PROFESSIONAL BOATBUILDER

The magazine for those working in design, construction, refit, and repair

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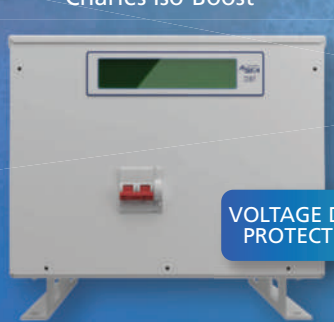

VOLTAGE DROP PROTECTION

DOCK BOOST TRANSFORMER

DIETER LOIBNER

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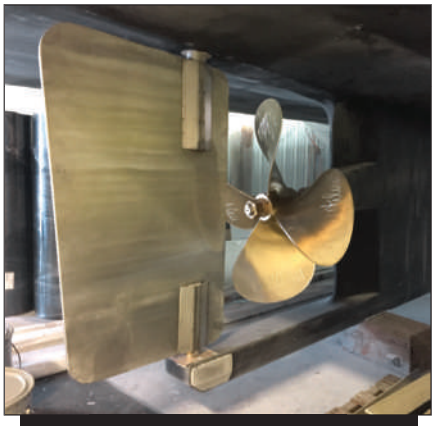

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On the cover: Prepreg carbon construction for the main foils of the cutting-edge Matanzas 29 powerboat: Working with a heat gun, Simon Miles warms unidirectional carbon fiber to adhere better to the glue film he previously put down on the cured substrate. Story on page 18. *Photograph by Dieter Loibner.*

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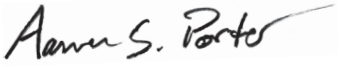
Custom Comes Back

Last month I made a midwinter trip to the Paul E. Luke boatyard almost at the end of the long road to East Boothbay, Maine. I was taking one of the Luke company's renowned feathering propellers in for the irregular service they require to keep their handful of cast-bronze moving parts all working in reliable concert. I had last been to the yard 25 years ago on a similar mission, retrieving the big props for the *Pride of Baltimore II* from a similar service period. The place looked unchanged, and in the office where Frank Luke and his wife, Nora, warmly greeted me and the returning prop, it could have been anytime between 1960 and 2020. "Well, if you want to pick them up again, they'll be ready next week," Frank joked when I told him what my last mission there had been. "Same props?" I asked. "Yes." *Pride*'s ambitious sailing schedule since her launch in 1988 has seen 275,000 nautical miles pass beneath her keel, all with the same Luke propellers. The key to that long life is that they come back frequently for service, and Frank knows exactly what they need and when.

That individualized attention and service is what the Luke Yard has built its success and reputation on since the late 1930s when Frank's father, Paul, started building custom boats, primarily in wood and aluminum, to the lines of leading yacht designers of the day—McCurdy & Rhodes, Sparkman & Stephens, K. Aage Nielsen. But in the 1970s and '80s, as boatbuilding was subjected to the economic determinism of the efficient mechanical reproduction of molded fiberglass models, custom builders fell by the wayside. The cost of molds for FRP parts and the efficiency of modern manufacturing processes trumped the return on customization to meet the needs of individual buyers. It was up to designers, manufacturers, and, increasingly, marketing departments to determine the look and amenities of middle-class boats. Buyers were left to choose from available models whether they were a good fit or not. Yards like Luke's concentrated on service and repair, where the unavoidable individuality of boats and customers can't be addressed by modern manufacturing methods. Luke's also kept the machine shop and hardware division intact.

My brief visit with Frank and Nora was a reminder of what owners who never know their boat's builder are missing—the experience, the intelligence, the solutions to problems you didn't know existed. Marilyn DeMartini's account of owner Bud Koch working with builder Bob Roscioli (**page 56**) is a drop of reassurance that collaboration between boat builder and buyer is not dead, even on a series-built sportfisherman. Similarly, Kenneth Sigel's record of his work with builder Stewart Workman to create a highly individualized Downeast power cruiser on a series-built hull (**page 30**) provides details of the advantages and risks in navigating the buyer/builder collaboration. Dieter Loibner takes us beyond those more conventional builds. His descriptions of Matanzas Watercraft founder Jan Brandt's creation of a foiling powercat to meet his needs and perhaps those of a small emerging market (**page 18**), and Zin Boats founder Piotr Zin's refinement of an electric runabout for limited production (**page 12**) point to an emerging potential for more customization in modern boatbuilding. Those new boats are possible not because the age of efficient mass production is over, but because manufacturing technologies like CNC-cut molds and small-scale composites processing make it possible to efficiently produce more variations of a general model or product type.

It's a change that leads to more choices for boat buyers and is likely to revive the vital relationship to builders who can leverage the growing wealth of possibilities our industry offers and help clients know just what they want.



Is Compliance Enough?

To the Editor:

I agree with Mike Telleria's excellent Parting Shot "Is Compliance Enough?" (PBB No. 183) regarding the *Conception* dive boat fire that killed 34 people last September.

As a longtime member of the fire service, I tried to imagine where in the United States you will find 34 paying customers sleeping in a legal commercial, combustible structure with an inadequate number of working smoke alarms and very limited safe egress. I came up with only one place: a Coast Guard–compliant T Boat—a "compliant firetrap." All U.S. land-based fire codes prevent such a risk.

There are four components to good fire protection: Prevention, Detection, Egress, and Suppression. Every pre-fire inspection and regulation closely evaluates these four functions. After a fire, they are critiqued for successes and failures—what worked, and what didn't.

Prevention: There has been a lot of discussion about lithium-ion batteries and 40+-year-old AC electrical wiring in the *Conception*. The National Transportation Safety Board (NTSB) is still working on the fire's cause and origin. It will likely be an ordinary ignition source that spread to the furnishings and construction materials.

When the cause is determined, there will be some efforts to reduce the cause, but we will never eliminate the possibility of fire. That is where Detection, Egress, and Suppression come into play.

A commonly used fire-protection acronym called A.S.E.T. (Available Safe Egress Time) is a detailed assessment of how long it will take the occupants to safely evacuate a space during a fire. The emergency egress functions and conditions (doorways, stairways, dimensions, distances to safety, etc.) for a specific space are appraised. Following this assessment, additional egress may be required; occupancy may be reduced; and permission to operate may be denied. Following a fire, A.S.E.T. information becomes part of the post-fire incident report. Unfortunately, there was zero Available Safe Egress Time provided for the *Conception* passengers.

Detection: The Coast Guard did not require smoke alarms in the area where the fire started or the upper deck where the crew slept. It did require smoke alarms in the sleeping area beneath the fire, but because smoke rises, this area was likely awash with fresh air. These smoke alarms played no part in alerting anyone to the fire above them.

Egress: "Two ways out" is another basic tenet of fire protection. On many boats the requirement is met by the familiar hatch at the bow. On *Conception* there were two egress paths from the sleeping area, but both led into the same galley/common space where the fire raged. That does not provide "two ways out."

Suppression: The firefighting equipment on a boat is intended for occupants and assumes that there is the opportunity to fight the fire. *Conception* met the USCG requirements for suppression equipment, but there was no opportunity to use it. A reasonable complement of smoke detectors would have made manual suppression a stronger possibility.

Although the *Conception* passed USCG inspections, an effective fire-protection assessment obviously never took place. Sadly, inadequate detection and restricted egress were overlooked.

The *Conception* carried a long list of expensive state-of-the-art technology: AIS, autopilot, radar, sonar, and detailed cartography equipment. Passengers also brought their own sophisticated electronic equipment: breathing gear, cameras, diving lights, computers, and underwater scooters.

A handful of inexpensive RF-interconnected smoke alarms were not on board, and should have been a requirement. The owners of the *Conception* did what was required by the USCG. The NTSB has criticized the USCG many times for inadequate fire-protection requirements. They will criticize them again when the *Conception* report is published.

Underwriters, surveyors, captains, owners, and Coast Guard inspectors should look at the mainstream fire-protection provisions that have surrounded us for years and see that they are provided for on a boat.

Take a fire-protection assessment and look at detection, egress, and suppression. Assume a fire occurs on open water where the only resources are those carried on board. Make sure you have what you need, even if the industry regulators don't think it's important.

John McDevitt
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Reverse Bows: When Fashion Becomes Dangerous

To the Editor:

Thanks to Laurie McGowan for calling out the designers of the emperor's new clothes in his Parting Shot, "Reverse Bows: When Fashion Becomes Dangerous" (PBB No. 182). His focus is on sailboats, but the problems are just as troubling, if not worse, on powerboats and motoryachts. Perhaps because I transited Jupiter (Florida) Inlet regularly for many years when I lived there and now live in the home state of the Graveyard of the Atlantic, where the Carolina flare was born, I am sensitive to the need for the reserve buoyancy that a traditional bow provides. Unless you are in the trireme business and use the bow to puncture the hull of an enemy's warship, I see no excuse for a reverse bow.

Dudley Dawson, PE (ret.)
Dawson Marine Group
Roxboro, North Carolina

Pluses and Perils of the New DC Boat

To the Editor:

Ever-illustrative, Nigel Calder's recent article "Pluses and Perils of the New DC Boat" (PBB No. 183) was excellent if a bit cobalt-saturated. Mr. Calder and readers may be interested in the start-up company TexPower (with which, to be clear, I have no affiliation), recipient of a Department of Energy Small Business Innovation Research (SBIR) grant for development of low- and no-cobalt cathodes for high-performance batteries. Testing with electric vehicle leaders has shown drop-in compatibility with other battery materials, increased energy density, reduced cost, and excellent durability.

Kevin Coffey
Andover, Massachusetts

Nigel Calder responds:

TexPower is new to me. In a quick Google search, theirs appears to be a reduced-cobalt cathode, for which others with very deep pockets are also striving. Until these kinds of products appear in the marine retail marketplace, I don't give them a lot of credence. There are "breakthroughs" in the battery world (including lead-acid) on a regular basis that either never make it to market or do so only a decade later. My focus is primarily a pragmatic one on what is available now, or looks to be credibly available in the near future. PBB

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Custom 43′ Coastal Commuter

ERIK DeBOER

DIETER LOIBNER

Above—*The Hylan & Brown–built* Scout *emerges from the paint booth at nearby Brooklin Boat Yard showing off a perfect Awlgrip finish.* ***Right—****Starting from his 38′ (11.6m) commuter, designer Reuel Parker worked with the client to develop a brand-new 43′ (13.1m) model of the same type.*

With a new build project on the home stretch at Hylan & Brown, regular PBB contributor Reuel Parker submitted this brief:

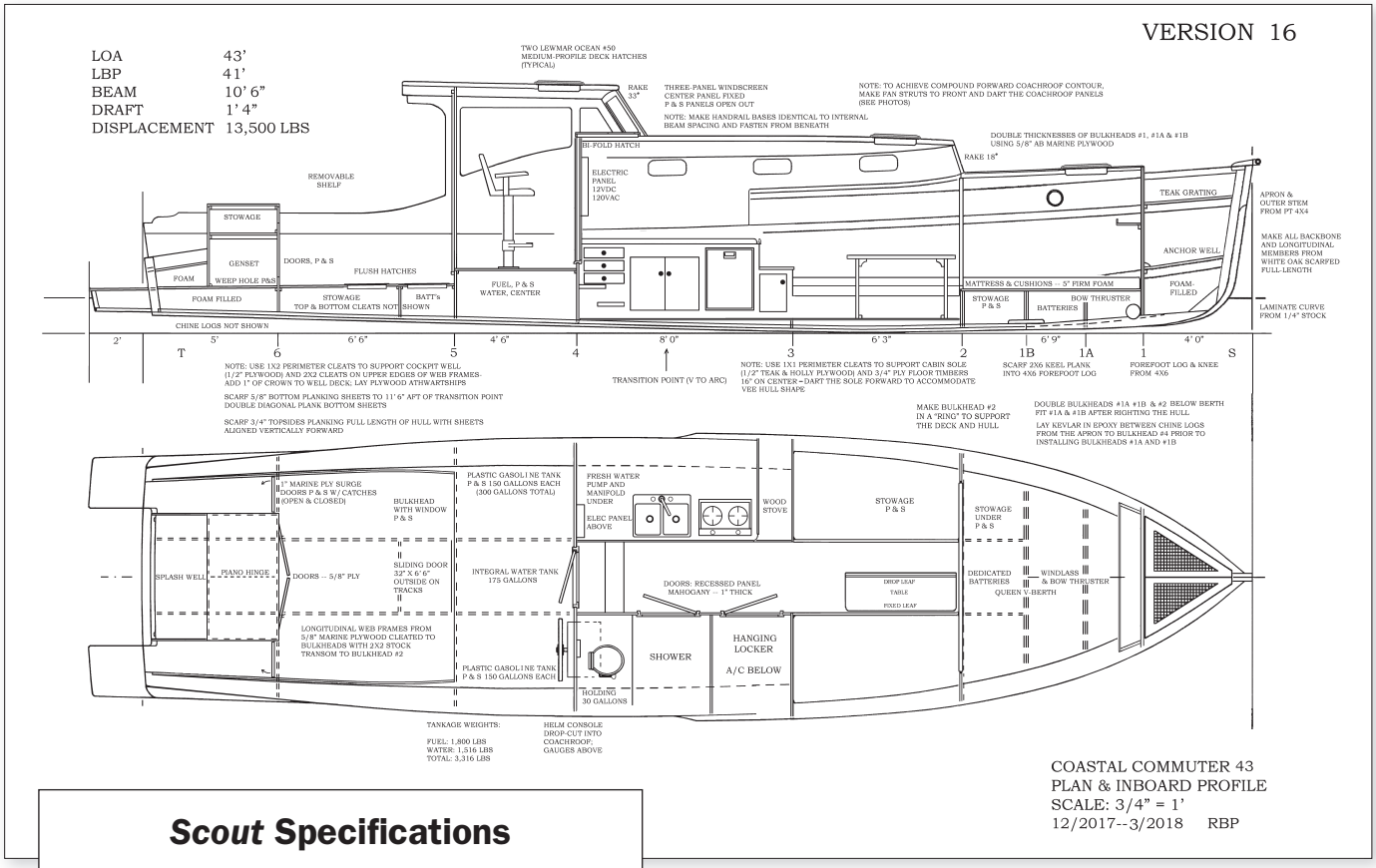
In 1996 I designed a modest powerboat for Erik DeBoer of Key West, Florida, the owner of the island's lumberyard, who previously had built Phil Bolger's Tennessee design. Having sold her years before, DeBoer now wanted a larger cabin cruiser with similar properties—narrow, light, easily driven, and with a very shoal draft.

DeBoer, his father Herman, and I collaborated until we all agreed on basic parameters, after which I took our collective ideas to the drafting board and designed *Magic*—my first Commuter 36 (10.97m), which Erik subsequently commissioned me to build for him in early 1997. (For more on the Commuter 36, see "Out of the Everglades," *Professional BoatBuilder* No. 130.) Unfortunately, in the summer of 2018, *Magic* was destroyed by Hurricane Irma, and DeBoer then asked me to design a larger, more sophisticated boat for him—suited to his mature years and requirements for comfort and more cruising range.

As a point of departure I used my Coastal Commuter 38 (11.6m) design, but DeBoer and I expanded and modified her until a whole new animal evolved. The new boat, *Scout*, has twin 250-hp outboards, integrated swim platforms, an enclosed pilothouse, air-conditioning, a bow thruster, and accommodations for four. She's a single-chine, shoal-draft, twin-outboard cruising yacht, moderately offshore capable, with trips to Cuba, the Dry Tortugas, the Bahamas, the Everglades, and the Eastern Seaboard and beyond during settled weather.

DeBoer chose Hylan & Brown–Boatbuilders in Brooklin, Maine, to build the new boat. We met there last summer and agreed that it was an excellent choice. Initially, I was concerned that the yard might not be comfortable with my admittedly old-fashioned plans but was relieved to learn that I did not need to worry. Doug Hylan imported my design into Rhino software, a crucial step for bulkheads and other structural components to be accurately cut on a CNC router.

Ed Note: The Scout *project is an example of close cooperation between owner, builder, and designer that continued throughout construction. "Reuel's drawings provided a concept for a simple boat that would be efficient to build and to operate, like many of his designs," Ellery Brown told PBB. "But even before we set up molds it was clear the owner intended to make some major changes and additions to*



REUEL PARKER

Scout Specifications

LOA	43′ (13.1m)
LWL	42′ (12.8m)
Beam	10′6″ (3.2m)
Draft	1′4″ (0.4m)
Displ.	13,500 lbs (6.12 t)
Fuel	300 gal (1,135 l) in custom plastic tanks
Water	175-gal (662-l) centerline integral tank
Power	Twin 4-stroke Yamaha F250 outboards
Cruising speed	30 knots, top speed TBD
Construction	Cold-molded marine plywood/epoxy, covered with epoxy-impregnated Xynole-polyester cloth. The hull is built around longitudinals spanning ⅝″ (16mm) ply bulkheads, greatly simplifying lofting and construction. Bottom: double-diagonal layers ⅝″ plywood. Sides: single-layer ¾″ (19mm) plywood. Decks: ½″ (12mm) plywood over foam-core/ply sandwich.
Coach roof & hardtop	Foam-core/ply sandwich; ⅝″ plywood web frames. Cockpit and lockers are self-draining.

construction, layout, and, most of all, systems. Consequently, the vast majority of details of Scout*'s construction were sorted out here at Hylan & Brown. Some details were figured out in the design office, still more on the shop floor, but always with lots of input from the owner."*

Even as the build commenced, the design continued to evolve in DeBoer's mind, and many changes were made in situ. The basic boat, however, emerged as I designed it, with minor modifications. Remembering the inexpensive American marine plywood we used in the construction of *Magic*—and the consequent problems that ensued—we elected to use the finest European marine plywood available, and ended up with Hydrotek Meranti BS 1088. Similarly, the longitudinals were fashioned from the best Douglas-fir lumber available, so *Scout* will be strong, durable, and offshore capable.

Because DeBoer wanted walk-through access to the swim platforms, I designed "anti-surge doors" on each side of the centered island lazarette, which houses a Westerbeke 3.5 SBCG – 60-Hz, low-CO gasoline genset. Another modification was made to the transom, because outboard manufacturers have a preordained minimum angle for their motor brackets, and my design did not meet it.

As changing the actual transom angle would have had a negative effect on the boat's appearance, Hylan & Brown simply added a laminated wedge onto the transom to achieve the desired angle for the outboard brackets and align them to each other—compensating for transverse curvature. This way, the partial transoms outboard of the walk-throughs retain the original visual aesthetic.

When DeBoer mandated that outboard power be increased to twin 250s (he originally specified twin 150s), I

DIETER LOIBNER

A lamp helps master finisher Naomi Bishtok find and fill pinholes in the primer coat on Scout*'s hull before the boat goes from Hylan & Brown to the paint booth at Brooklin Boat Yard.*

beefed up scantlings throughout the hull, and added new structural components in the boat's stern. The swim platforms are literally extensions of the hull sides and bottom, providing additional flotation with the cockpit well deck extending to form their tops.

An unusual feature of the pilothouse, designed by DeBoer himself, is an ingenious crank mechanism to raise and lower the windows. The outside of the pilothouse got a visual redesign at Hylan & Brown, including a flat windshield reminiscent of the historic commuters, and improved side windows. They also extended the hardtop to protect the cockpit aft of the pilothouse. The entire hull, including the bottom, was long-boarded to perfection.

Ed Note: During my shop visit last summer, a crew that included finisher Naomi Bishtok and boatbuilder Kit Macchi was prepping Scout *for subsequent painting, in the spray booth at Brooklin Boat Yard. At press time the boat was being readied for sea trials, after which DeBoer will decide whether to take her to Florida on her own bottom or have her trucked.*

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—Reuel B. Parker

Portier: Europe's Oldest Boatyard?

Few small family businesses and even fewer boatyards can claim a history dating back to the Napoleonic era. Of the many boatbuilders around the alpine lakes of Italy, Austria, Germany, and Switzerland, the one exception is Yachtwerft Portier AG. Originally named Suter, it was created in 1815, a crucial year in Europe: The emperor Napoleon abdicated on June 22; and in Switzerland, on August 7, the Federal Pact was signed forming the confederation of 22 Cantons, of which Zurich, already one of the most populous in the country, was part. Its eponymous capital was already a major economic power thanks to the lake, which served as a transport route linking prominent border regions in the heart of Europe, long before the development of railways and roads. In addition, because fishing was a crucial food resource for the population, building and repairing fishing boats was vital.

Left—*The 28′ (8.5m)* Flaneur *accommodates up to seven people with easy access to all seats.* ***Below—****Immigrating from France, Félix Portier settled at Meilen in 1914 and changed the destiny of the Suter family boatyard, founded by his wife's grandfather in 1815.*

FAR LEFT: HENRI THIBAULT; LEFT: COURTESY HENRI THIBAULT AND GÉRARD GUÉTAT

In 1815, the year of Waterloo and the Vienna Congress, David Suter acquired land in Meilen, ideally located on the shores of Lake Zurich, and built facilities to repair and build fishing boats. The small firm prospered. The origin of the typical French name that the boatyard bears today occurred

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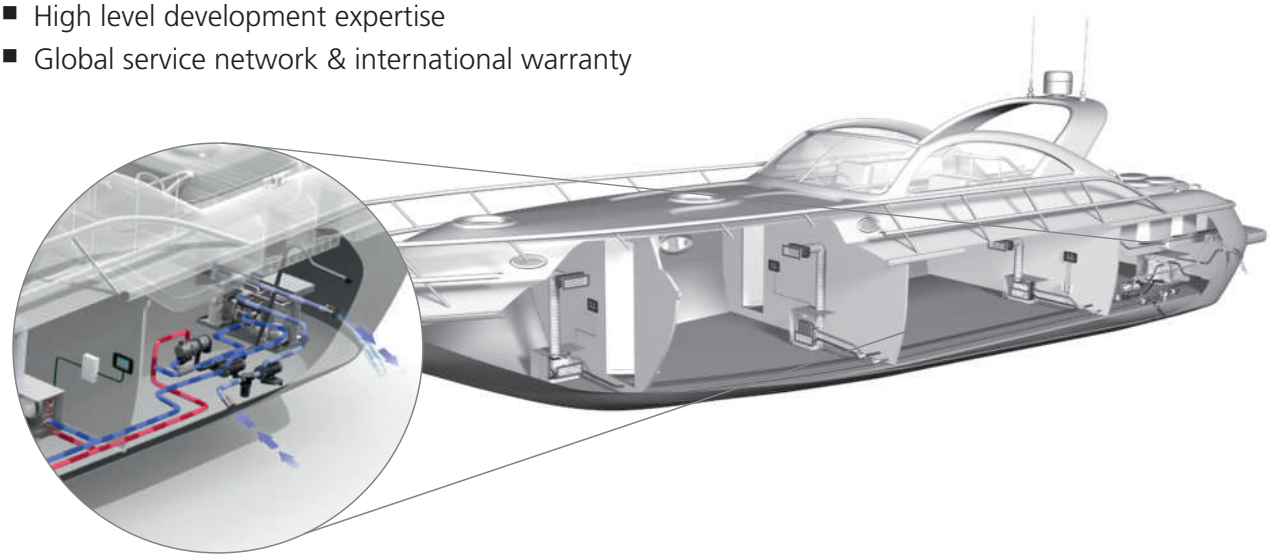

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HENRI THIBAULT (BOTH)

Above—*Portier no longer builds boats; it imports international boat brands and offers top-quality maintenance and storage in ultra-efficient facilities.* ***Right—****Flaneur's engine compartment is fed fresh air through bladed vents. The 1936 Ford V8 flathead was marinized by the Scripps Motor Co. (Detroit, Michigan).*

in 1914, with the arrival of Félix Portier. This skillful and enterprising shipwright from the French town Thonon-les-Bains on Lake Geneva soon charted a new course for the Suter yard—specializing in pleasure boating. In 1917 he married Paulina Rosa, one of the daughters of his aging boss. He soon took the helm of the company, which became Suter & Portier Yachtwerft. His father-in-law gave him greater control of the business at the time yachting expanded in the 1920s and '30s. In 1941 the Suter and Portier families split, and the firm bore the solitary Portier name.

At that time, more and more wealthy customers were coming to Meilen to have a custom yacht built. Félix Portier, without leaving the lucrative market of the working boat, proved right in betting on high quality and accommodating customer requests in each order.

For a wealthy Swiss watchmaker, Portier crafted a 28′ (8.5m) mahogany runabout named *Flaneur*. Sleek and

Port Support

At last November's ballot, the constituents of Jefferson County, Washington, made history by voting into office Pam Petranek, 59, the first female commissioner in the 95-year history of the Port of Port Townsend. Petranek ran on a platform pledging transparency, accountability, sustainability, and support for the marine trades and Port Townsend's unique working waterfront. She was endorsed by the local politicians County Commissioner Kate Dean, City Council member Michelle Sandoval, former Port Townsend mayor David King, and by many boating-related businesses and institutions, including wood supplier Edensaw, the Port Townsend Marine Trade Association (PTMTA), and Jefferson County Moorage Tenants Union. Other supporters included the Northwest Maritime Center and the Northwest School of Wooden Boatbuilding. Petranek defeated Chuck Fauls, a customer service representative at the port, to serve with the two other commissioners, Bill Putney and Pete Hanke, and replace Steven Tucker, who opted not to run again after two four-year terms.

DIETER LOIBNER

Pam Petranek, the first woman to be elected Port Townsend's port commissioner, will work to strengthen the marine trades and the port's infrastructure.

"Failure is not an option for our Port," Petranek said. "Its success is critical to the local economy. It also needs to remain accessible." Looming large in this election were Washington State's initiatives to drive growth in the maritime sector and the 2018 economic impact study of the Jefferson County marine trades, which made plain the boating industry's impact on the local economy. Prepared for the PTMTA, the study found that more than 2,200 direct and indirect jobs in the county are supported by the marine trades, accounting for 19% of overall employment and generating $12.6 million in tax revenue for the city, county, and state.

Another first that came about in the November ballot was the approval of

elegant with a torpedo stern, it was equipped with a 1936 marinized Ford V8 by Scripps. *Flaneur* had a seven-seat cockpit with rising side windows like a luxurious limousine. Satisfied with Portier's work, he ordered another special runabout named *Glisseur*, today part of the collections in a French museum at Arcachon, near Bordeaux. *Flaneur,* more or less abandoned for four decades, was meticulously restored and today is a signature vessel in the historical fleet of the HZB Foundation (Historiche Zürichsee Boote), which aims to preserve the most beautiful examples of Lake Zurich boatbuilding.

In 2015, Portier celebrated its 200-year anniversary, thanks to consistency, quality, adaptation, and location. These key factors helped Portier attract well-heeled and sometimes prominent customers such as Nestle and the jeweller Louis Cartier, who ordered the 65′ (20m) motoryacht *Elma*, launched in 1953. Portier built more than 2,000 units, in wood, steel, and fiberglass, gradually expanding its facilities. That number includes 300 wooden Star Olympic class keelboats and nearly 600 Ynglings. After the years of boatbuilding, the company, presently headed by Ariane Vonwiller, shifted its focus to boat storage, handling, service, and importing brands including Cranchi, Sea Ray, SAY Carbon, Boston Whaler, Chris-Craft, Jeanneau, and Bavaria.

Yachtwerft Portier AG, Seestrasse 824, CH-8706 miles, Switzerland, tel. +41 888 30 309, fax +41 43 888 30 36, website portier-yachts.com.

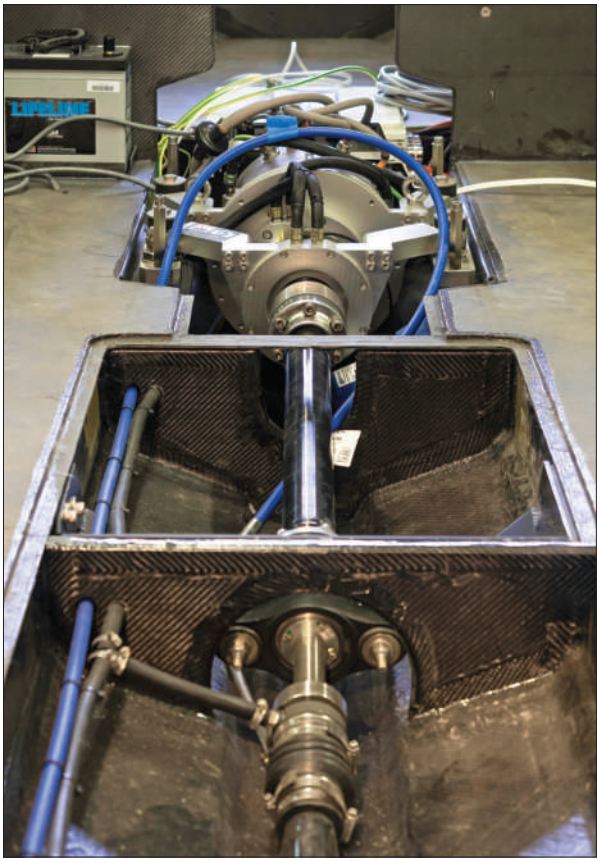
—Gérard Guétat

the Industrial Development District (IDD) levy for capital improvement projects. "According to James Thompson, director of the Washington Public Ports Association, in his memory, this is the first IDD levy that has ever passed a public vote since the legislation was first introduced in the 1960s," the *Port Townsend Leader* reported. The maximum amount that can be taxed is $15 million over a 20-year period, but the Port was leaning toward a tax of 13 cents per $1,000 of assessed property value for 20 years, amounting to a little more than $800,000 to be used as seed money for urgent infrastructure projects including the replacement of the Point Hudson jetty, dredging and dock replacement at Quilcene marina, updates to the breakwater, and dock replacements at Boat Haven, among others.

"There will be a direct impact if that [Point Hudson] jetty failed," Petranek said, noting that it wouldn't affect just the marina but also two marquee events, the annual Race to Alaska that starts in Port Townsend in June and the traditional Wooden Boat Festival in September. "And there's also a direct impact on the rest of the businesses in Port Townsend." Fixing critical infrastructure, she said, is something "I just want to do really well."

—Dieter Loibner

Piotr Zin's New Electric Speedster



DIETER LOIBNER (BOTH)

Left—*To better balance the weight of the big battery, Piotr Zin opted to install the motor of the boat's Torqeedo Deep Blue 50i 1800 forward and extend the driveshaft with a modified Aquadrive CV joint.*
Above—*Zin stands beside the 20′ (6.1m) ZR2 in his Seattle workshop before installing the deck and battery and finishing the boat. Note the chargers are also installed forward.*

Following the lead of European builders such as SAY Yachts (see "*a = F/m*," PBB No.180) venturing into high-speed electric boats by combining advanced carbon construction with powerful motors and high-end, high-cost lithium batteries, boatbuilders on this side of the pond have now jumped in.

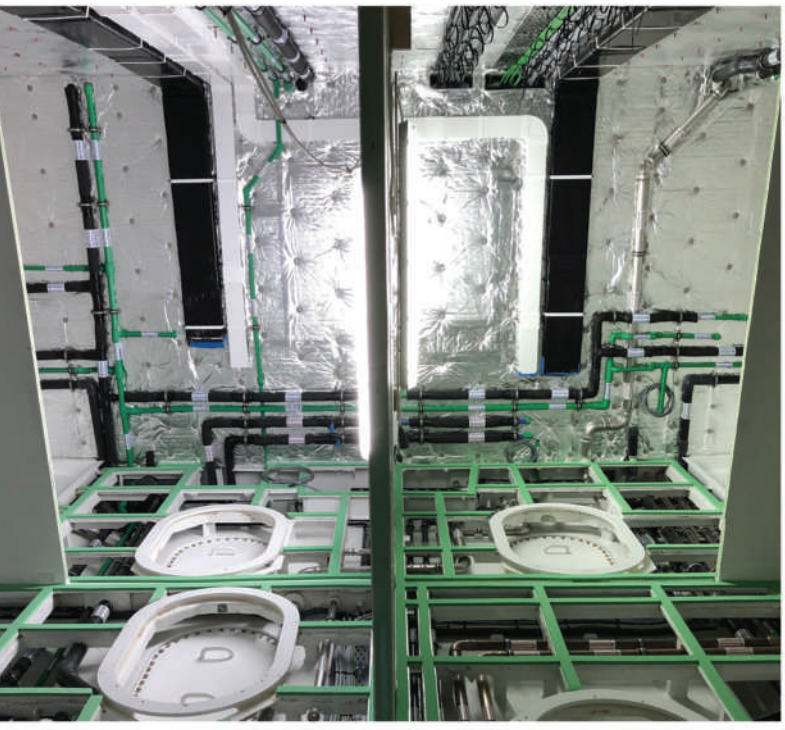
Earlier this year, nascent Zin Boats of Seattle was putting the finishing touches on the ZR2, a new 20′ (6.1m) carbon runabout with a 360V Torqeedo Deep Blue 50i 1800 propulsion system for its debut at the Miami International Boat Show in mid-February.

Company founder Piotr Zin, 42, is no newcomer to boatbuilding. Holding a law degree, the native of Poland decided to pursue a different career after coming to the United States about two decades ago. He earned a design degree from the College for Creative Studies in Detroit, Michigan, and worked in various design roles for General Motors, BMW Designworks USA, Microsoft, and Brunswick Boat Group. As a keen racing sailor, he also imported Seascape performance boats (a 60% stake of the Slovenian brand was acquired by Groupe Bénéteau in 2018) to the U.S. West Coast.

Like other entrepreneurs in electric propulsion, Zin likes to refer to Tesla. And like Tesla CEO Elon Musk, Zin raised investment capital to fund his venture. But unlike Musk, he stayed away from drivetrain development and focused on the platform instead. Yet the automotive influence still looms large; the ZR2's 40-kWh battery is also used in BMW's i3 electric car. Waterproof and shock resistant, it uses precisely assembled prismatic cells encased and housed in a stout frame.

Torqeedo rates its midrange system at 55.1-kW continuous input power and >32.4-kW propulsive power at 1,800 rpm. Peak input (i.e., to initiate planing) is 66 kW. Zin said he'd be more comfortable with a motor that could run between 2,200 rpm and 2,500 rpm, "but it's physics. You only have so much battery power, and you can only push so much."

The battery has its own automated built-in cooling system, with pump and heat exchanger separate from the electronics' cooling circuit. Measuring 65.4″ x 38″ x 6.9″ (1,660mm x 964mm x 174mm) and weighing 612 lbs (278 kg), the battery forced Zin to design the boat around it. Standard equipment includes two Torqeedo 3.3A chargers with a 240V, 50-amp plug that can handle 110V or 220V. Charging from 10% to 100% capacity takes four to five hours, and topping off at 50 amps adds 20%–25% in about an hour, Zin estimated. Plugging in over "lunchtime buys you 20 miles of



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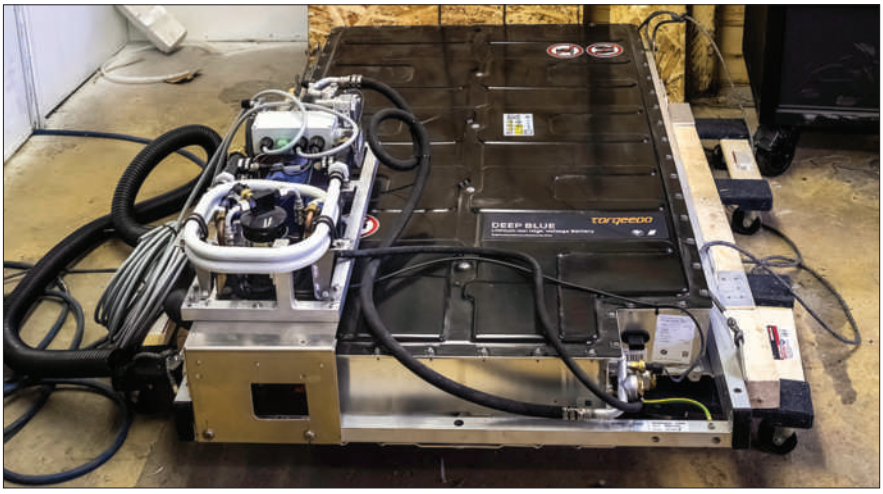


***Above**—BMW's marinized i3 battery with its cooling system and mounting bracket weighs more than 600 lbs (272.1 kg) and is housed in a supportive frame.*
***Below**—To offset this weight, Zin opted for a light carbon hull (<350 lbs/158.7 kg) and parts built by Turn Point Design.*

DIETER LOIBNER (BOTH)

range." To maintain longitudinal balance, which is critical to his performance goals, Zin moved motor and chargers forward of amidships using an Aquadrive CV joint and a thrust bearing screwed to the stringers to absorb the 550 lbs (2,400 N) of thrust.

For additional help, Zin tapped into his network of boatbuilding experts. Ross Carmichael, a veteran boatbuilder at Brunswick, assisted with the running surface design. Despite being partial to deep-V hulls and their smooth performance in choppy water, Zin chose a general-purpose hullform with reverse chines and variable deadrise. He also put the ZR2 on a radical high-carbon diet: the hull weighs less than 350 lbs (159 kg)—little more than half the i3 battery's weight, or the equivalent of an 80-hp four-cylinder outboard.

Zin outsourced hull construction to Turn Point Design in Port Townsend, Washington, the company of Brandon Davis, whom he met during the Race to Alaska in 2017. "We built a station mold with plywood skin that got covered in glass to make it suitable for infusion," Davis explained. "It is stable, and the part released easily. Being careful, we can pull 20 copies from it." Davis built the hull from Hexcell carbon skins infused with Pro-Set 114 epoxy over Divinycell H80 core. Infusion pressure was 28″ (71.1cm) mercury. "It's a tight infusion, but I think it's still overbuilt," Davis said. All parts are laid up by hand and infused using the same materials but with different hardener speeds and laminate schedules.

Corrosion protection is an important, complex topic for carbon fiber boats, but about those proprietary details Zin would only say that he "spent a lot of time and energy figuring this one out." Everything is bonded and protected, he explained, and parts like the strut, the rudder, and the motor are insulated.

With a price tag of $250,000 (and up) with 50% down, the ZR2 is for an affluent clientele who covet a sleek, light, fast, quiet, and zero-emission 20′ boat. "We target green lakes and

potential customers who understand that electric is the way to go," Zin outlined his marketing strategy. "We are looking for experienced boat owners, not first-timers. The boat is designed to be customizable. Want pink cleats? No problem. We'll put on pink cleats."

Zin estimates he put 2,500 hours of his own time into this project. He gave us a quick tour of the prototype in his shop before he packed up to travel to the Miami show. The carbon hull with recessed LED nav lights in the bow was finished in a matte metallic silver Oracal vinyl-film wrap by Orafol. The cockpit sole is okoume plywood, covered in 2mm Oakwood veneer with a custom Awlwood finish. The bucket seats and the contoured bench with Morbern Marine vinyl seat covers are resistant to UV radiation and pinking from bacteria. The dash is devoid of gauges and switches, save for one that operates the bilge pump. All the instrumentation is combined into one column that runs from the dash down to the cockpit sole and includes a Fusion Apollo stereo system and a B&G Naviop digital switching control system.

He plans to offer three different models based on the same hull and propulsion system, starting with the runabout, which he considers "the four-door sedan of the boating world." Later he wants to add a tender with a center console and an open bow for passenger seating, which he thinks could appeal to the superyacht segment, and a center-console fishing boat.

On his website, Zin lists potentials of 45 mph top speed and 100+ statute miles maximum range. In early tests on Seattle's Lake Union, he said, "the prototype reached 40 mph with ease. The production boat will max [out] at 30 mph, [emphasizing] efficiency and range."

Turn Point Design, 2320 S. Park Ave., Port Townsend, WA 98368–2275 USA, tel. 360–385–9637, turnpointdesign.com.

Zin Boats, 2207 Fairview Ave. E., Apt. 3, Seattle, WA 98102, USA, tel. 215–680–6935, zinboats.com.

—D.L.

Eight Bells: Duncan Lethbridge

Iconic South African boatbuilder and founder of St Francis Marine (now St Francis Catamarans) Duncan Lethbridge, 76, died during an armed robbery and assault at his home in St Francis Bay in the Eastern Cape Province, on August 15, 2019.

Lethbridge, who made a name for himself building luxurious cruising catamarans and had recently retired, was the recipient of an industry lifetime achievement award from the South African Boatbuilders Export Council.

According to a tribute in *Boating South Africa*, Rob Brennan, who succeeded Lethbridge at St Francis Marine in 2019, told funeral guests: "Duncan was firstly a gentleman, a legend, and a pioneer, and his passing is a great loss not only to St Francis Marine, the South Africa Marine industry, but to South Africa as a whole. I will always remember our daily technical discussions and tours of the factory. Duncan was very excited by all the new technical developments in boat building and was always looking for new ways and materials to build a better catamaran."

Lethbridge moved to the Eastern Cape to work for his father in property development before trying his hand at boatbuilding. Early on, he partnered with naval architect Angelo Lavranos, who designed a custom 43′ (13.1m) catamaran design that Lethbridge built when he started St Francis Marine.

Having found his niche, Lethbridge built high-end cruising catamarans that helped establish South Africa's reputation as a center for catamaran boatbuilding (see "Return to Cape Town," PBB No. 180). As the St Francis models grew in size, Lethbridge also became an international household name, winning a Boat of the Year award in the U.S. in 2005. —*D.L.*

COURTESY ST FRANCIS MARINE

A gentleman, legend, and pioneer of South African boatbuilding, Duncan Lethbridge died shortly after retiring from St Francis Marine, the company he founded in 1990.

PBB

The Efficiency Game

Motivated by his own boating experience and *America*'s Cup foiling technology, a startup builder launches the Matanzas 29, a new breed of powercat for fishing and cruising.

by Dieter Loibner

DIETER LOIBNER

Matanzas Watercraft's founder, Jan Brandt, in his office with a rendering on the wall and the Matanzas 29 prototype peeking through the shop door.

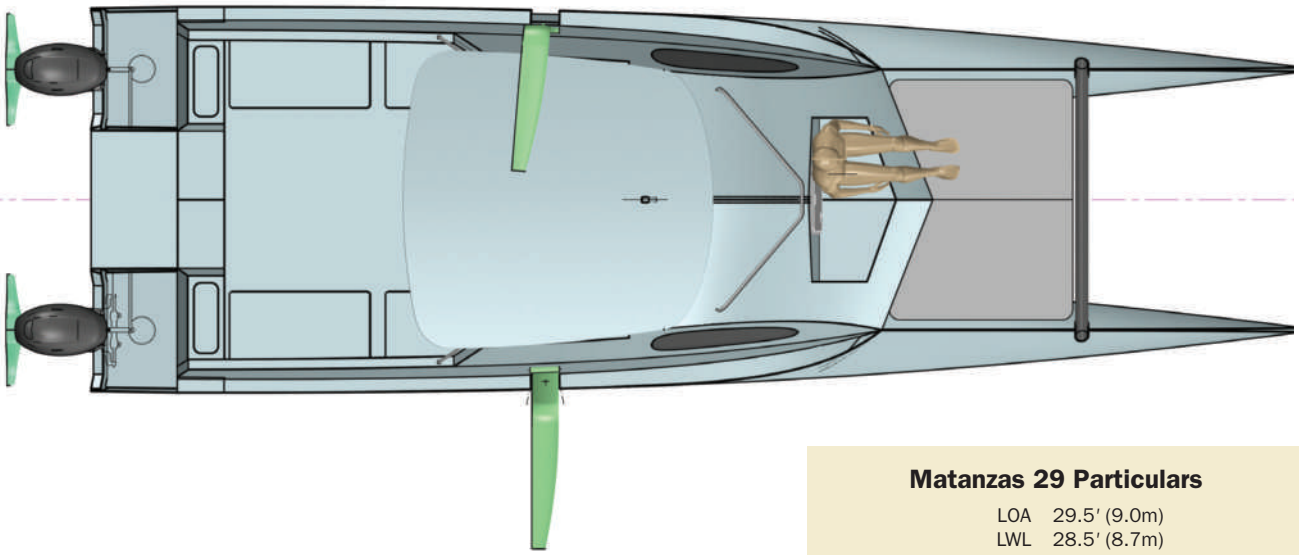
DIETER LOIBNER

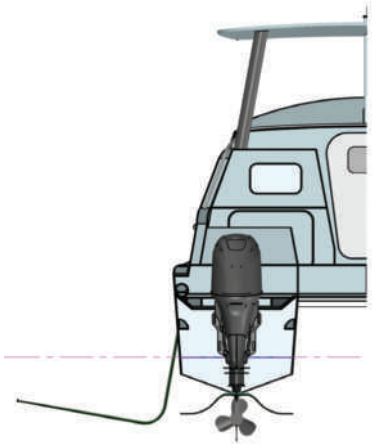
Wherever Jan Brandt goes, a constant companion since his childhood days in Hamburg, Germany, is his passion for watersports. Competitive swimming, surfing, waterskiing, fishing, scuba diving, sailing, you name it, he's done it—and still does. No surprise, then, that Brandt is also deeply involved with boats, not just using them but also designing and building them. His latest project is a 29′ (8.8m) foil-assisted planing cruising power catamaran designed for twin outboards from 60 hp to 90 hp. Last fall, construction was far advanced as Brandt prepped for finishing, outfitting, and getting the boat ready for sea trials off St. Augustine, Florida, where he set up shop as Matanzas Watercraft LLC.

Inspired by the Sliver 29, a catamaran designed for fishing and weekending, built by SuperCat in South Africa, Brandt defined specifications that suited his own use patterns and his home port in St. Augustine. "I am looking to build a day-use cat for fishing offshore waters but also capable enough to make the run to Bimini and Abacos on a calm summer morning," his design brief reads. Also on the list: sufficient load capacity for three to four people for day use and provisions for a couple to cruise for a few days; a range of 200 nm on one tank; and a cruising speed of 20 to 25 knots. Brandt: "I need to deal with a 2–3′ [0.6m–0.9m] chop and Atlantic Ocean swells. While an open cockpit with center console and hardtop is totally sufficient, a head and dry storage for gear with maybe just enough space for a bunk for two would be awesome." Since crab or lobster pot buoys are not much of a concern in Florida, Brandt explored the idea of foil assist to reduce power requirements and improve seakeeping. However, he was adamant about the ability to safely beach the cat and limit overall beam to 9.1′ (3m) to keep the trailering permits manageable.

He did some preliminary design work himself, but when the project got serious he consulted with Bieker Boats of Anacortes, Washington. Principal Paul Bieker served as the lead designer of the Oracle *America*'s Cup sailing team and was instrumental in developing the outrageously fast 72′ (22m) foiling catamarans that ushered in a foiling

The Matanzas 29 plywood/carbon prototype has wave-piercing bows with a positive rake and peaked decks that shed water quickly. The bows' fine entry flattens out toward the stern to encourage planing, even when operating without foils.



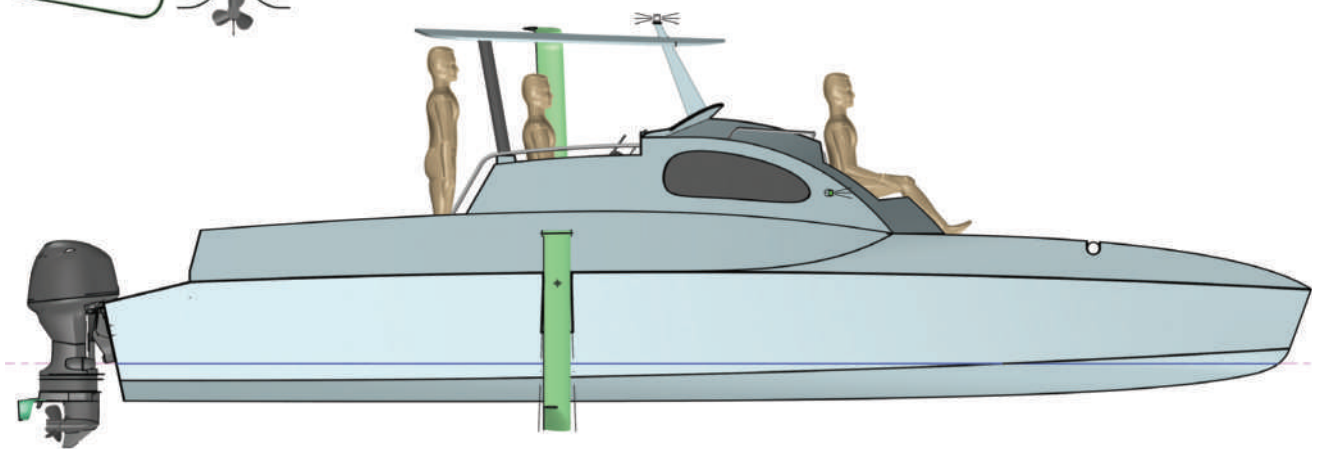


Deck, stern, and side views reveal the arrangement of the boat with foils deployed and folded up. Note the mustache foils mounted to the cavitation plates of the outboards to increase lift and help trim the boat.

COURTESY BIEKER BOATS (ALL)

Matanzas 29 Particulars

LOA	29.5′ (9.0m)
LWL	28.5′ (8.7m)
Beam overall	9.1′ (3m)
Beam DWL	9.0′ (2.8m)
Wet deck clearance	2.3′ (0.7m)
Draft hull	0.92′ (0.28m)
Displ. (light)	2,959 lbs (1,342 kg)
Displ. to DWL	4,585 lbs (2084 kg)
Max payload	1,626 lbs (738 kg)
Fuel	70 gal (265 l)
Engines	Twin Suzuki 90A outboards
Cruising speed	20 kts @ 3,500 rpm (non-foiling)
Fuel consumption	5 gph/19 lph (engines combined)
Range (cruising speed)	280 nm
Construction	Primarily 6mm and 9mm BS1088 Ply/Epoxy with carbon reinforcements



revolution following the 2013 Cup on San Francisco Bay. Bieker now applies variations of the foiling concept to pleasure craft, most recently with an innovative 53′ (16m) sailing catamaran intended for racing and weekend cruising (see "Fledging the *Eagle*," *Professional BoatBuilder* No. 182) and now with Brandt's cruising powercat.

The basic idea behind foiling is maximizing efficiency while curbing the need for big engines, a notion that has yet to find footing with production boatbuilders. Brandt: "I'm not interested in boats over 25′ [7.6 m] running 250- or 300-hp twin motors. I've been doodling around for a year on the idea, spent more time on the hullform, and when I decided to pull the trigger on building one, that's when I contacted Paul to help me finalize the design, incorporate some of the design criteria and requirements, and make it work from an engineering perspective. He helped crystallize the hull shape and get the details fleshed out."

Foiling Tech Trickle-Down

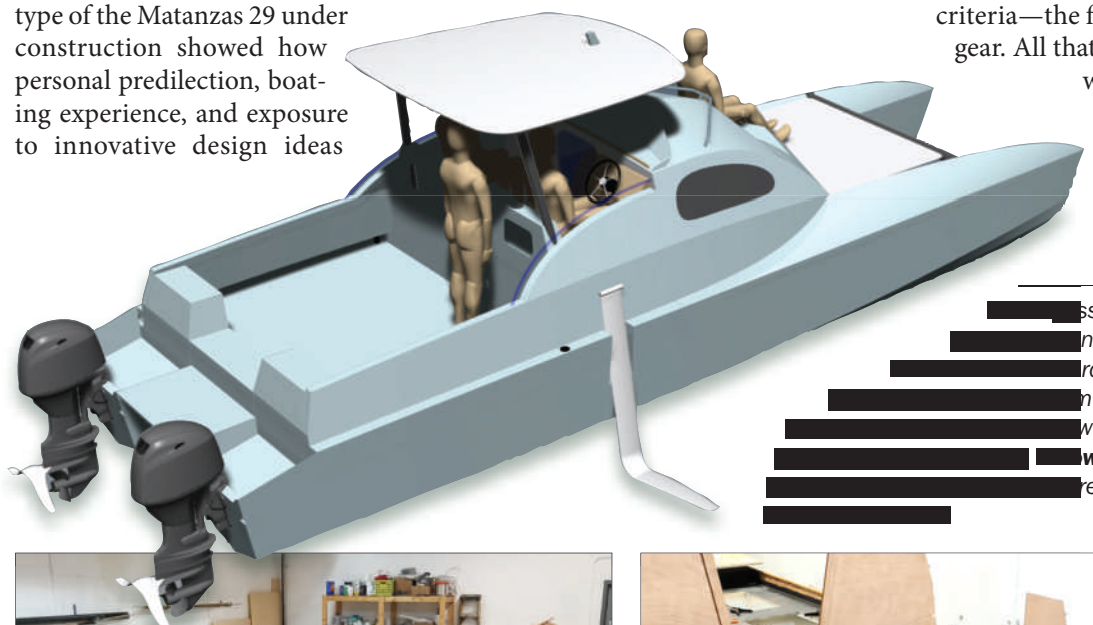
A former racing sailor who campaigned a Mini 650, Brandt met Bieker in 2010 while cruising the waters of Puget Sound. He ran his own environmental consulting firm in Seattle and also took up boatbuilding. First came stitch-and-glue kayaks, but soon he graduated to the PT Skiff, an 18′ (5.5m) kit boat by Port Townsend Watercraft designed by Bieker and Russell Brown. With Brown's encouragement Brandt designed and built the cedar-strip carbon composite *Syhoya*, a handsome 21′ (6.4m) weekend cruiser powered by a 60-hp Evinrude E-Tec outboard for cruising Puget Sound and beyond.

IAN ZELO

Previously, Brandt designed and built Syhoya, *a 21′ (6.4m) weekender with a 60-hp outboard for cruising the coastal waters of the Pacific Northwest.*

In Brandt's painstakingly clean and organized workshop a 10-minute drive from his house in St. Augustine Beach, Bieker's plans laid out on the workbench and the prototype of the Matanzas 29 under construction showed how personal predilection, boating experience, and exposure to innovative design ideas informed his choices. For a simple boat that aims to maximize efficiency and minimize power requirements, the design process was complicated. Some salient features, like the combination of planing hulls with wave-piercing bows and the foil arrangement most commonly associated with fast sailing cats, seem a bit counterintuitive at first, but Brandt explained the underlying thinking.

He wanted to minimize the fatigue of the acceleration/deceleration forces when running the steep chop of St. Augustine Inlet during an outgoing tide, "letting the bows do the work," rather than endure slamming, Brandt explained. "That's when we combined the wave-piercing hulls with the foil assist in order to get away from larger engines while still being able to carry the displacement we need, all the things we added that were part of my criteria—the fish boxes and the scuba gear. All that weighs quite a bit, [but we wanted] to manage that with reasonably small motors. That's



COURTESY BIEKER BOATS

ssengers can ride on the nder the hardtop, or on the rd. ***Below left—****Using n (bottom) okoume plywhich were then sheathed* ***w—****The forward beam of re carbon boom of*

JAN BRANDT

JAN BRANDT

DIETER LOIBNER

JAN BRANDT

DIETER LOIBNER

***Above**—This angle shows the square sterns, the cutouts for the fuel hoses and steering lines, the carbon-reinforced main deck, and the storage boxes.* ***Above right**—More creative reuse of carbon: The aft stanchions for the hardtop once served as spinnaker poles on a Mini 650.* ***Left**—Rolls of carbon hang from a rack, and the forward strut of the hardtop lies on the workbench.*

how we got to wave-piercing bows and the foils." Load-carrying capacity, especially at speed, is another reason he decided against displacement hulls.

Why plywood/composite instead of carbon-reinforced plastic construction, which would have further minimized weight? Brandt reasoned it was less complex and costly for a prototype that has to establish proof of concept and test the nascent market for foiling powerboats. Tooling up for a production run is his goal. The thin plywood—okoume 6mm/¼" for the topsides, 9mm/0.35" for the bottom—is sheathed in E-glass, a laminate schedule of 200-g (5.9-oz) and 300-g (8.95-oz) layers inside and out. Turn Point Design in Port Townsend cut the kit, based on design files it received from Bieker Boats. "That worked perfectly. We have had zero issues with the wood fit," Brandt recalled. "Every puzzle joint fit the first time." For the foam-core portions of the boat, he used 20mm (0.79") Divinycell H80 sandwiched between multiple layers of regular-modulus carbon woven roving of 5.9 oz 0°/90°, and 2x2 twill weave of the same weight, which conforms well to complex 3D shapes. For taping and to reinforce high-load areas, Brandt applied 400 g/m^2 (11.8 oz/sq yd) of 45° double biaxial carbon and 9 oz/sq yd (305 g/m^2) unidirectionals.

The entire wet deck, measuring 18′ x 10′ (5.49m x 3.05m), was vacuum-bagged with the foam core and three layers of carbon fiber on each side, laid up in various directions. That's a large piece to build in a compact workspace, so he tackled it first and then stored it against the wall to make room for hull construction. Florida's warm, humid climate imposes its own demands on working with resins, which ideally are catalyzed and processed in an ambient temperature around 65°F (17°C). Brandt planned to get the big parts done during the cooler time of year, turning on the air-conditioning if necessary and starting at 3 a.m. Doing "the large areas of the hull, we had three layers of glass on the bottom, so running that over 30′ [9.14m] in one shot, even just hand layup, gets challenging, because the initial pot cures before you have the last layer on." That's a herculean task for one, but he had help from his wife, Tonya, and then hired some neighborhood kids to do some sanding.

In addition to all this new construction, Brandt still found opportunities to include some repurposed parts from his Mini 650, which he had raced from Newport to Bermuda and in West Coast regattas. In his stash of spare kit was an extra boom—a 3.7m (11.15′) raw carbon tube from CST Composites that always traveled with the boat. It became the beam that holds the anchor roller and forms the front terminus of the foredeck, Brandt noted, adding that he cut and fit sections of carbon spinnaker poles to support the cat's hardtop.

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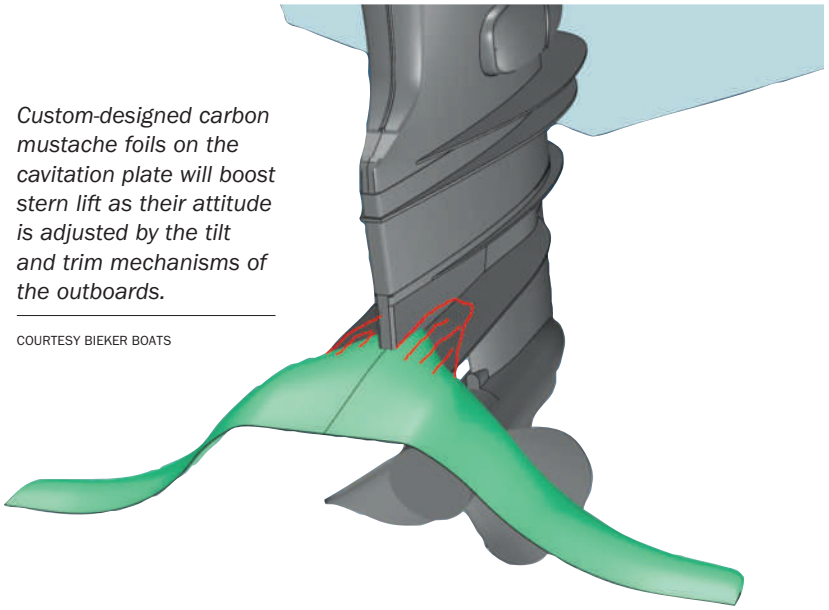
Outboards with Mustache Foils

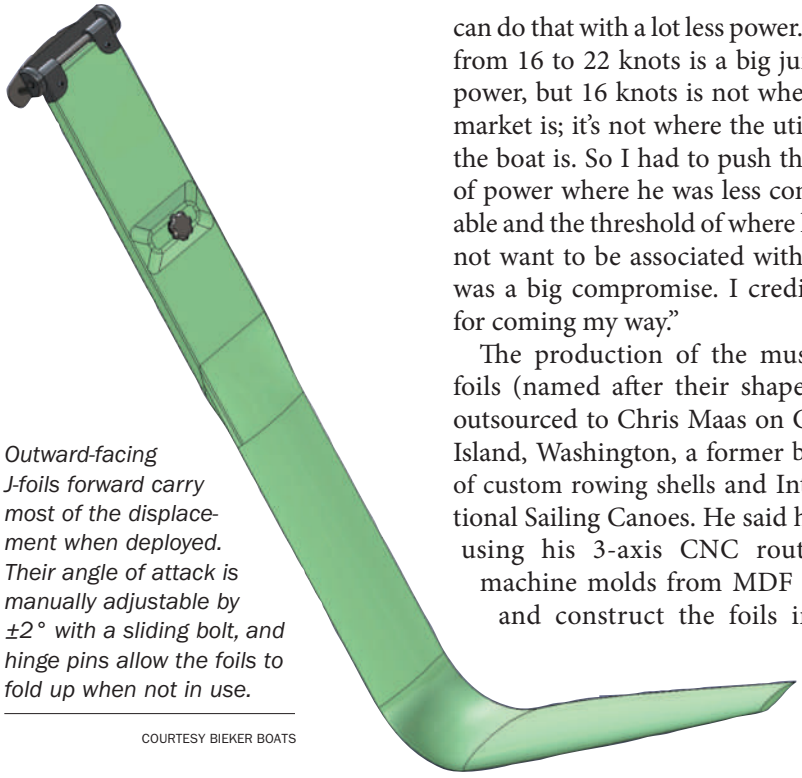
As originally conceived, the boat was to be powered by twin 60-hp Suzuki DF 60A three-cylinder outboards. However, working with technicians at Suzuki Marine of North America, which rents shop space from him next door, Brandt opted for the four-cylinder DF 90A, which he considered a better fit for the prototype's offshore work and for testing the custom mustache foils. Granted, the DF 90A packs 50% more power and a third more weight than a DF 60A, but it's still modest compared to twin 300s often seen on boats of similar size.

"I don't need 55 knots; 25 is awesome. That's fast cruising," he declared. "Every now and then…it's nice to be in the 30s to run home, but that's plenty." If it sounds extreme, Bieker wanted even less. "I think he was initially uncomfortable with the speeds I wanted, until we had a discussion about what the market expects," Brandt laughed. "The mentality is 'I gotta be able to go 30, gotta be able to outrun a thunderstorm. I've got 40 or 50 miles to the Gulf Stream, and I want to get there in reasonable time.' Paul's sweet spot is 15, 16 knots, because you



Custom-designed carbon mustache foils on the cavitation plate will boost stern lift as their attitude is adjusted by the tilt and trim mechanisms of the outboards.

COURTESY BIEKER BOATS



Outward-facing J-foils forward carry most of the displacement when deployed. Their angle of attack is manually adjustable by ±2° with a sliding bolt, and hinge pins allow the foils to fold up when not in use.

COURTESY BIEKER BOATS

can do that with a lot less power. To go from 16 to 22 knots is a big jump in power, but 16 knots is not where the market is; it's not where the utility of the boat is. So I had to push the area of power where he was less comfortable and the threshold of where he did not want to be associated with. That was a big compromise. I credit him for coming my way."

The production of the mustache foils (named after their shape) was outsourced to Chris Maas on Center Island, Washington, a former builder of custom rowing shells and International Sailing Canoes. He said he was using his 3-axis CNC router to machine molds from MDF board and construct the foils in wet layup with Pro-Set epoxy. These foils will be mounted to the cavitation plate, so any adjustment in the angle of attack comes from the outboards' tilt and trim mechanisms. The main appendages amidships are outward-facing J-foils (similar to those on the 31′/9.45m Foiler by Enata Marine; see PBB No. 173, pages 39–40). A hinge pin at their heads allows them to fold up when not in use, while the angle of attack is adjusted manually when the boat is stopped, by slacking two bolts and sliding the hinge mechanism fore and aft for a range of ±2°.

"We lofted all the layers carefully," Bieker said of the foil construction that was performed by Simon Miles, a carbon fiber fabricator in Port Townsend. "We came to 167 layers," Bieker continued. "Typically we get to within 1mm of the target shape. The structural spar is solid, and toward the trailing edge there's some hi-temp

PVC foam core." It will be done in five to six cooks at 250°F/121°C (see the **sidebar** below).

In foiling mode the cat will not be in "full flight" with hulls clear of the water but rather skimming along the surface. As simple and sensibly powered as the boat is, Brandt still wants the capacity to carry a payload of approximately 1,600 lbs (725 kg) for fuel (2 x 35 gal/132.5 l), water (14 gal/53 l) food, paddle, and surfboards, fishing, and scuba gear, a porta-potti, some electronics, and a small refrigerator. To cover his energy needs for starting and house loads, he'll go with 2 x 75-Ah lead-acid batteries with 650-amp cold-cranking capacity. Two 100-watt solar panels on the hardtop and intermittent charging from the alternators when motoring should keep the lights on and the beer cold.

Brandt named his company Matanzas Watercraft after the river that runs past St. Augustine, where he attended high school after emigrating from Germany with his family in the 1980s. Dating back to those days, he knows the surf spots, gnarly riptides, and choppy patches where sea breeze and ebb collide. After dialing in the new boat during sea trials, which include a trip to the Bahamas to test it as a cruising, fishing, and diving platform, he

Simon Miles heats the prepreg to bond it to an adhesive film he put down onto cured substrate in the foil mold.

Cooking the Foils

While Jan Brandt of Mantanzas Watercraft was putting the finishing touches on his Matanzas 29 (8.8m) powercat in St. Augustine, Florida, the foils were being made at the diagonally opposite corner of the lower 48, in Port Townsend, Washington, roughly 2,500 miles (4,023 km) distant. Working inside his barn workshop that used to house a boatbuilding shop called Seven Seas, carbon fiber technician Simon Miles, 31, stood next to the carbon tool he'd built for the job. He was warming swatches of prepreg with a heat gun to help them stick to the adhesive film he had previously put on top of the cured substrate of the first cook.

Having worked for Oracle's *America*'s Cup team and Mad Fiber, a Seattle company that made high-end carbon racing wheels, Miles is very much at home with high-end carbon work, but this job was new territory, because it required high-temperature tooling, and he was using a new source for the intermediate-modulus prepreg required. ►

DIETER LOIBNER (ALL)

Left—*Miles shows the 20'-long (6.1m) shipping container that was transformed into an oven for high-temperature curing.* ***Above***—*Infusion of the carbon mold.*

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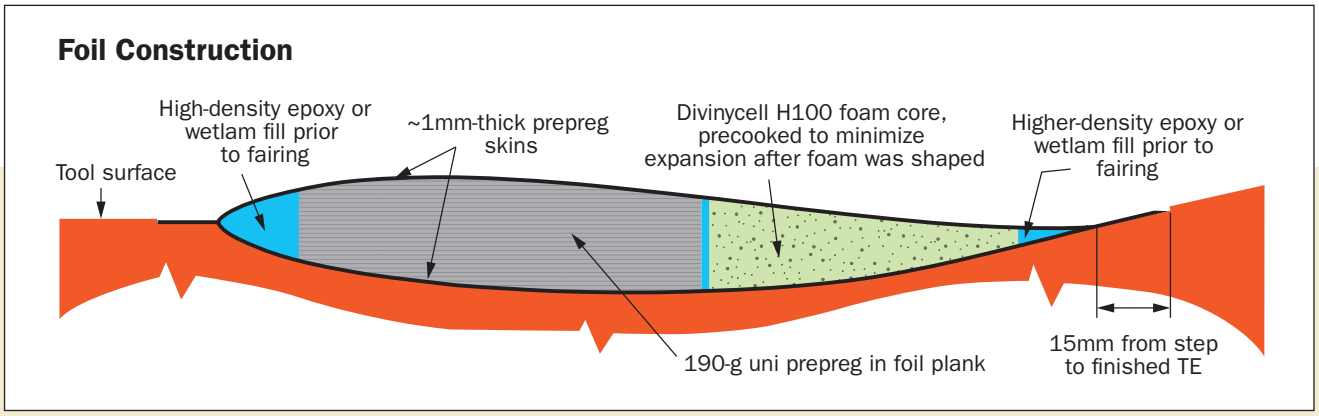


The tooling was built from a plug of machined medium-density fiberboard (MDF). The monolithic carbon mold is infused with Pro-Set High-Temp infusion resin using Sigmatex 660 g/m^2 (19.5 oz/sq ft) of 2 x 2 twill, a ply of 200-g/m^2 (5.9-oz/sq-ft) woven carbon, and two coats of Pro-Set High-Temp tooling putty against the machine-tool-face end to limit print-through of the heavy woven cloth.

The centerpiece of the foil project is a 20′-long (6.1m) shipping container the previous owner converted into a giant oven for constructing high-end carbon fiber parts. "It has Roxul insulation and stainless walls inside," Miles explained, "and there is a huge heater/blower unit from Electroheat." For this project, Miles moved the container/oven into his workshop and hooked it up to three-phase power.

To help lower the cost, Miles sourced 108 yd of 190-g/m^2 (5.6-oz/sq-ft) unidirectional 250 prepreg from Composite Recycling Technology Center (CRTC) in Port Angeles, Washington.

hopes this *America*'s Cup–inspired concept will generate the interest that warrants a limited production run. Ideal customers, Brandt reckoned, are sailors who share his passion for water sports, value his high-tech approach to efficiency, and "don't necessarily need the power that generally is the norm in the market." It's a bold bet but one that seems right for the times. "The intent is there, and we have the facilities to do it," he added. PBB

The material was rejected for use in aerospace applications, hence the substantial savings. At CRTC it was stored at 0°F (–17.8°C), which is common for prepreg. Once out of the freezer it must be processed quickly, but the cool ambient temperatures of the Pacific Northwest winter (at or below 50°F/10°C) allowed Miles enough time to complete the work.

Some complexities: The foils, designed by Bieker Boats, comprise 167 layers of carbon laminate, 144 of them unidirectional 0°, the rest off-axis plies (±45°). In the lower part of the foil, the structure will include foam core (Divinycell H100 foam) and Gurit SE 84 laminates. Miles said he planned to switch to the lower-temperature prepreg so the foam does not "blow up." At 250°F (121°C) H100 distorts, changing density and dimensions, but SE 84 cures below that threshold at a cooler 176°F (80°C). Miles said he would still precook the Divinycell to reduce the chances of expansion after the foam had been shaped. To finish, he will use woven cloth for wrapping, and SE 84 as well. Lastly, the B-side will be faired and sanded.

Miles estimated total construction time would run eight weeks for a springtime delivery.

—Dieter Loibner

About the Author: *Dieter Loibner is editor-at-large* of Professional Boat-Builder.

PBB Resources

- Bieker Boats: biekerboats.com
- CST Composites: cstcomposites.com
- Matanzas Watercraft: matanzas watercraft.com
- Port Townsend Watercraft: ptwater craft.com
- Suzuki Marine North America: suzukimarine.com
- Turn Point Design: turnpoint design.com

The *Star* Project

An experienced sailor and a skilled Maine builder team up to develop a lobster yacht with appeal to lifelong sailors transitioning to powerboating.

Text and photographs by
Kenneth Sigel

As my wife and I approached retirement, we found ourselves in a situation familiar to many sailboat owners looking to spend more time on the water. For 16 years we'd sailed a Valiant 40 more than 2,000 nm of coastal cruising. But our children grew up, and we had a lot of boat to handle and seemingly endless brightwork to maintain, which cut into either our sailing time or our bank account. It was time to consider a new style of boating that better fit our new circumstances and priorities.

Before we get to the details of our particular boat, builders and service yards looking for new business should note that our situation is not unique. The Census Bureau projected that between 2014 and 2020 there would be a 14% increase in the number of men and women over 65. During the same time, sales of midsized sailboats decreased, and sailboat brokerage listings sit on the market longer. Many older affluent adults aren't looking to get out of boating, but, like us, they may be looking for a new experience. Indeed, we'd like more adventure and recreation in our leisure time as our interests shift to visiting more destinations and arriving in greater comfort, all from the same home port and without markedly increasing cruising time.

The answer was a custom powerboat, but choosing the right builder to trust as a partner in this sometimes ticklish collaborative project was far from simple.

For boatbuilders, I hope this account of building *Star*, a 38′ x 15′ (11.8m x 4.57m) Calvin Beal Special Edition, demonstrates how SW Boatworks (Lamoine, Maine) helped us to realize our goals and avoid some of the perils that could have derailed the project. This story of design and construction exemplifies the client-builder relationship necessary for a successful custom build. I define success this way: the owner is proud of his boat; it has general appeal and resale value; and the owner and builder become friends in the end.

When We Talk About Comfort

The "greater comfort" we sought meant a flat, stable ride with minimal pitch and roll and being able to operate comfortably while seated in a wheelhouse permanently enclosed by solid glass windows with windshield wipers. This was in contrast to our sailing experience of suiting up in full foulweather gear and alternately hiding behind and then peering over a canvas dodger with distorted plastic windows.

Equally important was the capacity to remain on the boat at anchor or on a mooring without the intrusive noise of a generator.

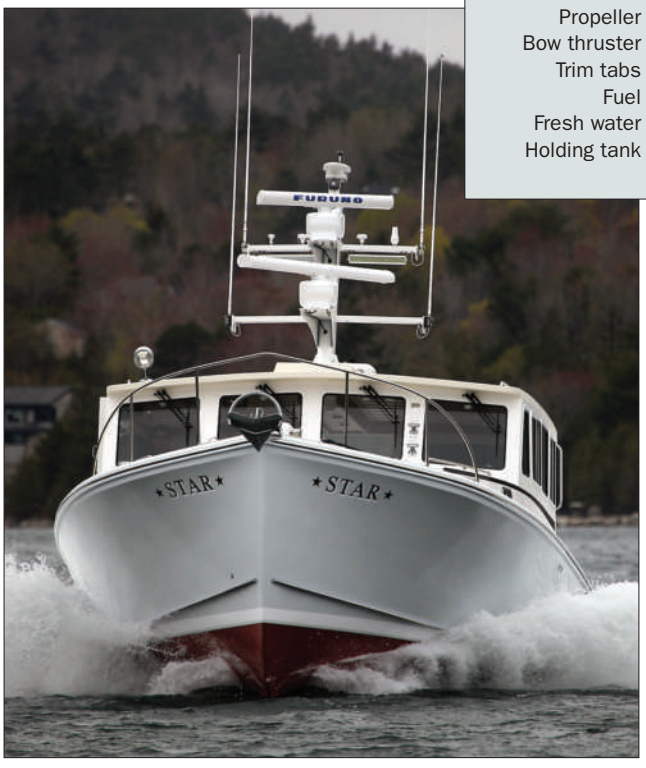
At the boat shows we saw products that promised greater comfort and convenience—powered glass window-walls on wheelhouses, engine hatches that lifted with the touch of a button, and shore-power cords that retracted automatically. We identified these and similar frills as expensive and vulnerable to failure. We confirmed their poor service performance and short operating lives in discussions with our service yard and several marine surveyors. We wanted a boat, not a condo. We wanted to go places, not fix things.

We definitely knew what we did *not* want. At 8 knots we had rocked and rolled in popular pseudo-tugs, sometimes even at the dock. We had pounded along at 25 knots in sportfishermen. At boat shows we'd also rolled at the dock in some sleek rounded-bottom jet-drive hulls, and we tried to imagine what it would be like to go forward to grab a mooring pick-up buoy on boats with streamlined euro-style hulls and no handholds.

The search confirmed some core principles for us: wide, moderately flat-bottom boats roll less; a proper skeg adds directional stability; a sleek, flared bow makes for a smooth entry in rough seas; and moderate-height covering boards enable easy boarding.

Star Specifications

LOA	38′9″ (11.8m)
Beam	15′ (4.57m)
Draft	4′ (1.21m)
Weight	19 gross tons, 15 net tons
Hull construction	Solid fiberglass, no core
Hull type	Semi-displacement with keel and skeg rudder
Engine	Single-screw diesel Cummins QSC8.3 500 hp (368 kW)
Gear	Twin Disc Model 5075A
Propeller	32 x 31 x 4 (LH)
Bow thruster	Side-Power
Trim tabs	Lenco
Fuel	600 gal (2,271 l)
Fresh water	100 gal (378.5 l)
Holding tank	18 gal (68.14 l)



Facing page—*The 38′9″ (11.8m) Calvin Beal–designed lobster yacht* Star *emerges from the build shop at SW Boatworks (Lamoine, Maine).* ***Left—****The author's quest for an able and seaworthy power cruiser led him to a proven workboat hull with ample flare in the bow, moderate volume for accommodations, and an efficient semi-displacement hullform.*

Left—Star's *fully enclosed wheelhouse met Kenneth Sigel's comfort criteria that he be able to make passages in inclement weather without donning full foulweather gear and cowering behind a dodger as he did for decades on a series of cruising sailboats.*
Right—*Reliable pantograph wipers are essential operating equipment on such a vessel, necessary even on clear days when seas are up and spray is flying.*

Performance and Maintenance Requirements

Given that we would be operating between Rhode Island and the Maine–Canada border, stability and seakeeping considerations won out over speed. However, we were not content to travel at 7 to 10 kts on a trawler—those were sailboat speeds. It seemed that a 14-kt cruising speed with a 20-kt top end would give us our ideal range and transit times. A ±400-nm range at cruising speed would allow us to create float plans based on where we wanted to go, not where we could get fuel.

Beyond performance, we wanted a boat with classic appearance that could be easily maintained. That meant no brightwork and a single low-rpm engine. We opted for a gelcoated hull and deck instead of paint; nonskid on the cockpit sole, not teak; plus easy access to the engine and electrical systems.

For an accommodation plan as seakindly as the ride, we drew on our experience with offshore sailboats. The classic layout of opposing settees with a table between them had served us well on our other boats. We saw no reason to change that. It meant plenty of handholds, a galley where we could prepare a full meal under way, berths that could be used while en route, and a boat we could safely move about in during rough weather. Simply put, the boat needed to be rugged, functional, and comfortable, and we needed to be able to run with two crew in berths and two on watch.

Our desire for "full-size accommodations" meant twin- and queen-sized berths, ample space around the engine, walk-in access to electronic/electrical equipment, and plenty of storage space. The galley had to be a true food-prep workspace, not just a sink and a cooktop. And in the main saloon, I applied this principle: For a person to use the head during dinner, no one should have to stand on the settees to open a path.

We've cruised enough to know that

Generous utility space around the main engine installation provides easy access and encourages frequent maintenance of onboard systems like the fuel filters seen here. Much of that elbowroom was secured by forgoing an onboard generator in favor of solar panels.

Modeled loosely on the Sigels' earlier Valiant 40 sailboat, the finished galley space on Star *is functional, well appointed, and practical for cooking full meals while under way.*

we are not dock people; we almost always anchored or stayed on a mooring. Ashore, our home is too close to our neighbors. While aboard we did not want to be even closer to others. Being away from the dock was a major design driver in *Star*'s build sheet. She had to be electrically self-sufficient without a generator, even with refrigeration running. (Relying on her solar panels after launching in May 2018, *Star* has yet to be plugged into shore power.)

Then there was the aesthetic aspect. On our travels we had always admired the working boats like tugs, trawlers, and lobsterboats, but the trawlers were slow, and popular tug-styled yachts had no appeal. That left us to look hard at lobsterboats. To be clear, I don't mean boats with just a Downeast look but hulls designed to be out working, often in rough seas and high winds. These boats need to provide a stable platform for hauling hundreds of

Stewart Workman, owner of SW Boatworks, specializes in building Downeast workboat hulls in solid fiberglass. He sells many as hull kits to fishermen and other builders to finish, but he completes some in-house with practical finishes done to high standards.

heavy lobster traps daily. We started looking for a builder of working boats with the capability to build a yacht.

Connecting with SW Boatworks

Through a mutual friend we were introduced to Stewart Workman of SW Boatworks in Lamoine, Maine. Online research reveals that Workman is a highly reputable builder of GRP fishing and pleasure boats to proven hull designs by Calvin Beal and Ernest Libby. The boats range from 30′ to 50′ (9.14m to 15.24m), all based on working models that have been actively fishing for decades. Even his pleasure-boat clients tend toward the sportfishing, not the teak and Topsiders, set—the initial indicators were all good. With our due diligence done, it was time for the true chemistry test: discussing our still notional project with the man we thought might help us make it a reality.

The initial stages of any project must include a period when builder and owner gain confidence in one another. If things are awkward or contentious, or there are communication problems at this initial phase, it's time for everyone to take a long, hard look and decide if it is in their long-term best interest to proceed.

From the builder's perspective, Workman summed it up this way: "Once you decide a customer is serious, you have to ask two more questions: 'How well does the customer really know what they want?' and 'How much effort is he willing to put in the project?'" He added, "Translating the customer's want list into the specifics of the

Listening and Planning Before the Build

From its shop in Lamoine, Maine, SW Boatworks molds a range of hulls between 30′ and 50′ (9.14m and 15.24m) designed by Calvin Beal and by Ernest Libby. Much of SW's business is selling hulls and tops for finishing by other shops for the lobster fishery. Of the boats that come out of SW's finish bays, half are for the fishery, and the other half are a mixture of yachts, law-enforcement vessels, and research boats.

To better understand how SW maintains satisfied customers across that broadly diverse spectrum, I asked Stewart Workman to talk about some of the specifics of his approach. One disclaimer: At Workman's request I have edited the questions and answers so that, as he suggested, "It will read like we were both wearing suits but still telling the truth." What follows is the slightly sanitized "truthful, suit-wearing" version of our interview.

Workman frequently discussed details of Star's build on-site during the project.

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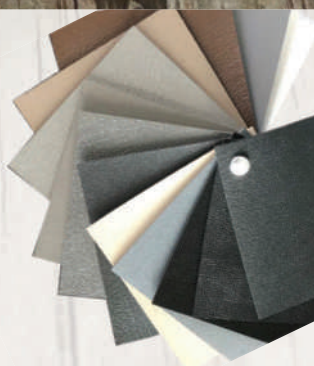

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Left—*The support grid of beams and stringers prior to deck installation reveals the mechanical systems and ample tankage space below the broad, open cockpit.* ***Below—****Full-size mock-ups helped inform final decisions like the one to not carry two Rocna anchors on bow rollers.*

boat takes significant face time, and the willingness of both parties to build it on paper and mock-ups first. Go slow to go fast. Pencil erasers are cheap; fiberglass erasers cost way more. The greater the owner's boating experience, the easier this is."

In the early going we asked Workman about the pros and cons of engaging a naval architect. He said it would add an unnecessary level of complexity and cost to the project. As we would essentially be varying the fit-out and finish of a Calvin Beal 38, a proven design he had built many times before, Workman suggested that frequent meetings with us would be the best approach to getting the boat we wanted. We started by further refining the goals mentioned above, and then got into specifying equipment and systems and finally detailed mock-ups. For example, during the mock-up process we gave up on the idea of carrying two Rocna anchors on the bow, and we significantly changed the configuration of the helm.

Kenneth Sigel: What is the biggest challenge for your crew in moving back and forth between the boat types—fishery, recreational, research, and law enforcement?

Stewart Workman: I lean on the crew pretty hard about finish details on the yachts. I have to make sure they can step back, as needed, when building a working lobsterboat. The systems and running gear always have to be 100%, but lobstermen accept some exposed wiring and piping that a yacht owner would not like, for example.

K.S.: What are the similarities in the two markets?

S.W.: My lobstermen customers have years of experience, and each one fishes his own way. They can be just as particular as the yachtsmen. That's why I always spend lots of time listening, and building on paper.

K.S.: How do you size up a potential customer? How do you know you can both come out satisfied with the result?

S.W.: Of course, this is a business situation, so we do have to start talking budget. If their budget is in range, I quickly take our discussion to how they want to use the boat. The more experience and knowledge they have, the better. When every decision is based on cost, I get concerned. All owners want to spend more money in one place than another. For example, I think the order for *Star* cleaned out the Furuno warehouse, but that's what you wanted. You wanted to find and pinpoint wrecks for diving. But when a customer wants everything as cheap, cheap as possible I get worried they won't be happy in the end.

K.S.: What advice would you give a powerboat builder in building for a longtime sailor?

S.W.: It is good to get them out on a sistership both to experience the handling and get a sense of what it's like to spend time aboard one. Many cruising sailboats have lots of fussy detailing. It's not really part of the true Downeast style. Those details are expensive. As a builder you need to see if that's where the customer wants to spend their money. Pictures of their former boats showing what they liked help. *Star*'s galley is based on the one on your Valiant 40. Seeing those pictures made it easy to scale it up.

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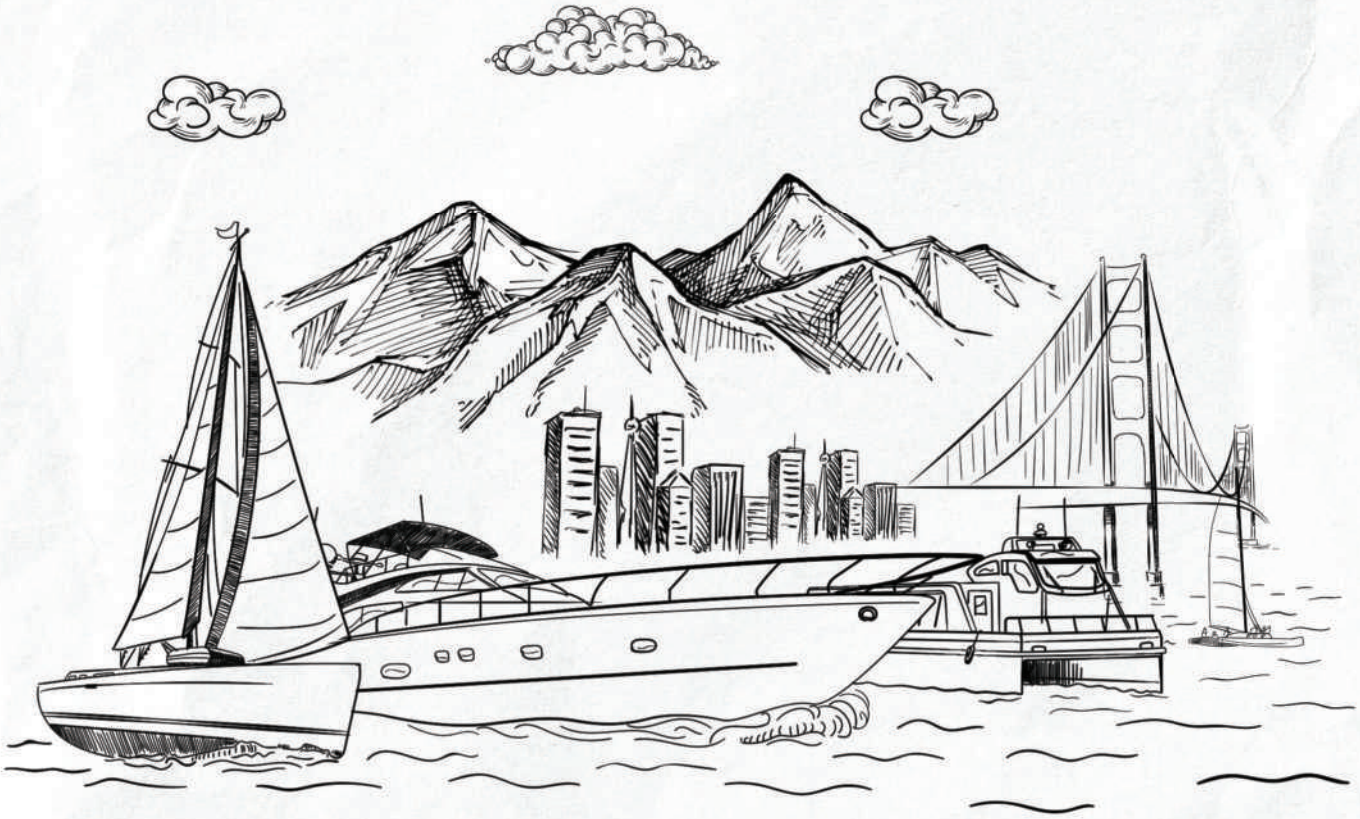

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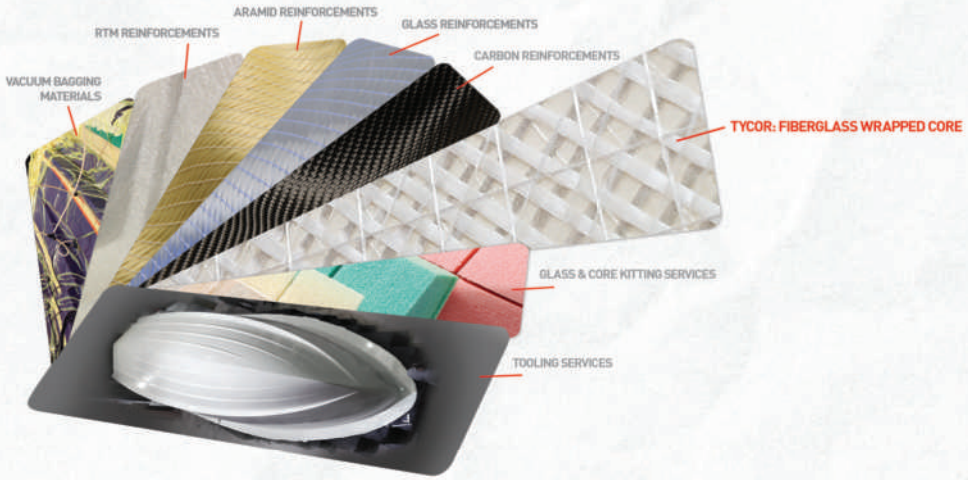

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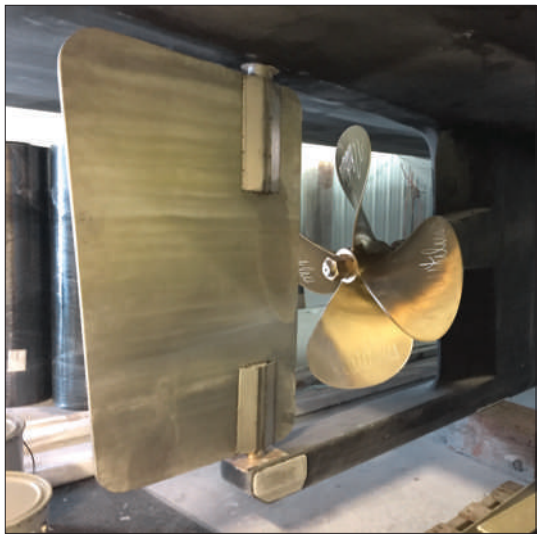
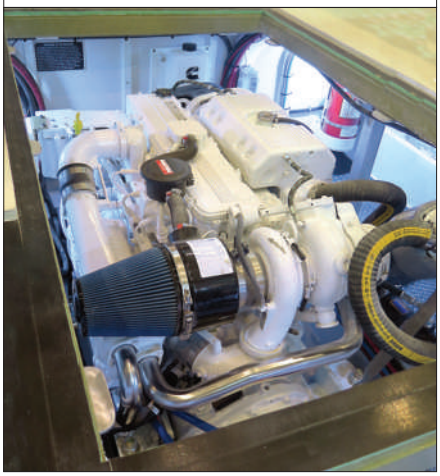
Diesel Selection

Early in the plan, one of the most essential decisions was the main engine. Fortunately, we wanted the same basic propulsion system most lobsterboats have: a single-screw diesel. When asked how he arrived at the Cummins QSC8.3 specifically for *Star*, Workman said, "The first thing I look at is the client's target speed and range. *Star* uses about 1.2 gal (4.54 l) per nm at 15 kts. With her two 300-gal [1,135.6-l] tanks she has about a 450-nm range. Next, I was very aware of noise. That's where the 3″ [76mm] of Soundown came in. Finally, I wanted to be sure there was a good service network for the engine and systems in the areas in which she would be operating."





***Above**—A single prop and a skeg-hung rudder are in* Star's *workboat DNA and on Sigel's priorities list.* ***Right**—Workman suggested the QSC8.3 diesel based on Sigel's speed and sound requirements, and the fact that in any single-engine installation, reliability and simplicity are essential.*

Cummins QSC8.3 4-stroke diesel
6 cylinders, 8.3 l (505 cu in)
2,600 rpm
368 kW (500 hp)
Turbocharged with aftercooler
High-pressure common fuel rail
Weight 896 kg (1,975 lbs)

K.S.: What's a red flag? When do you say no to someone?

S.W.: For me it all comes down to trust and listening. It goes both ways. If someone can't trust me, or doesn't want to listen and get my input, then I won't build a boat for them. This, in fact, has happened once. I had to return a deposit. I think we were both better off.

K.S.: What would you tell a customer is the best way for them to make detailed decisions during the build process?

S.W.: There are times when we need the customer to make decisions. This is very true in the finishwork. There is no substitute for the customer to be on the boat and lay out with blue tape, or mock up, the details. It saves time, money, and avoids reworks.

Workman advocates for having the customer on board to see and touch actual mock-ups in plywood and blue tape before making final installations.

K.S.: So you've starting a new build, what's round one?

S.W.: Once I know they are serious, then I focus on what they want. Remember, *Star* started out as a 36′ [10.97m] boat, but we quickly came to realize it just wasn't going to be what you wanted. We needed the extra beam and length. So, I focused on building the boat you wanted on paper. That got us to a price. Then we tested some of our decisions and got to the right boat. Boats are expensive; that's reality. But when someone spends a lot of money on a boat and it is not what they want, that's when you get an unhappy customer. I always start with getting to the boat they want.

K.S.: Anything else?

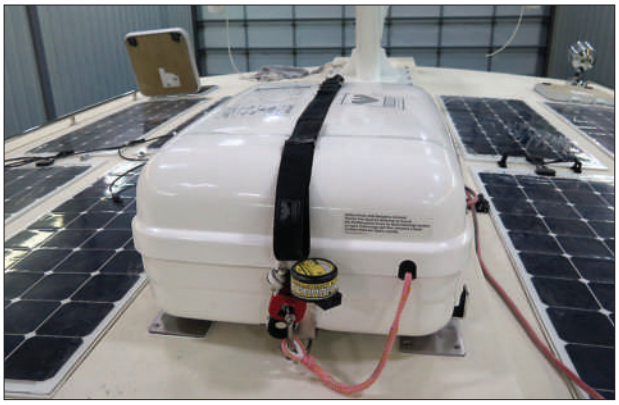
S.W.: I think our approach is pretty solid. You and I are now good friends. That says something. The overwhelmingly positive response to *Star* at the 2018 and 2019 Newport International Boat Show, and the positive attention she gets wherever she is says lots about broad appeal and resale value.

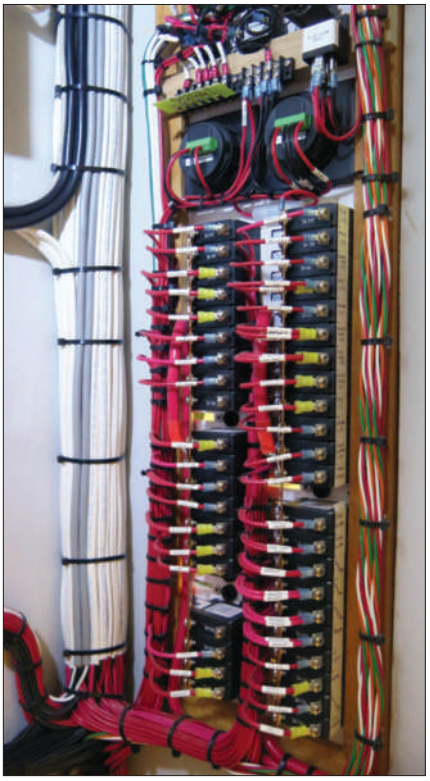
—Kenneth Sigel

Big Solar

Perhaps *Star*'s most unique single feature is the charging system, a combination of dual alternators and a 1.12-kW solar array on the wheelhouse roof. This allowed us to avoid installing a generator, which freed up more space in the engineroom and makes for less maintenance, a lighter boat, and a silent charging system. With the solar panels, *Star*'s batteries are constantly charging, even in low light. Note that in consideration of resale, the fuel taps, tankage, and full foundations for a generator are there should the next owner feel compelled to install one.

Relying on my own mission-critical electrical background and in consultation with Kramp Electronics (electrical and electronics contractor) and





Right—*To eliminate a generator, high-output alternators on the main engine and a large-scale solar energy system on the cabintop were installed.* ***Far right***—*A clean electrical system from Sigel and Kramp Electronics meets ABYC standards; all wiring connections to the panel circuit are labeled.*

As master electrician, Sigel oversaw installation of the complex electrical system. After the overhead is finished, only the full-length longitudinal grabrails will be left exposed.

Ocean Planet Energy Inc. (equipment vendor) we translated my initial electrical-power-system design into a working onboard system. On the engine-driven side, *Star* is fitted with two 130-amp alternators feeding four 8D absorbed-glass-mat (AGM) batteries. One pair feeds a service bus through individual on-off switches, and the second pair feeds the engine bus in the same way. Each bus has a dedicated alternator. We installed Blue Sea Systems remote switches controlled from the electrical panel. The only connection between the two buses is a manual emergency switch in the engine compartment. This is intentionally located away from the panel to prevent accidental combination of the two buses. This double-ended system allows any battery, solar array, or alternator to be routed to either bus. A defective unit can be isolated from service in the same way.

One solar array consists of eight 125-watt Solbian SP-125L-JB (53″ x 21″/1.35m x 0.5m) panels dedicated to the ship's service bus. The second is a 112-watt Solbian SP-112Q-JB (33″ x 31″/0.84m x 0.79m) dedicated to the engine start batteries. The panels feed through individual Victron charge controllers to minimize the impact of shading. This allows for the system to function, albeit at lower capacity, if only some of the panels have the necessary sunlight. Running through a

single controller, significant shading of one or two panels could shut the whole system down. (See Nigel Calder's "Advances in Onboard Solar," *Professional BoatBuilder* No. 182.)

Workman: "The solar equipment is relatively new to us in our market. It has performed way beyond our expectations. I started out thinking this would be a fill-in system, but it has turned out to be the primary system. Even with long periods of dark, cloudy weather the batteries are maintained, and the refrigeration keeps running. Compared to a generator, it saved weight, space, and money, and there is zero noise. But my biggest surprise was *Star* winning the Green Boat Award at the 2018 Newport Boat Show. I think we got the award because we used the system to solve a practical problem, as opposed to using bamboo flooring and cleats made from recycled hubcaps."

Conclusion

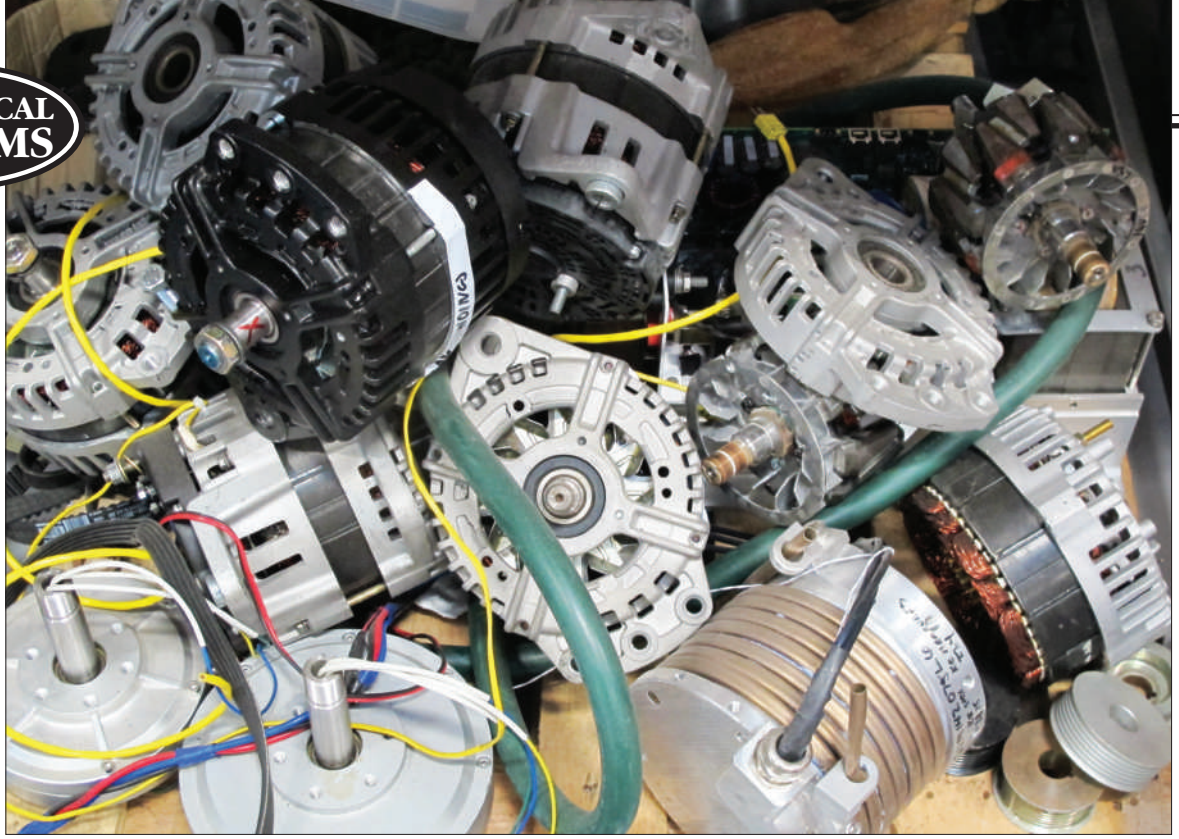
For my wife and me the biggest surprises also came from the Newport International Boat Show when one visitor asked, "If you had to do this all over again, what would you change?" My wife and I looked at one another and simultaneously said, "Really nothing." Of course, we have refined our storage plan over these first 500 hours onboard, but the boat is perfectly fine just the way it is. At that same show, we were surprised at the overwhelmingly positive response to *Star*. Time and time again we heard, "Wow, this is the first real boat I've seen today. I could see myself on board in bad weather."

We had two genuine serious offers to buy her on the spot, but *Star* is not for sale. Perhaps that says the most. PBB

About the Author: *Kenneth Sigel is a retired master electrician with marine, industrial, and technical construction experience. He has renovated and sailed (offshore and coastal) a Rhodes 41, Hinckley 38, and Valiant 40. He currently works on marine systems in the shipyard at the Mystic (Connecticut) Seaport Museum.*

Resources

Blue Sea Systems: bluesea.com
Cummins: cummins.com
Kramp Electronics: marineelectronics.com
OceanPlanet Energy Inc.: oceanplanetenergy.com
Rocna Anchors: rocna.com
Solbian: solbian.eu
SW Boatworks: swboatworks.com
Victron Energy: victronenergy.com



HIGH OUTPUT

Installing alternators becomes more complex and problematic as they evolve to meet the greater charge-acceptance and storage capacities of new battery technologies.

Text and photographs by Nigel Calder

The combination of lithium-ion batteries and more powerful and efficient alternator-style charging devices has reshaped how we generate energy for house loads on many boats. For decades, batteries were the limiting factor in these systems, but that distinction has shifted to the alternator. With that change in mind, we'll focus on the challenges of alternator installations—some longstanding and relevant to any system, and others driven by recent technological advances.

Above—*A pile of various experimental alternators, including permanent magnet and liquid cooled, built and tested during the author's investigations into optimized DC systems. The resulting Integrel system won the DAME award at the 2018 METS in Amsterdam.*

Determining Output

Looking at any charging system, our first step is to distinguish real alternator output from *rated* output. An alternator is normally given an SAE (Society of Automotive Engineers) rating that describes its maximum output at a given temperature—77°F (25°C)—and speed of rotation. But in practical operation, an alternator will rapidly heat up, causing its output to decline by as much as 25%. Thus, the meaningful rating number for a systems designer is a hot rating (sometimes known as a KKK rating). Although I have found some SAE-rated alternators with matching operating and rated outputs, for design purposes I derate an alternator by 20% if a hot rating is not available.

Manufacturers provide curves or tables illustrating alternator performance (amps) as a function of speed of alternator rotation (rpm). Comparing these may reveal that models with the

same nominal peak (e.g., 150 amps) might require very different speeds of rotation to achieve it. The lower the speed at which an alternator reaches full output, the more desirable it is for most marine applications, because it maximizes charging when the engine is idled solely for battery charging or is run slowly for harbor maneuvering. The rate at which an alternator builds output is a key factor in designing a system.

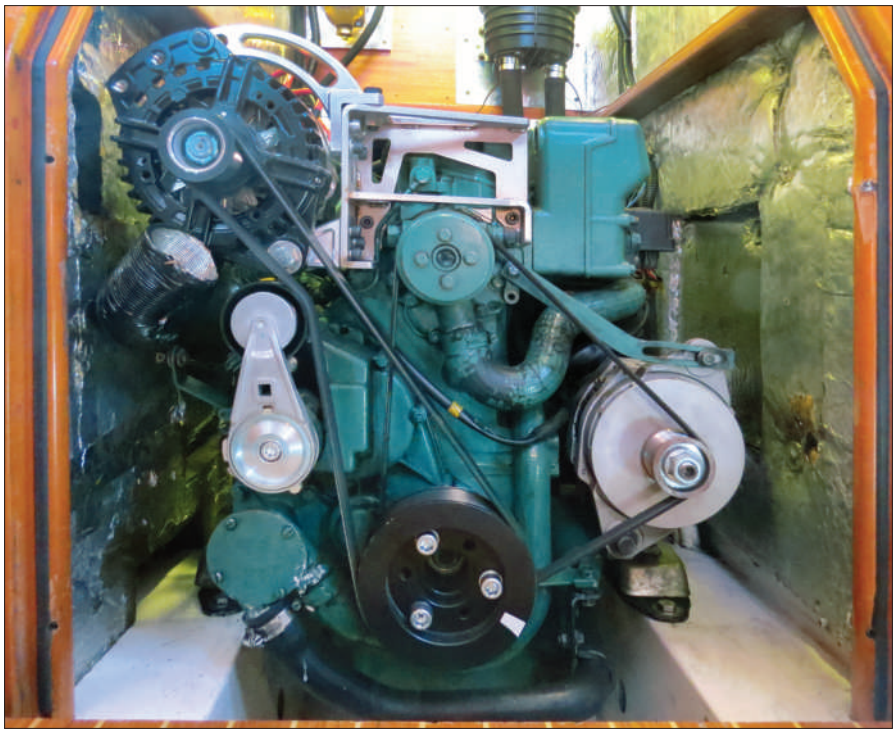
Another important element is pulley sizing. Standard engine pulleys, and those supplied with high-output alternators, often don't allow an alternator to reach target output at a common engine rpm. That's because most alternators and pulleys are geared for automotive applications, where engines typically run at 2,500 rpm or higher; marine engines operate most frequently anywhere between idle speeds of 700 rpm to 800 rpm, and cruising speeds no higher than 2,000 rpm.

Because boat engines and usage vary considerably, you must specify alternator pulley size based on individual applications, using the following steps:

- Determine alternator rpm needed to produce the target alternator output. Unless the alternator is specifically designed for high-temperature operation, as a guard against overheating, the target continuous alternator output should not exceed 75% of rated output.
- Find the alternator's maximum safe operating speed (usually 10,000 rpm).
- Determine minimum engine rpm during normal operation.
- Establish an alternator pulley ratio that will achieve the target output at this minimum engine speed.
- Check that the alternator will not overspeed at maximum engine rpm. If necessary, power down the pulleys so the alternator reaches its maximum rated speed only at maximum engine rpm.

As a general rule, if alternator rpm needs to increase for a given engine rpm, you should increase the engine pulley diameter rather than decreasing the size of the alternator pulley. The latter is highly loaded, and decreasing pulley size exacerbates belt slippage and other issues.

An additional complication is that some engine tachometers operate by sensing the internal *phase* frequency of the alternator (those are the ones with a wire run from a terminal on the alternator to the tachometer). If a nonstandard pulley ratio is used to drive the alternator, it will throw off the tachometer calibration. There's not always a means of adjusting for this, and with some multistep voltage regulators the tachometer may also trip out or flicker on and off when batteries are nearing a full state of charge and the charge controller trips to its "float" setting.



In a previous installation on the author's boat, a high-output alternator (rated at 195 amps at 24V) is in the standard position on the engine's lower right side, and an add-on 48V, 8-kW device is mounted on the upper left, including a spring-loaded tensioner, and cooling air ducted to the alternator's base at front and back.

Alternator Installation

In many cases, an ideal installation does not replace the existing alternator but instead adds a high-output alternator to it.

High-output alternators commonly come in a *small frame*, which is the same size as most automotive alternators, and a *large frame*, which is highly desirable to optimize heat dissipation but may be hard to mount in some circumstances. There are several standard mounting arrangements in general use. Whatever its size, a replacement alternator should use the same mounts as the original. The most common are saddle mounts (also known as dual foot), on which a long bolt runs through two lugs spaced at either 3.15″/80mm or 4″/102mm (J180-style); and single-foot mounts, with one heavy-duty lug either 1″ or 2″ (25mm or 51mm) thick.

High-output replacement alternators

Left—*The author and his wife modify an alternator bracket to fit a prototype experimental alternator with embedded permanent magnets in the rotor.* ***Above***—*The black dust is either from a slipping belt or misalignment. Belt slip is easy to remedy with additional tensioning, but not so misalignment, because of the fixed location of the main mounting bolt on almost all alternators.*

on older engines are often driven by a single V-belt that also powers the engine's freshwater pump. Unless the pulleys and belt are replaced, the factor limiting alternator output will be the existing belt size. As a rule, a single ⅜″ (10mm) belt should not be used to handle much more than 1 kW of alternator output (e.g., ~75 amps at 14V); and a single ½″ (13mm) belt not much more than 1½ kW (e.g., ~100 amps at 14V). Note that the belt tension needed to power higher loads may damage bearings in the water pump.

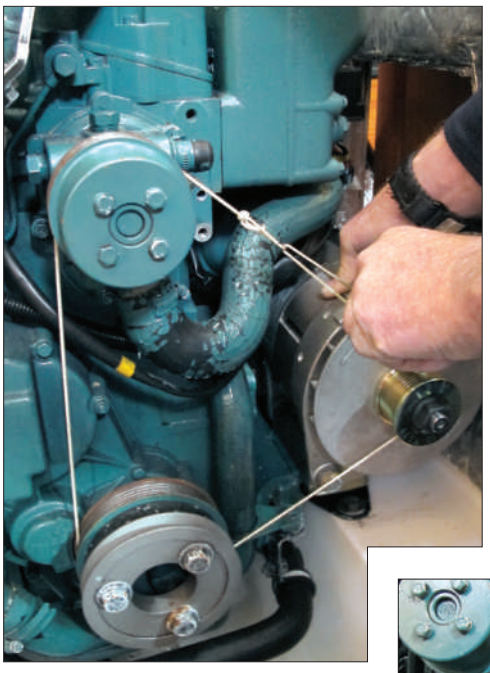
Traditional V-belts come in two profiles: classic (based on 1930s U.S. standards, also known as *wedge* and *conventional*); and narrow, the most common on engines with conventional pulleys. (Metric versions of both profiles exist.) Belt quality varies markedly between manufacturers. In my experience, there is no way to tell the level of quality just by looking at a belt. I have

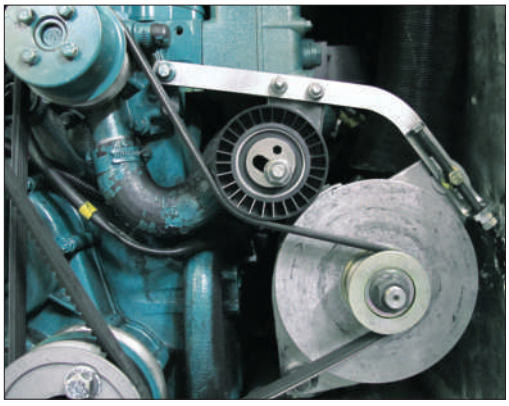
had excellent results with Gates Green Stripe belts, and thus always specify them. Note that the bible for a detailed description of V-belts and associated design factors is the Gates *Heavy Duty V-Belt Drive Design Manual* (Gates document number 14995; get the latest edition).

Serpentine belts eliminate many traditional pulley and belt issues, and can also support extraordinarily high belt loads, with the limiting factor on many systems now being the bearing in the water pump if it is included in the circuit. Retrofit serpentine pulley kits are available for most popular marine engines and are an excellent investment if installing high-output alternators.

When specifying serpentine belts, the automotive industry currently uses "K" section "micro-V" belts and compatible pulleys. The marine world is largely following suit. However, the industrial "J" section sometimes appears in marine applications even though finding replacement belts is nowhere near as easy as replacements for "K" section belts.

Typical belt geometry on a marine engine results in no more than 90° of belt wrap at the alternator pulley. Given the high loads of powerful alternators, considerable belt tension is needed to prevent slipping in that configuration. Adding an idler or tensioner pulley to increase the alternator pulley belt wrap to as much as 180° will accommodate high loads with significantly lower belt tension and less risk of slippage. Such a pulley should always be located on the low-load side of the alternator pulley, where the belt feeds onto the pulley, not the side from which it is pulled off the pulley by the crankshaft pulley.





Above—*In figuring out the belt run for a large-frame high-output alternator, the belt wrap indicated by the string is inadequate to handle the alternator loads without either having the belt slip or overloading the water pump pulley bearings.* ***Top right*** *and* ***right****—An idler pulley is added to increase the belt wrap.*

Engine Overload

Powerful alternators can easily overload a relatively low-powered engine when under way, particularly at idling and low speeds and when approaching wide open throttle (WOT). If this is a problem, you'll need to limit the alternator's output at specific engine speeds, which requires a more-sophisticated charge controller than is normally installed. In the likely absence of specific detailed information from the manufacturer, what follows is a rough method to determine whether you need one:

- Obtain a graph of the engine's full power curve and a nominal propeller load curve (commonly published online by the engine manufacturer) with the engine power and the propeller load expressed in either hp or kW. Print out this graph in a reasonably large format.
- Obtain a copy of the alternator output curve expressed in amps at a given speed of alternator rotation.
- Multiply the amps by the charging voltage (e.g., 14V, 28V) to determine the maximum output in watts (W) at any given alternator speed of rotation. Divide the watts by 1,000 to get to kW (e.g., a 150-amp output @ 14V = (150 x 14)/1,000 = 2.1 kW). If the engine power and propeller load curves are expressed in hp, multiply the kW by 1.34 to convert kW to hp (e.g., 2.1 kW x 1.34 = 2.81 hp).
- If you know the alternator's efficiency, convert this to a decimal (e.g., 60% efficiency = 0.6) and divide this into the alternator's kW or hp output at any given alternator speed of rotation to determine the approximate crankshaft-pulley load at that speed (e.g., at 60% efficiency, a 2.1 kW output = (2.1/0.6) = 3.5 kW crankshaft load; a 2.81 hp output = (2.81/0.6) = 4.68 hp). If you don't know the alternator's efficiency, assume it is no more than 60%.
- Determine the engine rpm at which these crankshaft pulley loads occur by dividing the pulley ratio between the crankshaft pulley and the alternator pulley into the alternator's rpm at any given output point.

• Add the alternator load at a specific engine rpm to the propeller load at that rpm. This can be done by adding the alternator loads to the propeller curve graph you printed out. We are looking for a rough indication of the combined alternator and propeller load rather than a precise number. If there are two alternators, do the same calculations for both; add both loads; and add the sum to the propeller load.

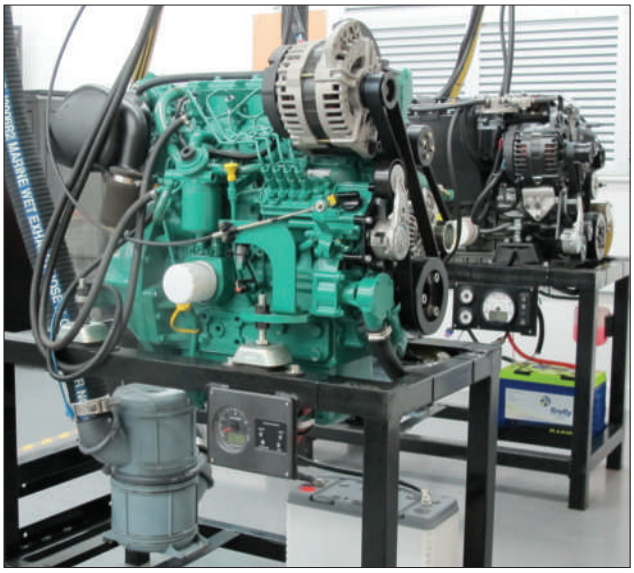
• If the combined propeller and alternator load ever approaches the engine's full power curve, reduce the alternator load at that engine rpm. It can be done manually in some cases but most likely will require a sophisticated charge controller. In general, until you approach WOT, at which point ideally any powerful alternator will be shut down, the combined alternator and propeller load shouldn't exceed 70% of the engine's maximum power rating (the full power curve) at any given speed. This accommodates calculation inaccuracies and unanticipated loads while simultaneously coming close to optimizing engine fuel efficiency.

The calculations above provide a rough idea of the alternator loads added to the crankshaft pulley at any given engine speed. Convert them to torque values as follows:

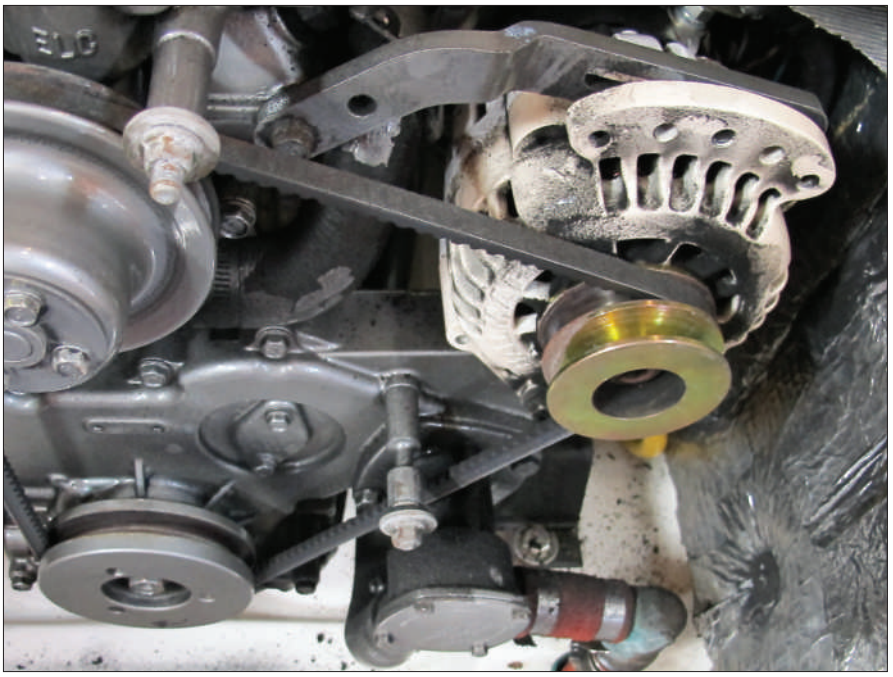
- Nm = (9,549 x kW)/rpm
- In-lb = (63,025 x hp)/rpm
- Ft-lb = (5,252 x hp)/rpm

where kW and hp are the crankshaft pulley load as calculated above, and rpm is the engine rpm.

On smaller engines (e.g., below 100 hp) these loads *can exceed published allowable side loads;* engine manufacturers may void the warranty on new engines. This has been an ongoing issue for many years. In correct installations there are few instances of engine damage that can be attributed to an alternator, and engine manufacturers have been increasingly forced by consumer demand to accept these installations. I am not qualified to give legal advice, but in the U.S. the Magnuson-Moss warranty act, passed in 1975, specifically bans the voiding of an engine's warranty because nonbranded parts have been used in servicing and maintaining it.



A Volvo Penta (left) and a Yanmar engine fitted with 8-kW generating devices undergo endurance testing in the laboratory at Triskel Marine (now Integrel Solutions) in the United Kingdom.



A high-output Balmar alternator installed on a small Yanmar 3GM diesel exhibits some signs of belt wear, most likely from belt slip, not misalignment.

Alignment and Tension

With the correct pulleys, brackets, and belts on hand, the mechanical installation of most alternators is straightforward. Alignment is determined by the mounting brackets, so it either works or it doesn't—there's no means of easily making any adjustment. You can check pulley alignment with various laser tools prior to fitting a belt. For the K-section serpentine belts, a couple of easy-to-use and accurate devices are available from Gates (model numbers 91075 and 91006). Although belt tension can be checked more-or-less satisfactorily by hand, if the belt is to be driven hard, it is best to use a tension meter. The best one I've seen is a Gates Sonic U-508 model, expensive at $700 but worth it for the professional installer.

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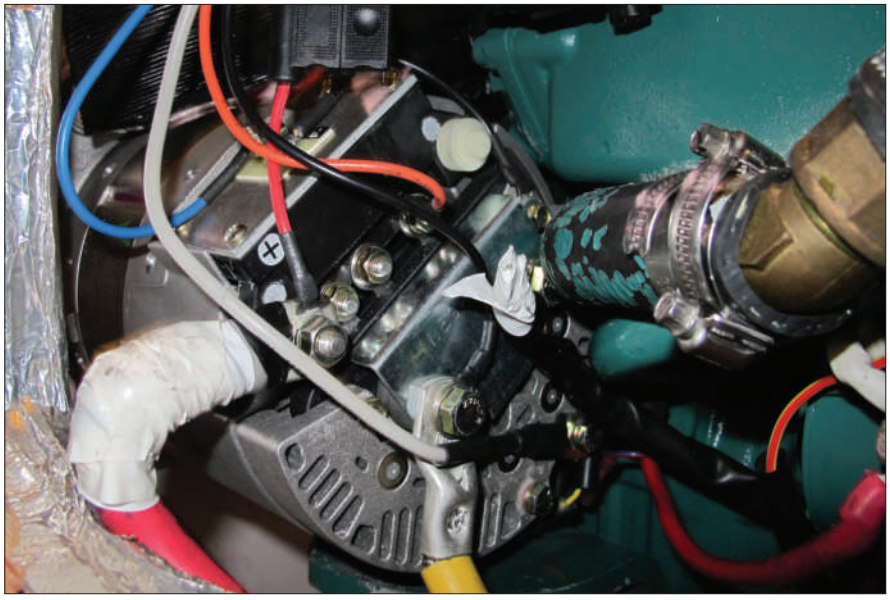
Cable Sizing, Stranding, and Connections

After the mechanical installation, wiring is next. There is more to this than meets the eye, especially with higher-performing alternators. Below I describe some obvious requirements and some not-so-obvious ones that I see violated from time to time.

In accordance with the American Boat & Yacht Council (ABYC) E-11 standard, cables should be sized to allow a maximum 3% voltage drop in the alternator's full rated output. Depending on the length of the cable run, with high-output alternators this can easily require 2/0 (70mm²) cables, and sometimes even larger. Additional considerations include:



A 195-amp, 25V large-frame alternator is a tight fit on a Volvo Penta D2-75 engine. Most smaller alternators are grounded through the case and engine block, but on high-output alternators it is common to add a ground cable. In that case, two heavy cables (red and yellow) hang off the back of the alternator. They must be well supported close to but not in contact with the (hot) alternator case, and secured against vibrating loose.

- Cables should always be at least Type 2 stranding to withstand the inevitable vibration without work hardening and fracturing.
- Depending on the cable size required to meet the standard, your installation may include a large cable connected to a relatively small output stud on the back of the alternator. It is essential that cable terminal and studs be exactly matched and mated, and that the retaining nut includes either a lock washer or a nyloc nut. The former is preferable, as the temperature on the back of an alternator (see below) can exceed the rated locking temperature (250°F/121°C) of the plastic insert in a nyloc nut.
- The cable should be supported with strain relief close to the alternator to prevent it from working loose. If it does, a resulting arcing fault can burn through the output stud, allowing the cable to drop off entirely. If the loose cable end contacts the engine block or any other grounded surface, a dead short across the batteries to which it is connected could burn through the engine oil pan or start a fire.

A laser heat gun, or a thermal-imaging camera, is a terrific tool for measuring the case temperature of alternators run hard. If not properly managed, this heat—frequently more than 100°C (212°F) and sometimes much higher—can destroy the alternator.

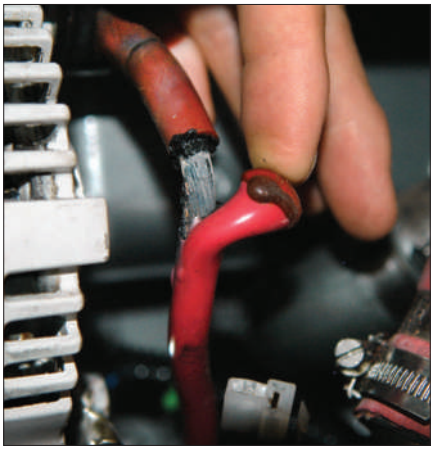
Thermal Issues

Conventional alternators with peak efficiency of no more than 60% get hot when they run hard. To put this in perspective, a 60%-efficient nominal 12V alternator running at 150 amps supplying (150A x 14V) = 2,100 W = 2.1 kW of electrical energy to the boat's electrical system will also generate 1.4 kW of heat. Alternator case temperatures frequently exceed 212°F (100°C} and sometimes go significantly higher. For example, the factory temperature setting for many Balmar alternator temperature sensors, which are bolted to the alternator case, is 226˚F (108˚C), with an option to raise this temperature setting as high as 248˚F (120˚C)

via Balmar's charge controller software. I have set it at 237°F (114°C). High operating temperatures have several consequences:

• To prevent it from burning out, the alternator may require a temperature sensor tied to its charge controller, especially when charging lithium-ion batteries (see below).

• The output cable(s) from the alternator, in particular the positive cable (most alternators are grounded through the case without a negative output cable), carry the alternator heat, with the section immediately after the attachment to the output stud approaching the temperature of the case. Cables with insulation temperature ratings as high as 392˚F (200˚C) should be employed here, yet I have not seen them in use. Common in the U.S. is UL 1426 "Boat Cable" (also known as BC5W2) with a "dry" temperature rating of 221˚F (105˚C). An alternator running hard will transmit enough heat to the cable terminal to push a cable to its maximum rated temperature. At this point, according to ABYC ampacity tables, no amps should be put down the cable, but the alternator is delivering outputs of well over 100 amps. At present there is no good standards-compliant solution to this other than to size cables very conservatively; never use cable rated for less than 221˚F; and *never support the cable close to the alternator output stud by strapping it to the alternator case.* The wire needs to be in free air to dissipate heat as fast as possible. Note that many European boatbuilders install cables with a temperature rating below 221˚F—*completely inappropriate for many alternator installations*. To compound problems, the cable is frequently not labeled with its temperature rating.



The positive cable for this high-output alternator has been touching the case. Despite the cable rating of 221°F (105°C), the insulation has melted, creating the potential for a dead short across the batteries.

• Automatic engineroom-fire-suppression systems trigger at 174˚F (79˚C). To avoid nuisance triggering,

install the temperature sensor away from high-output alternators that will be run hard. *Never mount the temperature sensor directly above the alternator or in the exit path of its cooling air*. Advise boat owners to invest in the more-expensive gas-filled extinguisher option, not the dry powder, which can cause irreparable engine damage if triggered with the engine running.

• Following installation, an alternator should be run at its full rated output, *held there for at least 10 minutes*, and then all the connections in the associated cabling—from the alternator output stud to the batteries being charged—should be *photographed with a thermal-imaging camera to ensure that there are no hot spots*. If you find any, clean and reestablish the flawed connections. (Thermal-imaging cameras that plug into smartphones can now be purchased for about $200. This device is an essential component of any marine electrician's tool kit. A laser heat gun can serve a similar purpose for less than $20, but the area image of a camera provides a better overall picture of what is going on.)

• In an increasing number of applications it makes sense to remove the diode pack from the back of an alternator and mount it separately. Diodes contribute significantly to heat generation and simultaneously obstruct airflow through an alternator. Removing the pack improves alternator cooling, while the pack itself can be mounted in a cooler environment for better heat dissipation. With this change, instead of a single

Another way to measure alternator case temperature is to attach a thermocouple to a multimeter and place the thermocouple on the case. The temperature on this alternator is just over 113°C (235.4°F).

positive cable coming off the back of the alternator, with perhaps a negative cable, there will now be three *phase* cables between the alternator to the diode pack, with a positive and negative cable thereafter.

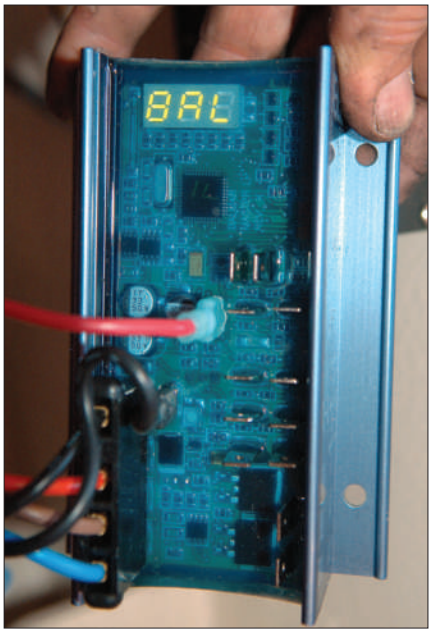
Overcurrent Protection

Under ABYC E-11, an alternator wired back to a starter motor solenoid (the most common installation) with a cable run of less than 40″ (1m) does not require overcurrent protection (OCP). But if the alternator is wired to any other point in a boat's electrical system, it may require OCP, sometimes at both ends of the cable. The determining issue is whether the alternator's maximum possible output is "self-limiting" (in practice, it will be) and whether *the ampacity of the output cable is as high as, or higher than, this maximum possible output*. If the 3% voltage drop table is used for sizing cables based upon the alternator's full rated output the cable ampacity will be high enough.

It is important to follow the positive cable electrical path back to the batteries being charged until you find an OCP device. If this device has a rating higher than the ampacity of the cable from the alternator, an additional OCP device, rated according to the ampacity of the output cable from the alternator, is required at the point where the alternator output cable connects to the rest of the system. ANL or similar fuses are commonly used here and elsewhere in high-current DC circuits. The connections to these are almost always made with stainless-steel fasteners, which have low electrical conductivity. *It is essential that cable terminals are in direct contact with fuses, or with the conducting surfaces of busbars, and that no stainless-steel washers are placed between conducting surfaces*. Such washers accidentally included in the circuit and subjected to high continuous currents can generate sufficient heat to blow fuses (at which point the diodes in the alternator may be destroyed) and even to start fires. I recommend slow-blow fuses to minimize the chances of nuisance blowing.

Lithium-Ion Batteries

As lithium-ion batteries gain wide acceptance, the tendency is to think of them as a straightforward replacement for lead-acid batteries. For a number of reasons, some directly related to alternator installations, they should not be treated this way.



To safely optimize performance, the Balmar multistep regulator shown here and other similar regulators require sophisticated programming to match alternators to batteries.

In principle, a well-discharged lithium-ion battery can drive charging devices to full continuous output for extended periods, but if an alternator is not rated for continuous duty, there must be a way to derate it. For example, Yanmar requires that, when their Valeo alternators are used with lithium-ion batteries, the output current is limited to no more than 75% of their rated output. Another derating mechanism is to track alternator temperature and control the output based on a set temperature limit.

Note that not all lithium-ion batteries are rated for high charge rates. In fact, recommended charge rates as low as 0.3C (i.e., a charge rate in amps that is 30% of the battery's Ah rating; for example, a 200-Ah battery would have a recommended maximum charge rate of 60 amps) are the norm. It is important to match the battery's characteristics to those of the alternator.

Even though lithium-ion batteries are 90%–95% efficient, if they are cycled at high C rates, the remaining 5%–10% can generate significant heat. If the internal temperature rises beyond a certain threshold, a battery management system (BMS) is likely to disconnect the battery from the boat's electrical system. Thus, alternator charge rates must be coordinated with internal battery temperatures.

The BMS on any lithium-ion battery for marine applications is likely designed to forestall the battery entering a potentially unsafe condition. A range of voltage, temperature, and state-of-charge thresholds will trigger protective measures, which usually result in the battery being disconnected from the boat's electrical system. If this occurs with an alternator running, it may create a voltage spike throughout the boat that damages all electronic equipment turned on at the

time, and it may destroy the alternator by blowing out its diodes. To prevent this, the BMS should be programmed to shut down any alternator *before* disconnecting the battery. This feature is frequently absent in so-called drop-in batteries designed to replace existing lead-acid batteries.

The two predominant lithium-ion chemistries in marine batteries are lithium iron phosphate (LFP) and nickel manganese cobalt (NMC). It's a peculiarity of NMC batteries that they will permanently lose capacity if maintained for extended periods in a full state of charge, such as when a battery charger is plugged into a dockside power supply. Similarly, if a generator or propulsion engine is running 24/7, continuously charging NMC batteries, a charge-control mechanism must be programmed to maintain the batteries *below* a full state of charge.

LFP chemistry is not as sensitive to continuous full charging but will still benefit from being maintained below a full state of charge. This is the opposite of how we aim to manage lead-acid batteries.

Conclusion

For at least the past three decades pretty much everything we have done to advance onboard DC systems design has been to work around the inherent limitations and weaknesses of lead-acid batteries. Increasingly, adoption of lithium-ion batteries is eliminating this roadblock, and the stress point in our DC systems is shifting to the generating side, notably alternators.

Some excellent solutions in development include high-output alternators married to extremely sophisticated control systems, but until the capabilities of such solutions filter down to the broader alternator marketplace, to avoid unhappy customers we need to pay close attention to the finer details of conventional alternator installations. PBB

About the Author: *A contributing editor of* Professional BoatBuilder, *Nigel Calder is the author of* Boatowner's Mechanical and Electrical Manual *and other marine titles (including, earlier in his career,* Marine Diesel Engines*), and is a member of the American Boat & Yacht Council's Electrical Project Committee.*

PBB Resources

Gates V-belts and tension meters: gates.com

Heavy Duty V-Belt Drive Design Manual (Gates document #14995)

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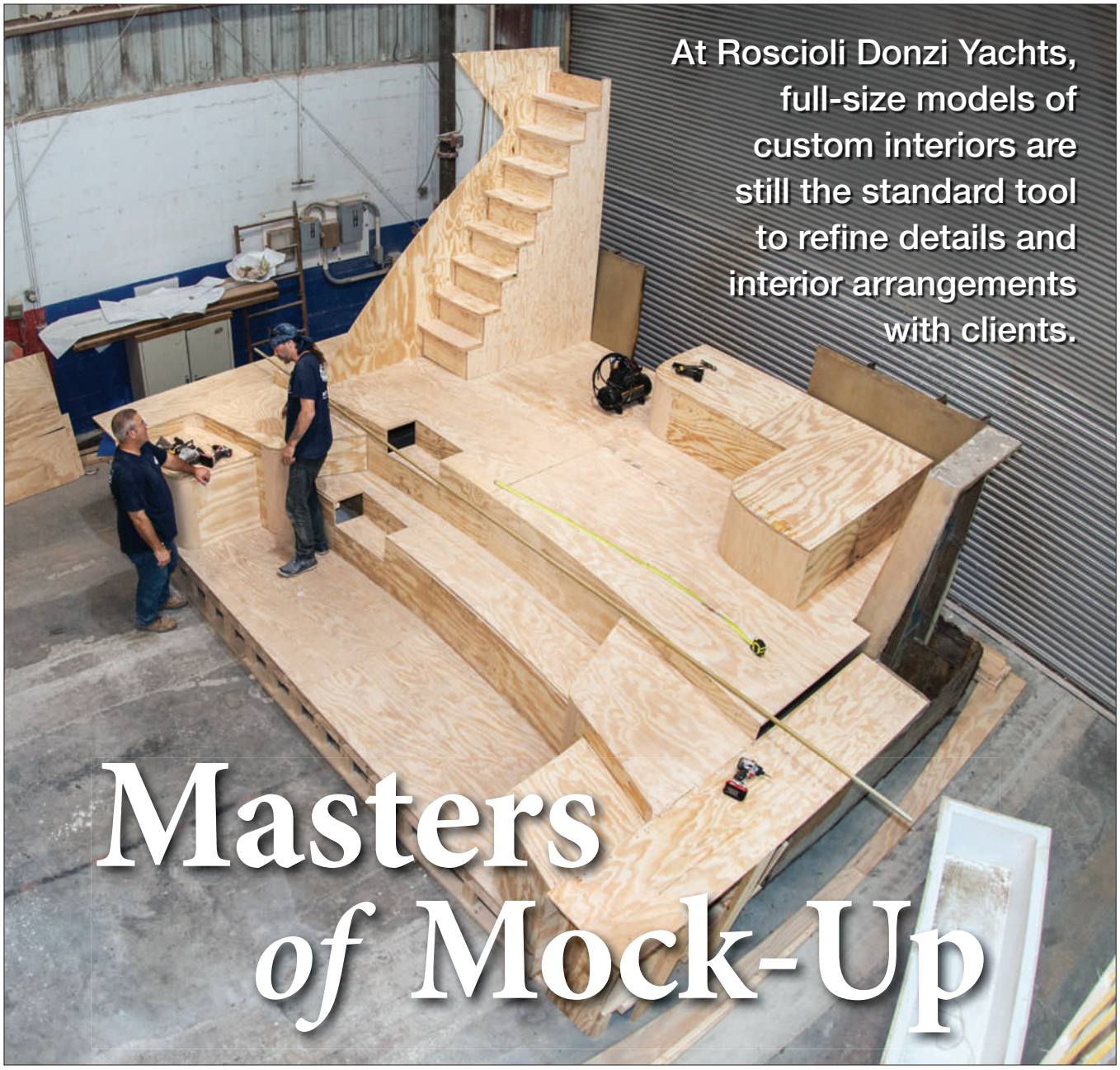


At Roscioli Donzi Yachts, full-size models of custom interiors are still the standard tool to refine details and interior arrangements with clients.

Masters *of* Mock-Up

Text and photographs by **Marilyn DeMartini**

Above—*A plywood mock-up of the after-deck and steps to the flying bridge on a Roscioli Donzi R-76 (23.16m) Sportfish takes shape in the company's Bradenton, Florida, shop.*

Bob Roscioli is an old-school builder who started working on boats as an apprentice in 1962, mostly scraping and painting bottoms in a South Florida boatyard. He liked the hard, often dirty work, but when he requested a 10-cent-an-hour pay raise he was laid off. His next move in the business was something of his own. Because he knew paint, mostly brushed enamel at the time, he began there and progressed rapidly, establishing himself as one of the premier marine coatings specialists in the country. Awlgrip and Alexseal sought out Roscioli to vet their new urethane-based products as the paints that previously had been used in aerospace applications were introduced to the marine industry.

As Roscioli diversified into all aspects of yacht service, repair, and refits, the 14-acre (5.67-hectare) Fort

Lauderdale facility on State Rd. 84 has built a reputation as a superlative traditional full-service yard. Today it comprises covered storage for yachts up to 150′ (45.7m), haul/launch capacity for boats up to 360 tons, and more than 100 employees—carpenters, electricians, welders, fabricators, captains, painters, mechanics, sandblasters, interior designers, furniture makers, propulsion specialists, and project managers.

While much of his career has been focused on his service yard, Roscioli also builds new boats that bear his name. That change came about in the mid-1980s as the service yard prospered and the opportunity to be a dealer for the Donzi 65 (19.8m) arose. "I never saw a boat like it," he says of the 65′ sportfisherman. "It was 25 years ahead of its time." Seven months later, he bought the "yacht" division of Donzi Marine, adding his name to the iconic brand, and has since built more than 74 boats ranging from 54′ to 82′ (16.5m to 25m), mostly from the Roscioli boat factory in Bradenton, Florida. (Note that Donzi Marine continues to thrive building their iconic smaller high-performance boats in Washington, North Carolina.)

Just as linear polyurethane (LPU) paint has replaced enamel in Roscioli's coatings work, fiberglass, vinylester resins, and foam-core construction have replaced wood in most aspects of boatbuilding, but at 73, Roscioli still uses wood in one specific aspect of Roscioli Donzi Yacht construction—building custom interiors. I visited the Roscioli Yacht Center and the Bradenton shop in 2019 to see how persisting in that material and this practice enables the development of interior arrangements to better fit customers' individual needs.

The carpentry shop at the Roscioli Yacht Center in Fort Lauderdale houses detailed mock-ups of interior accommodations as well as cabinetry for the finished boats.

In the Yard

As I walk through the Yacht Center, multiple vessels in capacious covered work bays are being painted and refit; metal shops turn out custom-fabricated components; there's a buzz in the air; and an image of Rosie the Riveter, emblazoned on the top of the 351-ton mobile lift, appears to survey the yard. In the carpentry shops, life-sized models of yacht interiors rise from floor to ceiling, providing an inside look at the still malleable spaces of Roscioli Donzi's newest models: an R-76 (23.16m) Convertible Sportfish and an R-76 Med.

Both these new yachts are being built for existing Roscioli Donzi clients. One has an 80′ (24.38m) Sportfish and wanted a day cruiser or adventure boat to add to his fleet, hence his new Med model. Not a traditional fishing boat, it has no cockpit but rather a walkaround with a flybridge that doubles as an entertainment, dining, and lounge platform surrounding the helm station.

The other client, Bud Koch, a consummate fisherman, is upsizing from his 58′ (17.68) express, *Classic Coke*, to the 76 Sportfish so he, his wife, and his frequent fishing buddies have the option of adding a professional captain on their trips. While a manager oversees details of the Med project, Koch is a hands-on guy who enjoys the process of a build as much as the finished product. During my visit he talked about his boating experience and reasons for his second Roscioli Donzi as we walked the shop looking at his new boat with Roscioli himself.

Repeat client Bud Koch is a hands-on participant in planning the custom interior of his R-76, Classic Coke.

Crews build the foam-cored infused FRP hulls of the R-76 in Bradenton.

Koch first worked with Roscioli several years ago when he owned a 45′ (13.7m) Spencer sportfisherman but was looking for something a little faster. He met Roscioli at a boat show where the company was showcasing its 73′ (22.25m) Sportfish. Asked if he could build Koch an Express, Roscioli said he could and took the 6′5″ Koch and his 6′7″ son fishing. They liked the boat's speed and were impressed by its performance, even in the rough weather and sea conditions they encountered.

As a result, the two men struck a deal for a new 58′ Sport Cruise. During that first project, Roscioli found Koch to be a discerning client who wanted to be involved in the build. With mutual respect intact, the two created the boat that is now for sale as Koch awaits delivery of his new 76—yet another *Classic Coke*. "I guess we're not very creative," says Koch. He's had nearly a dozen boats with the same name.

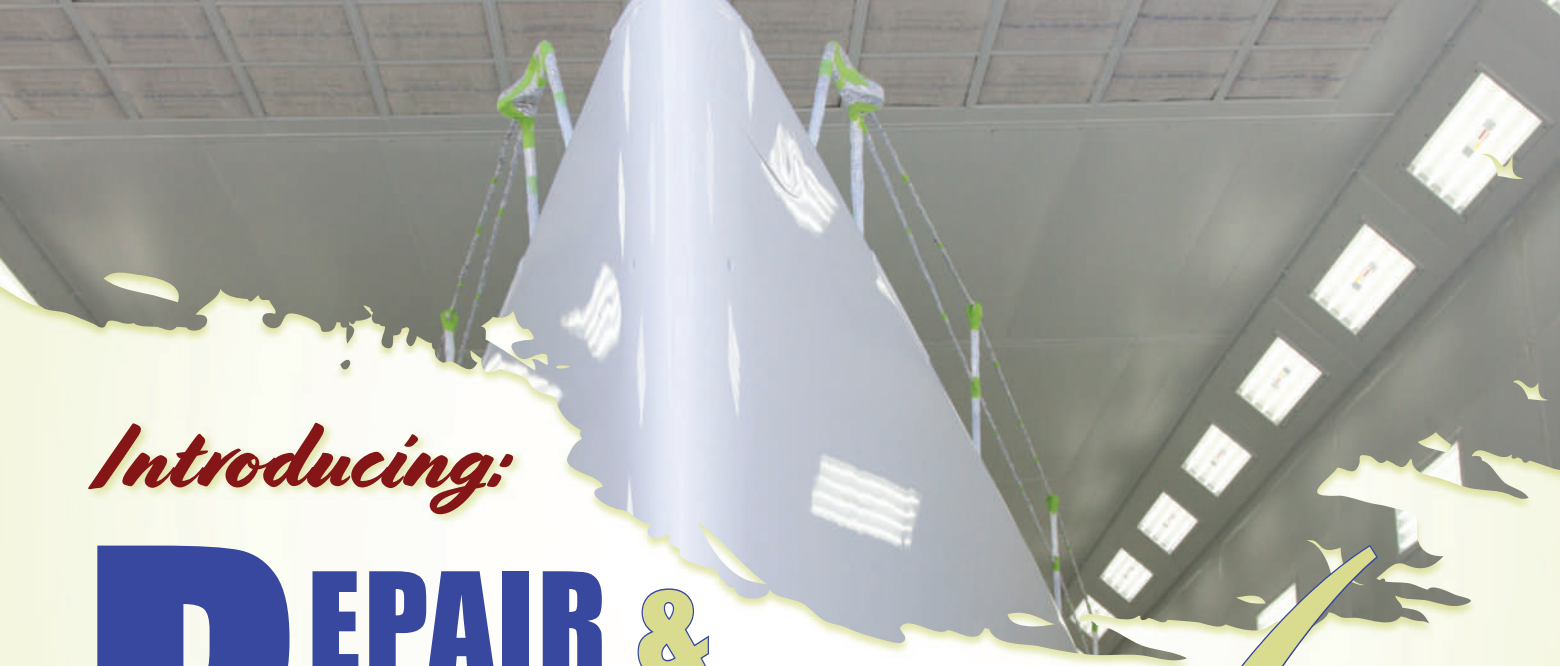
Customized by Customers

Bob Roscioli starts each day by reciting his mantra, "Today's the day!" and then walks the entire shipyard, providing general advice, specific direction, close supervision, or maybe just an encouraging "Atta boy!" He's a sort of Vince Lombardi of boatbuilders, coaching, enabling, and giving everyone from ex-cons to green apprentices chances to prove themselves and work successfully outside their previous comfort zones. The payoff for that management style is clear when we meet Shawn Schmoll, who started years ago as a 19-year-old "yard dog" doing manual labor, just as Roscioli did. He worked his way up to plant manager, a complex and demanding job that keeps him on the road between the Bradenton factory and the Fort Lauderdale yard.

As the customer liaison, Schmoll regularly walks through the plywood mock-ups with the carpenters and clients as they plan the custom interiors of their new boats. He emphasizes that there are no "options" in layouts at Roscioli: each boat is totally custom-built to the buyer's specifications, with every detail negotiated between the builder and client. Schmoll says he finds that customers like being a part of the build, and they gain perspective as they see the flow of the space—its potential and limitations.

As an example, he points out the rod storage holder incorporated into the dash of Koch's 58-footer. Being tall, Koch wanted a dash on the inside helm high enough for comfort, but he also wanted a clean appearance with a minimum of technological clutter. While examining the plywood mock-up Koch, Schmoll, and Roscioli noted some extra space on the starboard side of the dash. Together, they came up with a unique solution: By extending

Bob Roscioli has been in the yacht business since the early 1960s; he still actively oversees all aspects of the company and has the last word on the details of every build.



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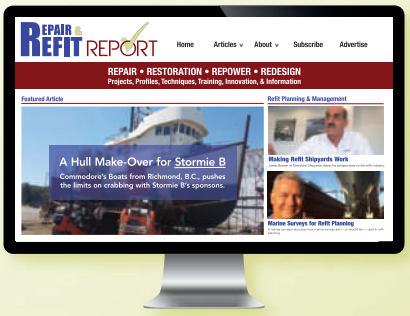

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Roscioli Standard Equipment

A few equipment specs stood out as I inspected the builds and viewed plans for the R-76 (23.15m) Convertible Sportfish and the R-76 Med—details that help set the boats apart from the rest of the sportfishing fleet.

Procurve Glass, installed by Advance Marine Glass, makes large wrap-around windshields and windows chemically treated to provide more tensile and flexible strength for wave force and impact resistance. The glass also has better visibility, and light and UV protection to reduce interior fading and deterioration. (For more on modern glass, see "See-Through Structure," PBB No. 174.)

The Von'Widmann Underwater Exhaust System uses technology that Roscioli found minimizes back-pressure and engine power drain, while maximizing fuel loads and range. Located in the bilge in otherwise unusable space, the exhaust system makes room for other equipment like a Seakeeper.

The Seatorque Bolt On Shaft System (BOSS) eliminates shaft-line noise and vibration. The full-length, nonrotating shaft casing and thrust-bearing assembly minimizes mechanical losses, enhancing propulsion power. The rubber-mounted connection is rugged with low underbody drag.

—Marilyn DeMartini

the dash a bit and opening it up with a hinged hatch, they could create a sturdy concealed storage space, ideal for 20-lb–50-lb fully rigged rods. That practical feature will be replicated in the new 76. The team also found additional space under the stairs to the flybridge for more stand-up rod storage.

"Plans are important," says Roscioli, "but you can't *feel* the space on paper." He compares the experience to building his home. "I didn't build anything until I walked the entire foundation and laid everything out—making sure that it was going to be where I wanted it." The same thing happens on each custom-built boat. "We can see how many drawers will be in each cabinet, where the fixtures will be. I want customers to give me ideas, and we'll do it—unless it's crazy and will mess up the boat." He'll collaborate, but Roscioli always maintains control over anything that bears his name.

Above—*This mock-up of the complex shape of a tiny head compartment includes a bucket for the toilet and marked clearance of a door that will swing open into the limited space.* ***Right—****Roscioli, carpentry foreman Hernan Jimenez, and Koch discuss the consistent shape and height of the interior doors for the finished boat.*

As we walked through Koch's new mock-up, I saw that even the toilets were laid out in detailed shape and proportions, with cutouts of a seat attached to a 5-gallon bucket to show the height and placement of each commode.

As the master carpentry foreman reviewed a pocket door with Koch, Roscioli got interested; a debate ensued. Koch wanted the pocket door between the head and the master suite, but Roscioli was against it. "Pocket doors are a pain—they rattle. They have to be locked to stop the rattling and then

unlocked. Think about it," Roscioli advised. After the carpenter showed Koch how a conventional door could be adjusted and explained how it could swing open into the head and still accommodate the heated towel bar his wife wanted, Koch agreed to the change. And then they went into an involved discussion of door shapes. Koch liked the rounded doorway shown in the entry to the master stateroom. As a group they decided *all* the doorways should be rounded, and although that design requires more craftsmanship and time, it enhances the boat and pleases the owner.

Similarly, radiused transitions, rather than sharp corners, are incorporated into the interior bulkheads and cabinetry. Koch likes windows and rounded corners to soften the passageways to the staterooms, and while the softer edges look good, they also require extra lamination to stand up to the high boat speeds and vertical accelerations. "We have boats out there for 30 years or more and they are still going strong," Roscioli says. "We build in durability."

Engines and Engineroom

Roscioli Donzi yachts are built on what Roscioli calls an "efficient and quick planing" hullform to handle the high horsepower and bottom loading the boats are subjected to. The infused cored fiberglass structure helps absorb variable loading at speed, while the wide chines and keel add stability for a seaworthy ride at all speeds. The twin Detroit Diesel MTU 16V2000, 2,600-hp engines in the 76 deliver a projected cruising speed of 38 knots and top out at 42+ knots. Running gear includes Aquamet 22 H.S. propeller shafts sized for a 5:1 safety factor. Each main strut is a single airfoil leg design, custom cast from 316 stainless steel and fitted with a Cutless bearing. Four-blade custom propellers are tuned to each vessel for maximum performance. The high-aspect-design spade rudders' lower bearing is housed in a custom bronze stuffing box, and the upper bearing is mounted on an aluminum stringer.

The enginerooms are simple by modern standards—open and spacious with keen attention to detail and easy access to equipment, pumps, and through-hulls. White urethane paint coats all surfaces, the engines, two 32-kW Kohler generators, and a customized space accommodating an expansive rack for the battery banks. Tanks of 2,500 gal (9,453.5 l) for fuel and 250 gal (946.4 l) for water will support Koch's long-distance cruising.

Another practical focus for Koch and the Roscioli crew is sound reduction. Boats equipped with large diesels and driven at high speeds in rough seas can be loud. Each Roscioli Donzi is

Interior components going into an R-76 in Bradenton include the spacious white-painted engineroom to the right, and the crew quarters fitted below the saloon sole on the left.

subjected to a 14-point build checklist created in consultation with noise-control experts Soundown. Included are linear exhaust sound barriers; vibration mounts securing all engines and generators, pumps, and blowers; sound blankets and vibration isolators in saloons; floors with a sound mat topped with sound-absorbing structural core; air-inlet boxes made with sound-absorbing material; and foam-filled-void areas.

Onboard electrical systems are designed to American Boat & Yacht Council (ABYC) standards. The custom main panel has an engraved Lexan face; all panel functions are wired to terminal strips; and posts are mounted in a full aluminum enclosure fitted with an independent fire-suppression system. Smoothly radiating wires are neatly bundled and secured.

Bridge and Cockpit Layout

Koch recalled how the plywood mock-up also helped determine the dimensions of the mezzanine on the new Sportfish, because the 76 has a lot of extra cockpit space. "I had guys sit on the mezzanine so I could see the height. They know I want to stand up, so there are two tiers to the mezzanine. They inserted 4′ [1.2m] steps that are steep enough for someone to sit on

and still give me headroom," he said.

On Koch's 58′ Sport Cruise, a custom starboard helm station had been added to increase visibility and flexibility for the captain. An ample overhang protects against weather and sun, and recessed LED lighting above adds night ambiance. At Koch's direction, these features will be replicated on his 76, and the flying bridge and aft helms will be fitted with joystick controls. On the flying bridge, the helm station will also have CZone control and monitoring that integrates all onboard electrical systems. Seating up there is ample, and amenities include a refrigerator, a freezer, and an icemaker.

Customized to accommodate Koch's fishing hobby, two refrigerated, insulated fish boxes and livewells are located on the afterdeck. They flank a fighting chair from Release Marine mounted to the reinforced deck structure that Roscioli engineered for safety and stability. Koch had specified pressurized livewells on his 58 to help preserve live bait. On the 76 he requested an additional pressurized 60-gal (227-l) livewell on the center transom, as well as a 500-lb/226.8-kg/day Eskimo icemaker.

After numerous walk-throughs and negotiations over detailed changes to the plywood mock-up, each interior and cockpit is custom-built by Roscioli's carpenters. Koch: "Bob [Roscioli] is influenced by the many megayachts in his yard, so he uses higher-quality finishes, hinges, and hatches you won't find on a competitor's sportfish. He does it right, so we avoid reworks." He also noted that because Roscioli likes to cook, "his galleys are great." Koch's 76 will include a dumbwaiter to the flying bridge, suggested by his wife and embraced as a challenge by the Roscioli team. "It is another example of working with the builder to brainstorm ideas to make things a little more unique and better," said Koch.

Accommodations

The final galley design also includes a curved bar counter with swivel stools, "not something you find in most sportfish. It's not conventional and has more style," Koch said.

Forward, the galley opens to saloon lounges and a portside C-lounge and dining table. It's hard to see in the mock-up, but the entire level benefits from curved windows providing a 360° view and natural light. Koch's custom cabinetry will be match-grain teak. A large-screen TV retracts into the cabinetry to starboard, and to fully open the aft deck, its door and window can retract into the engineroom below. There'll be a day head to port.

Steps to starboard lead belowdecks, where the full-beam 'midship master and forward VIP staterooms include en

suite heads and tall glass showers with flat floors. Koch laughed that he preferred a step-up shower but compromised with his wife on that one. A chilled-water air-conditioning system is channeled through high overhead soffits. A third guest cabin is located between the master and VIP staterooms. If additional guests are invited instead of a captain, the crew quarters below the saloon offer comfortable full-size bunk beds to port and starboard, with a mini-galley and head. Roscioli designed a retractable counter to cover the toilet for extra space and included room for a washer/dryer.

Koch will use his new *Classic Coke* much as he did the old one—summer on Lake Erie with jaunts to Mackinaw, Harbor Springs, New England, and Canada. Come winter, he'll bring the boat to South Florida—Ocean Reef, Key West, and the Bahamas, where his boats always get attention on the docks. Another attraction is the convenience of having the Roscioli yard just miles from his Fort Lauderdale home for storage, service, and hurricane protection when needed. "Even after the sale, Bob's service is second to none," he says. "He's good to work with." Roscioli basks in such comments, adding, "I like to build relationships, not just boats." PBB

About the Author: *Marilyn DeMartini has represented World Championship offshore racing teams such as Drambuie On Ice, Lucas Oil, Outerlimits, and Statement powerboats. She managed PR for Latham Marine and the Cigarette Racing Team for more than a decade. She has written for* Yachts International, Power Motor Yacht, Soundings, Boat International, Passage Maker, *and* Guy Harvey Magazine *as well as* Professional BoatBuilder.

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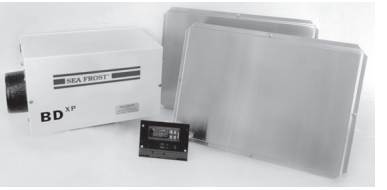

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by Steve D'Antonio

Can you be released from the burden of professional responsibility?

Years ago while I operated my own marine electrical and mechanical service business, a boat owner asked me to install a radar antenna on the cabintop of his sailboat, which had an unstayed rig. Understandably, he was unwilling to drill holes in the spar to fit a conventional radar bracket. However, the on-deck installation he proposed would have placed the radar's beam at eye level for those in the cockpit, and eyes are very sensitive to electromagnetic radiation. While researching, I found a passage in an FCC engineering document that summed up my concern: "Two areas of the body, the eyes and the testes, are known to be particularly vulnerable to heating by RF energy because of the relative lack of available blood flow to dissipate the excessive heat load (blood circulation is one of the body's major mechanisms for coping with excessive heat)." That sounded serious, and because it was before the Internet, it was all I had to go on. In hindsight, my concern for such exposure to a small, civilian-grade radar may have been overly cautious, but there was something else: The proposed location was a clear violation of the radar manufacturer's installation guidelines. Also, I was sure that such a low mount would cause the radar to perform poorly.

I was young, hungry, and needed the work, but I explained to the owner that the installation was wrong and shared the section in the manual prohibiting the location he proposed. He was a retired New York City executive, a private pilot, and a member of the yacht club where I was a contractor. Who was I to tell him what he could and couldn't do on his own boat? He listened, and then had a hold harmless agreement drawn up, which he signed and gave to me. He even had the club commodore pressure me to proceed.

My brother, an attorney who specializes in insurance litigation, reviewed the document. He said, "This is essentially worthless. As a professional, you can't knowingly allow a layperson to sign away their safety, and then expect to not be held accountable if there is an injury, or loss of property or life." I reluctantly refused to carry out the installation, proposing instead a stern-mounted mast option. He declined and found someone else to install the radar.

Professional responsibility often comes up with industry clients I consult for and in lectures I deliver. "You are the professional," I explain. "You are expected to know better. You have to say no when something is wrong, regardless of what the customer is willing to accept. In the eyes of the law, you have a duty to put safety over profit, no matter what kind of release a customer is willing to sign."

While a hold harmless agreement may apply to an individual customer, it won't apply to the next owner of the vessel, who someday may still hold you liable for an installation you knew, or should have known, was incorrect, unsafe, or unreliable.

Imagine the following exchange that starts with you on a witness stand saying: "I knew the ABYC Standards prohibited this, but I did it anyway because the owner signed a hold harmless agreement when he asked me to install a non-GFCI receptacle on his hot tub because it kept tripping." The prosecutor interjects, "And if you didn't do what he wanted, he might not have hired you. Correct?" "Yes." "And how much did you get paid for this modification?" "$106.29." "So you sacrificed your customer's safety, and life in this case, for the equivalent of dinner for two at a nice restaurant. Is that right?"

Your legal peril is obvious, and morally you are on thin ice.

At best, hold harmless agreements provide limited protection, especially if the wording is vague. At the least, they must include a detailed fair assessment of the potential risk—"this could lead to electrocution, injury, and death"—so the signer understands what he or she is agreeing to. It can't simply say you are "absolved of all responsibility." Furthermore, if you initiate a hold harmless agreement, it could be viewed as an intentional act and an admission that you are knowingly subjecting someone to risk of harm. That's the difference between gross, rather than ordinary, negligence in most jurisdictions, the former likely leaving you subject to punitive damages.

In some states anti-indemnity laws limit or prohibit hold harmless agreements and clauses, particularly in certain professions or under specific circumstances. A host of caveats could apply to a hold harmless agreement, so unless you've paid an attorney well versed in this law to review what you've prepared or been asked to sign, there's a distinct possibility that it can be invalidated.

Amateurs and uninformed do-it-yourselfers can make foolish mistakes and often can't be held responsible, at least not legally. Their failing is usually referred to as incompetence. On the other hand, if professionals commit such errors, their failing is most accurately categorized as negligence, and waivers or hold harmless agreements rarely absolve them of responsibility.

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About the Author: *A former full-service yard manager, Steve works with boatbuilders and owners and others in the industry as Steve D'Antonio Marine Consulting. An ABYC-certified Master Technician, he sits on that organization's Hull and Piping and Engine and Powertrain Project Technical Committees, and is also* Professional BoatBuilder*'s technical editor.*

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