Hella Marine, *770/631-7500, www.hellamarine.com.*
Imtra *(Cantalupi), 508/995-7000, www.imtra.com.*
Lumileds, *877/298-9455, www.lumileds.com.*
Perko*, 305/621-7525, www.perko.com.*
Reddford Technology*, 208/666-1955, www.reddford.com.*
Sailor's Solutions*, 631/754-1945, www.sailorssolutions.com.*
Taylorbrite *(Taylor Made), 941/708-0940, www.taylorbrite.com.*
Thin-Lite*, 805/987-5021, www.thinlite.com.*
Weems & Plath, *410/263.6700, www.weemsandplath.com.*
West Marine*, 800/262-8464, www.westmarine.com.*

Reintroducing Mr. Funnel

Clean diesel fuel is the first step toward proper engine maintenance. Thanks to an Alaska-based inventor, attaining perfection in that department has become easier and less expensive.

The Nov. 15, 2002 issue of *Practical Sailor* contained a report on 10 deck-fill fuel filters. Besides the results of tests (both visual and bench, to determine if the filters removed dirt and water), the report included three sidebars dealing with humbugs, dust, and how to keep your fuel clean. (Humbugs, which are fungi and bacteria, are the critters that live in water and feed on oil. The term humbug is an industry expression that stands for Hydrocarbon Utilizing Microorganisms and Bugs.)

After the *PS* report was published, several diesel engine makers, a half dozen oil industry spokesmen, and some diesel mechanics called to offer nice words about the report. Several said that if boat owners heeded those recommendations, they should never again have fuel problems—whether using diesel, gasoline, or kerosene (the filters tested work for all three).

The runner-up in the water/dirt removal testing was a widely-known filter called a Baja. The Baja is a fat, stainless steel cylindrical filter about a foot long with three screens, that comes in two sizes ($120 and $192), and is a pain to dismantle, clean and reassemble. But for years, it has been the premier filter.

The winner was a new filter from West Marine—WM-F8C. Much smaller and easier to stow than the Baja, it cost but $29 and did not need cleaning. Most importantly, the new filter passed fuel more quickly because it was designed to keep water particles away from the finger-shaped, Teflon-coated screen, which allows the fuel to flow more freely.

A month or two later, *PS* heard from a gentleman named Roger Patch in Chugiak, Alaska. Patch identified himself as the maker of that West Marine filter. Chugiak sounds like how Dangerous Dan McGrew might categorize that stupid beer drinking game. You can't find Chugiak in any atlas or encyclopedia because it's a small community north of and a municipal part of Anchorage—with the whole thing overlooked by the Chugash Mountains.

Shown in the foreground are the two jugs, one containing a gallon of diesel fuel (less one set-aside cupful) used in the 'speed pour' testing. The funnel in the empty jug is the 3.9 GPM model F3, which has a 149-mesh filter. Also shown are the measuring and mixing gear, and the Suunto chronograph used for dead-accurate timing. In the background are the other three sizes of the funnel. The new 12-15 GPM model (far right) is the same overall size as the 5 GPM version (far left), but has two filter elements, with 74-mesh screens, which means that it will not pass anything bigger than .0029". (Because most commercial diesel pumps are set to deliver 10 GPM, this filter would be ideal for boats that take aboard large quantities of fuel.) Besides the very special screen, these filters have shallow 'sumps' to collect and pour off the water. The filters work because fossil fuel molecules are very small; speaking comparatively, water molecules are much fatter and will not pass through the fine-mesh screen elements, unless pressurized or emulsified with something like HEET, alcohol or soap.

Patch's company, Smart Tech, LLC, is situated in the Chugiak part of the Chugiak/Eagle Creek area where they have a soccer club, a Quilters Guild, and an awful lot of churches—37 of them—which is a lot for 30,000 folks; they must have a lot of fun up there. They also have a Dog Mushers

Mr. Funnel — Filter Facts

Model	Price (from West Marine)	Dimensions (height and diameter)	Advertised Flow Rate	Advertised Flow Time for 1 gal.	Measured Flow Rate	Measured Flow Time for 1 gal.
F1C	$14.00	6" X 3.5"	2.5 GPM	22.2 sec.	2.7 GPM	22.2 sec.
F3C	$20.00	8.75" X 5.5"	3.5 GPM	15.4 sec.	3.8 GPM	15.6 sec.
F8C	$30.00	10" X 8.5"	5 GPM	12 sec.	5 GPM	12 sec.
F15C	$55.00	10" X 8.5"	15 GPM	4 sec.	15.4 GPM	3.9 sec.

Association, something called ABATE (which stands for "Alaska Bikers Against Totalitarian Enactments," and you'd better not fool with them), and a very active chamber of commerce—from whom *PS* probably will hear very shortly because 22% of those 30,000 folks work for the government and likely have lots of time to write peevish letters, if so moved.

Patch told us that he now has four sizes of filters, all made of black polypropylene that is conductive (by including carbon in the plastic, the funnels conduct electricity so that they can thus be grounded to dissipate the static electricity that is generated when fueling). He offered to send a set to *PS*, to test for their rated gallons per minute. GPM is important because most filters pass fuel so slowly that fuel dock personnel—as well as boat owners themselves—often grow irritated while filling up. *PS* agreed to check the GPM.

Patch, who developed the Teflon-coated, stainless steel filter element in conjunction with the Racor Division of the Parker Hannifin Corporation, sent them promptly, and *PS* set up the workbench.

From a gallon of new diesel fuel, one cupful was removed and replaced with water. That's more than 6% water; you'd probably never accumulate that much in your tank, unless you left the fill cap off during an all-day rain.

That oil/water solution was poured several times through each of the five filters, checking the time required with the stopwatch mode of an extremely accurate Suunto Mariner (Model 4789), which reads in tenths of a second. The water removed was measured carefully to see if one honest cup of water was removed each time. The fuel also was examined visually. (Unless continuously agitated, water settles out of fuel in very little time.) Patch's Smart Tech literature claims that the filters remove 100% of any water.

Because the filters did almost exactly as claimed, the fuel-water solution had only to be recombined and vigorously mixed for each cycle of the test. During the testing, only a half dozen drops of fuel or water were lost through spillage, certainly not nearly enough to affect the results.

The figures in the accompanying chart, which also displays the sizes and West Marine prices, contain the results, with a column of extrapolated GPM numbers to compare with the rated figures.

Patch added that these filters should last about 10 years, without a speck of maintenance.

As for GPM, those locals up there in Chugiak are honest. ■

Smart Tech LLC, *800/972-1550, www.mrfunnel.com*

EPIRB Update

In the wake of independent tests conducted by the Equipped to Survive Foundation (ETS), wherein the GPS components of two EPIRB models from McMurdo failed to self-locate under certain conditions (see *PS* June 2004), West Marine pulled the products from its shelves. McMurdo subsequently announced that it would offer free upgrades for these units. The company then initiated its own tests and found that the units, performed "faultlessly." Nonetheless, McMurdo's "collection and return" program remains in place.

West Marine vice president Chuck Hawley, after attending portions of McMurdo's tests, said in July that his company would begin restocking its stores with the upgraded units. Yet Hawley still favors additional tests: "I always think that independent tests are a good idea...We truly want consumers to have the best information possible," he said.

Doug Ritter of ETS hopes to test the upgraded McMurdo units, but isn't sure when that will take place. Though his tests have caused a stir, they've set in motion activities that should ultimately benefit consumers.

"If we had not done this test," explained Boat/US Foundation Director Ruth Wood (also a test sponsor) [the McMurdo units' failure to acquire fixes], "would not have come to light." Wood is concerned that people retain confidence in the 406 EPIRB system. The system works, she added. "It was the GPS portion of the product that had the problem."

ETS's tests may lead to an additional Federal Communications Commission standard requiring EPIRB makers to prove—through similar testing—that the GPS portion of their product works. Bob Markle, president of the Radio Technical Commission for Maritime Services (a non-profit group that writes standards used by the FCC), said he and his colleagues discussed the ETS test results. "The general feeling is, if someone pays for the extra GPS function, they should get it," said Markle.

To receive information regarding the upgrade program, or McMurdo's tests, call the company at 800/783-0889. For details on the ETS test findings log on to www.equipped.org. ■

Enter the Keen Shoe

In our ongoing quest to discover optimal personal gear, we think this California company is on to something with its hybrid sandal-shoe.

A solid toe, integrated into the rugged, siped, non-marking outsole, is the Keen product's chief attribute and distinction. There's also a molded midsole that enhances comfort, and an antimicrobial lining to combat foot odor. PS *is wear-testing the Newport to see how it stands up—and smells—over time.*

Three years have passed since we visited the realm of sailing footwear (see "The State of Our Soles," Aug. 15, 2001), and as you might imagine, many new products have come to the market in the intermim. We've seen the maturation of the sailing sandal, the refinement of the engineered sneaker, and the duration of the venerable sailing moccassin, known generically as topsiders. (Sperry Top-Sider remains a registered brand of the Stride Rite Corporation; an intriguing history underlies the development of that product's famous siped soles involving avid sailor and inventor Paul Sperry who in 1935 hit upon the idea of razor cuts in rubber shoe soles after observing his cocker spaniel bound about over ice and snow).

Not much has changed in the topsider genre, save for some breathable and self-draining features. And the engineered sneaker, though continually evolving, persists in being relatively bulky and thus a liability despite the substantial protection it affords. Fortunately, there's promise in the area of the sailing sandal.

When we last issued an opinion about sailing shoes, we wrote that "the jury will always be out on the issue of whether sandals can be proper deck shoes....The danger lies in the open design—a line caught between the sole and toes can be a real problem, and sandals offer little in the way of physical or thermal protection for the feet."

That outlook endures, which is why we were pleased to stumble upon a new product from Keen Footwear in Alameda, CA. Co-designer Martin Keen, like Paul Sperry, is both an inventor and avid sailor, and word is he developed this shoe expressly to protect sailors' feet.

We purchased Keen's Newport model at a local shoe store. Admittedly, the $89 price tag was intimidating, but the intial comfort of the fit helped to ease some of that pain.

This product's departure from the norm (and from sailing sandals we've tested in the past) is based upon its molded toe, fashioned from synthetic rubber, which protects pedal digits from the on-board obstructions that abound on most vessels.

The Newport's tire-like soles consist of siped panels divided by 1/8"-deep channels. Keen uses the term "lugs" to describe the knobs lining the side of the sole, providing additional traction. During our initial tests on non-skid surfaces inclined at 45 degrees, the shoes held well whether oriented toe-down, heel-down, or sideways.

The Newport is fitted with elastic cord "laces" that draw the fingers of the shoe's uppers together and hold that tension by way of a spring-loaded cord lock. Sailors accustomed to the more open, Teva-style sandal may find these fingers slightly constricting, but they do offer additional protection for the skin with ample ventilation. There are also reflective pull tabs above the heel and at the tip of the tongue.

The uppers are fashioned from waterproof nubuck. (Another Keen model—the H2—has uppers made from polyester webbing, which purportedly dries faster and absorbs less moisture than the nubuck.)

For sailors in the northern latitudes, these are strictly summer shoes, but that, and the price, are so far the only drawbacks. If you can get two solid seasons of wear out of either model, they'll be worth the dough. ■

***Keen Footwear**, 800/509-KEEN; www.keenfootwear.com*

LEDs in Emergence

You published a letter in your June 1 edition this year in which the writer questioned the feasibility of LED lights for on-board application. I'm not certain I fully understand LED technology, particularly for sailboat applications. Can you help me out here?

F. Lee Wainright
Via e-mail

Before we discuss LEDs, we should first mention the feature article in this issue comparing cabin lights. (See pg. 27.) That piece offers insight into how LED lights fit into the range of available cabin light options.

LEDs (light emitting diodes) have quietly evolved over the years, getting brighter, and becoming available in many colors. For years, the quest was for an affordable blue LED to be used in making white lamps. The first blue LED lamp we're aware of cost over $250 back in 1982 and barely emitted any light. Now, blue LEDs cost just pennies and are very bright. White LEDs (a combination of red, green, and blue LEDs) likewise are inexpensive, plentiful, and finding work in what were typically incandescent applications.

Currently, LEDs find great use in directional lighting applications, especially those that require a colored light. For example, traffic signals with LEDs use about 80% less electricity than their incandescent versions. In 2002, the state of California estimated that nearly a third of the traffic signals in the state used LED lamps and were saving over 10 megawatts of electricity each year—enough electricity to supply 10,000 homes—and saving $7.9 million.

LEDs achieve their brightness by a combination of factors, but two of the biggest factors are the reflector that the LED chip sits in and the lens above the chip. To achieve its high brightness, the LED light spread is very narrow compared to other lamp types. This works out great for directional applications like traffic signals and flashlights, but it's not always best—just yet—for boat lighting.

Navigation lights seem like a natural for LEDs. For example, a port bow light needs to be directional (10 points or 112.5°) and red. A red filter in front of an incandescent bulb removes all the colors except red from the light and baffles direct the light as required. However, most of the light from the incandescent lamp is wasted as heat. A red LED gives the proper color without any light-wasting filters, but its directionality is much too narrow for a running light. There are, however, some companies, such as Deep Creek Design, making specialty LED lamp assemblies for navigation lights. We look forward to all LED-based navigation lights one day while sailing and not worrying about the power being used, especially when we forget to switch off the lights after the sun comes up.

For those who want to retrofit existing fixtures with LED technology, the Deep Creek StarDrop LED cluster series (we didn't test those in our Cabin Light Comparison) is an advanced option. The clusters start at just under $200 and go up from there. If you want an LED cluster to equal the output of a 10-watt halogen lamp, they can make it for you, but it'll cost you dearly. Clusters are hand-made with premium Lumileds LEDs, advanced Deep Creek driver, and proper heat sinks, and come with unconditional guarantees. If you want some LED lore, get in touch with Rob Hoffman at Deep Creek (615/646-2532). Lumileds, by the way, is also a well-established, high-quality firm; first-class documentation is available on the company website.

There are off-the-shelf LED navigation lights on the market, although they are all in various stages of USCG approval, and the one-mile lights won't do on larger boats. You can find many of these sold via Orca Green Marine, Hella Marine, Taylorbrite, and SailNet.com.

...ON THE HORIZON

Inflatable PFD Test: We rounded up most of the vest-style inflatable PFDs on the market and ran them through a series of tests. We'll let you know which ones fit comfortably and which ones you're better off leaving on the shelf.

Minimal Safety Equipment: A renowned authority on seamanship offers his take on what safety gear is essential for coastal cruising vessels.