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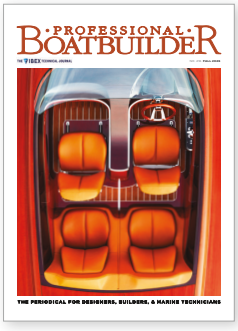

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FROM THE EDITOR

A Long Game

In the past two decades, development timelines for new products have shrunk by about 30% to 50% across manufacturing and tech, depending on the industry. Compressed design, engineering, and production cycles, largely enabled by computer modeling, easy prototyping, and artificial intelligence, have come to define the expectations and demands for automotive, software, and consumer electronics companies. Mercifully, this trend doesn't hold true for most boatbuilders. Sure, there are some high-volume production brands driven to innovate quickly and snag a dominant share of some emerging market trend, but most successful custom, semicustom, and low-volume boatbuilders still play a long game. The cover of this issue—the cockpit of *Victoria Z*, a 35' (10.6m) Michael Peters-designed stepped-V ventilated tunnel model built by Van Dam Custom Boats in 2025—is a testament to the success that can be found in carefully developing one-off boats at a deliberate pace.

My February visit to Van Dam's Boyne City, Michigan, shop was a reminder that some of the finest and fastest pleasure boats being built in 2026 cannot be fast tracked (page 52). Indeed, part of what makes them so valuable for owners is the opportunity to consult on every structural and aesthetic detail and to make the essence of the vessel unique to their taste and preferences. That's not standard operating procedure at leading brands in other sectors. Imagine the response to buyer requests for changes in structure, materials, or form made to BMW or Apple.

Lest you think the long game is only for the top percentile, read on. In Rovings (page 6), Nigel Irens delivers details about the multi-year, on-water refinement of his 26' 3" (8m) outboard powered launch *Clara*. While the goal is an efficiently and faithfully reproducible boat for ordinary people, Irens has subjected himself and his partner, Zoe, to hundreds of miles of camp cruising since 2022 to make sure *Clara* performs optimally. Hardly a truncated development schedule.

In Wendy Mitman Clarke's profile of Danish production builder of trimarans, Dragonfly (page 28), second-generation builder Jens Quorning explains the importance of constantly developing new products, but doing so slowly and deliberately so as not to imperil their successful but intentionally modest company.

Then there's *Capt. Nat's New Boat: A Treatise Imagining the Next Development in Wood Boatbuilding—the Stringer-Built Boat*, the latest book from sailor, builder, and designer Alfie Sanford (review page 64). It's a distillation of Sanford's nearly 50 years of experience on the water and in multiple boat shops into a modern technique for consistent and efficient construction of wood/epoxy boats enabled by his focus on process, sequence, CAD design, and CNC-cut parts.

For an industry often obsessed with maximizing speed on the water and efficiency of operation and production, boatbuilding is consistently conservative in its embrace of new technology. Perhaps it's the slim margins that haunt most industry business plans and a shared adversity to risk that forces us all to play a long game. Whatever the cause, I hope you'll embrace some of the hard-won industry wisdom accumulated in these pages and join us in person for technical education and discussions at IBEX (Oct. 6-8 in Tampa) and Metstrade (Nov. 17-19 in Amsterdam).

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LETTERS, ETC.

To the Editor:

Steve D'Antonio's article on navigation lights is spot on ("Lights in the Darkness," *Professional BoatBuilder,* No. 215, page 18). When I was working in the U.S. Coast Guard Office of Boating Safety, we made a point of visiting major boat shows. The most frequent violations of the federal regulations? Hull identification numbers, and a close second, navigation lights. We could look down a row of boats and almost always spot at least one that had the lenses in the red and green combo lights reversed. Obstructed lights were the most common failure, especially on boats under 20 feet. Put up a bimini or awning and the all-around light on the stern is obstructed. On bigger yachts and houseboats, equipment typically mounted on the cabintop obstructs lights. On many yachts and houseboats, the side lights are mounted under overhangs, so that when the yacht is heeling or rocking, lights are obstructed. One I saw had canvas decorative fringes under the overhang that completely covered the lights. My pet peeve is bullseye lights mounted below the gunwale on small powerboats. There is no way these can meet the cut-off angles of the red and green side lights. Now, the rules have been amended to essentially ban them. There are several pages on my website, newboatbuilders.com, devoted to navigation lights and what builders do wrong when installing them.

Peter D. Eikenberry Sr.
Seattle, Washington

To the Editor:

I was interested to read Reuel Parker's article about building birdsmouth spars ("New Masts for Reef Chief," *Professional BoatBuilder,* No. 213, page 46). In it, he mentions the difficulty of closing off the last staves because they want to fall into the cavity. My answer to that problem is to include solid sections in the mast, which make it a lot easier to assemble.

For structural reasons, I locate solid sections at all load points to resist compression loads that could deform the spar, even when the load is applied via a strop or soft eye and thumb cleats. My masts are solid at the step, gooseneck, cap, hounds, and anywhere else that load is applied. The side benefit is that the solid cores support the last three staves that go in on the top, preventing them from falling inward.

This method also allows the solid section at the tapered top of the mast to be properly shaped to fill the tapered void, rather than trying to fill it from the open top later.

I detailed birdsmouth spars for my Cape Cutter 19 and all its later, bigger siblings. All the boats of this lineage that were built in Cape Town had those hollow spars and were easily rigged by one or two people.

I also detailed birdsmouth mast options with modern aerodynamic shapes for some of my more modern designs, like the Didi 26 and its bigger sisters.

Dudley Dix
Virginia Beach, Virginia

With plumb bow, fine entry, and sharp trailing edge of her transom, Clara *leaves a barely perceptible wake and can efficiently cruise at 10-12 knots.*

Nigel Irens' Build-Anywhere Low-Impact Motor Launch

I first caught wind of U.K.-based yacht designer Nigel Irens' fascination with efficient powerboat design in the late aughts when, in the middle of our discussion of cutting-edge sailing multihulls, he confessed a desire to apply his hard-won and sophisticated knowledge of efficient hullforms to improve powerboat performance and reduce fuel consumption. Since then, he has persisted, developing a series of what he calls low displacement/length ratio (LDL) models powered by inboard diesel, electric motor, or small gas-powered outboard—a sideline to his larger, more renowned offshore sailboats (see "Built for the Crew" on page 20).

One of the largest and earliest of the series is the 63' (19.2m) cruiser *Molly Bán* launched in 2008 in Denmark. Powered by a single 300hp diesel and carrying a nearly 15' (4.6m) beam, this custom model, along with the production-built 39' (12m) Rangeboat, provided Irens early proof that LDL boats could defy conventional laws of displacement hull speed. *Molly Bán*, he says, is run most at 10 knots using just 50hp. As he refined his hullform and construction methods in subsequent years, the boats got smaller and proportionally leaner—*Greta*, *Aoife Nile*, *Wilhelmina*—all inboard, diesel-powered, wood-epoxy launches. (For more on those boats, see "Slippery When Wet" in *Professional Boatbuilder* No. 187, page 68.)

In 2022, he built *Clara*, the first in a series of 26' 3" (8m) open launches designed for outboard power. With a beam of just 6' 6" (1.98m) and an exceptionally fine entry, the 1,825-pound (827.8-kg) displacement boat made 12 knots with a 20hp outboard during sea trials. Constructed of high-quality CNC-cut plywood and epoxy, it's the basic powerboat he's stuck with since then, building four of them between 2021 and 2024, always refining details and the build process.

In 2023, Irens and his partner, Zoe, took the original *Clara* on a 100-nautical-mile passage from Dartmouth to Southampton, making 10 knots in fair conditions for a 10-hour passage. In 2025, they undertook a more ambitious trip of 185 nm total from Dartmouth to Helford River with a meandering route back, visiting friends on other boats and camp cruising under the generous canvas shelter that covers the forward end of the boat. This July he reported, "We recently returned from a cruise in *Clara*. The first transit was from Dartmouth to the Isle of Wight—90 nm. In our eight-day tour, with a total of 254 nm with five stops visiting friends, we cruised at our usual 10 knots most of the time and used 125 liters (33 gallons) of petrol."

On those trips, he also confirmed that a 30hp outboard running at 3,500 rpm (much less than full throttle) makes for a quieter ride than a 20hp model turning at high rpms. And while one of the four new boats was fitted with quiet electric power at the owner's request, a standard outboard remains Irens' choice, as it can accommodate the long passages he has shown the seaworthy, super-efficient model is well suited to.

Clara's on-water performance is visibly different from that of a standard modern powerboat. Her axe-like plumb bow does not rise as speed increases, and the sharp trailing edge of her transom separates cleanly from the water and leaves an almost imperceptible wake. Irens explains the difference as one of design intention.

Nigel Irens and his partner, Zoe, have been cruising the original Clara *for several seasons in a kind of long-term sea trial and information-gathering holiday.*

PHOTOS COURTESY NIGEL IRENS

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"In a nutshell, almost all motorboats will have been designed on the assumption that people want to go as fast as possible…I think standard planing-hull boats and what we call LDL boats are two very different things, with very different objectives," he says.

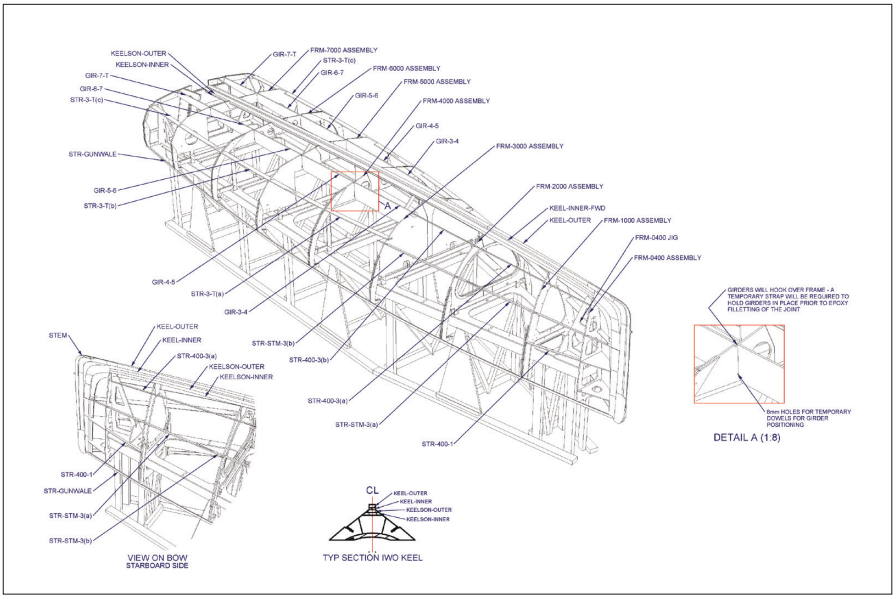
Irens also designed the boat to minimize storage and mooring expenses.

"'Freedom' is the word," he says. "Keeping a *Clara* in your garden (or maybe a farmer's barn) saves having to pay for a mooring. More importantly yet is that keeping a boat on a mooring will always invite deterioration, above water and below. It's also great to have the boat under cover and yet ready to go, so that when the forecast is good, the boat will be ready to be trailed anywhere."

Clara can be towed easily behind a moderately sized car. And when it is afloat, the boat requires just 14" of water, well clear of expensive deep-water slips or moorings.

Irens' thoughtful design evolution has been toward an efficient and sustainable vessel for boaters of modest means to be on the water even in uncertain economic times. It's also intended to be affordable to build especially for those who have time and skill to build it themselves.

Irens says hull material is as important as the hullform when he considers the efficiencies of his *Clara* model. Shipping boats of this size to customers in other countries and continents "is a waste of money," he says. That's especially true when the optimized CNC cutting files comprising some 750 build components needed to build a *Clara* can be sent anywhere via the internet. The boat can then be built by an adequately skilled client (or for the less-skilled client, by a local professional builder) using locally sourced materials.



The* Clara *boat is designed to be easily built by a skilled amateur or a professional assembling 750 CNC cut components.

The project will consume 54 sheets of plywood of five different thicknesses; solid hardwood like oak for trim and blocking; 25kg of epoxy; various paint, caulk, and hardware; the engine; and a well-appointed shop to assemble it all in. That might be a bit daunting if the refined CNC cutting files didn't make the assembly very straightforward.

Irens says he originally had doubts about how accessible the build process would be as he worked with builders on the first boats. It took a very successful build by a German boatbuilder, with whom he never communicated directly, to satisfy Irens that with optimized files and clear documentation he could safely send his kits into the world, and they would be built accurately and as he intended.

What he intends is a slight but essential shift in what a small pleasure boat can be, a shift that can meet the needs of ordinary boaters as fuel prices and wealth disparity increase. *Clara* is his answer to what recreational boating for most of us might look like in 2027. It's a model that harks back to the simple small family outboard boats that dominated the market of the 1950s and '60s, only far more efficient and seakindly.

While he's satisfied that the current *Clara* design is ready for prime time, Irens says he is not intending to produce kits at volume or to deliver the support to builders he knows will be likely to need it. To that end, he is looking for boatbuilders and CNC cutters in likely market areas around the world to work in partnership delivering *Clara* to the boating public. He says he and his build colleagues intend to tread lightly in the first months of this endeavor, so there may only be a handful of boats built in the coming year. Interested?

Nigel Irens Design Ltd., Sparkwell Cottage, Totnes, Devon TQ9 6AW, U.K., claraboat.co.uk

—Aaron Porter

With his* Clara *boat design, Irens is encouraging a return to an affordable, manageable recreational powerboat to allow more people to enjoy the water.

PHOTOS COURTESY NIGEL IRENS

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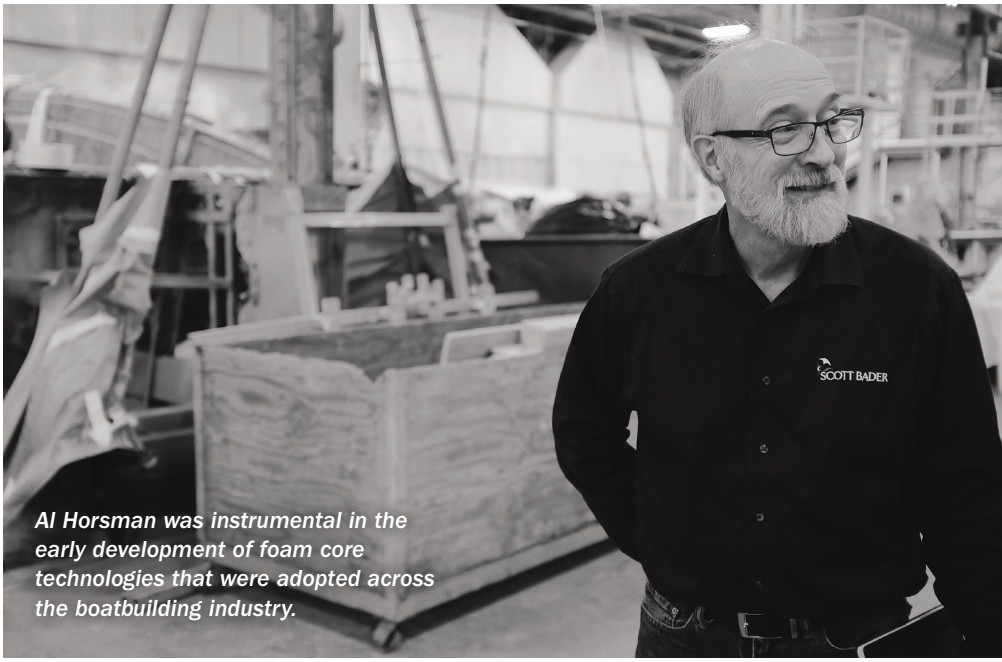
Al Horsmon, Engineer, Composites Expert, and Naval Architect, Dies at 71



Al Horsman was instrumental in the early development of foam core technologies that were adopted across the boatbuilding industry.

Albert W. Horsmon Jr. was known as Al to his classmates and colleagues, and Lieutenant Commander to his shipmates. His family and dear friends called him Bucky. And the words they use to describe the engineer who helped define and advance composite boatbuilding as we know it today paint a picture of a man who was admired for his visionary brilliance, loved for his generosity as a mentor, and who "lived his life with a contagious zest."

"Al influenced so many people and their lives without asking for anything in return," says Jef Benkelman, his longtime colleague. "He was a teacher and steadfast companion."

Horsmon died in February, age 71, at his home in Three Rivers, Michigan, due to complications from brain surgery.

He earned his marine engineering bachelor's degree from the U.S. Coast Guard Academy and dual masters' degrees in naval architecture and mechanical engineering from the University of Michigan, where he met and married Christine, his wife of 42 years. After his Coast Guard tours, during which he served active duty on the 269' (82m) USCG icebreaker *Westwind*, he transitioned to a robust career specializing in the advantages of composites in ship and boat construction. In the early 1990s and throughout his career, he published peer-reviewed papers and made groundbreaking presentations to the U.S. Navy Shipbuilding Program, the Society of Naval Architects and Marine Engineers (SNAME) journals, and the World Maritime Technology Conference.

Along the way, he found kindred spirits and forged deep friendships in the emerging world of composite-sandwich boatbuilding, beginning with Tom Johannsen (1933-2021). Johannsen introduced composite boatbuilding technology to North America as the distributor of Airex, the first foam-core material to hit the market. He engaged Horsmon, Jef Benkelman, and eventually Rob Mazza to help him explain the advantages to forward-thinking builders and to guide them in the processes of working with the material. Benkelman came from a boating family and plastics fabrication background with experience in injection molding and production. Mazza was the bonding expert with plenty of yacht design and boatbuilding experience at C&C and Hunter Yachts. Horsmon was the essential engineer.

Airex eventually changed distributors to reach broader applications, and Johannsen pivoted to develop Core-Cell, a styrene acrylonitrile (SAN)-based foam as an improvement on PVC-based material. He changed the company name to ATC. The *Core-Cell Design Manual*, largely written by Horsmon, Benkelman, and Mazza, quickly turned up in cutting-edge racing sailboat and speedboat shops. As the technology spread to other applications such as wind generator blades, aeronautics, race cars, and you-name-it, major international corporations came calling.

In the early 2000s, SP Systems, Gurit, and Scott Bader acquired elements of the ATC business, and all along, Horsmon remained the essential engineer—analyzing the loads, specifying the core thicknesses and densities, mapping out the layups and fabric orientation, the resin choices, and the lamination methods. He was on staff with every iteration of the laminated foam-core business and worked as an independent consultant—Horsmon & Associates. In 2025, he received the *SNAME Fellow* honorific, which is "exclusively accorded to those who have made outstanding personal contributions to naval architecture, marine or ocean engineering, or allied disciplines through achievements in design, research, production, operation, education, or associated management."

In this space, it's not possible to gather the full breadth and depth of Horsmon's impact on modern boatbuilding and the makers, visionaries, and colleagues he influenced and supported. He took lead positions from the smallest to the greatest projects including *America*'s Cup boats, the 155' (47.2m) cored-FRP yacht *Roxana* (still the largest ever), and countless others around the world. Most recently, he engineered the structural components of the Lou Codega-designed, 55' (16.7m), 55-knot, carbon fiber-on-foam boat built in Maryland by Composite Yacht, which may be the fastest inboard-powered sportfishing boat ever built.

Lewis Hardy at Composite says simply, "Al kept us out of trouble for 25 years. He wrote the book and set the standard."

Benkelman was joined at the hip with Horsmon through countless projects. "I was the process guy working with the builders and suppliers on how to execute the plans that Al engineered," he says.

PHOTO COURTESY HORSMON FAMILY

"Al did the math. We shared a passion for these projects and the people who take them on, and as a result, we never worked a day."

Lou Codega: "Al was always involved in my projects when they were unique. He was the consummate professional—careful, attentive to detail, but willing to push boundaries when needed and justified. We spent long hours talking about shipbuilding history and the influence of the navy and shipping on the world. I mostly listened, as his knowledge was far greater than mine."

Reid Bandy, who owns Bandy Boats in Edgewater, Maryland, first met Horsmon at IBEX in 2008. "Al was always surrounded by people," he says. "Over the years, he answered all of my calls, and he was the window to everything. He was the keeper of knowledge, and he guided me through to achieve my God-given potential."

Renowned hydrodynamics expert Brant Savander of Maritime Research LLC, was Horsmon's grad school classmate. They collaborated on shipyard design and production and remained close friends and colleagues. "We worked together on countless projects, where I would design something slippery with all kinds of shapes, and Bucky would make sure we were light and structurally sound," Savander says. "Working with him was effortless. He was highly competent, and he always looked for a cost-effective solution for the builders and wove all of those traits together with a fun personality. His lighthearted humor put everyone at ease, especially when under time and budget pressure, as always. He was one of the good guys."

Pursuit Boats VP of Engineering Molly Ditzler met Horsmon in 2006 when she was studying naval architecture at the University of Michigan. "Bucky was an incredible mentor to all of us SNAME students," she says. "When I graduated, he hired me, but the role he truly filled was mentor and friend. He led with patience, kindness, and humor, and taught me how to lead with character. He lived with contagious zest and never took himself too seriously. His influence is woven into every milestone of my life, and his guidance will be deeply missed."

—Joe Evans

PHOTO ROB MAZZA

Jef Benkelmen (left) and Al Horsmon (right) collaborated with Rob Mazza and Tom Johannsen advancing foam core knowledge and technical skills for builders.

A custom console door replacement from Boat Outfitters is sized to fit the existing opening and can be spec'd to match the fastener patterns.

Outsourcing Custom Parts from Boat Outfitters

Maintaining a skilled workforce and a shop with tools and materials to match a modern boatyard's diverse demands is one of the constant challenges for a boatbuilder or service yard in 2026. Time was when a basic wood shop, mechanic's shop, composites space, and paint booth staffed by a crew with experience in all those areas was enough. What's changed dramatically in the last two decades is the range and complexity of technologies a boatyard encounters. While there's no substitute for technical skill and experience when troubleshooting a CAN bus system or repairing a carbon/Nomex laminate, yard managers have learned that with a bit of judicious outsourcing, more pedestrian repair and refit projects can be executed with minimal shop or labor hours.

A 2019 visit to Teak Isle (Ocoee, Florida) opened my eyes to the efficiencies that more than 200 boatbuilders were able to realize by outsourcing fussy parts like doors, hatches, dashboards, drawers, tables, shelves, brackets, latches, and more in high-density polyethylene, acrylic, foam PVC board, Corian, Sparalloy, and powder-coated aluminum. Major production builders like Regulator, Hinckley, Hunt, Scout, and Whaler saw the advantage of not needing to keep the tools, space, skills, and materials to build these small parts in house. And Teak Isle had optimized on-demand production of those parts to the point that they had a full-time engineering team (it has grown to 22 in 2026) and were consuming 3.5 million pounds of King Starboard annually.

With thousands of parts already in the design files for all those builders and new ones being produced every day, at some point the distinction between custom and production projects became burry. Teak Isle principals, brothers Pat and Dave Brown, started their online retail platform Boat Outfitters in 2012 when they realized the team at Teak Isle that focused on production builders could just as easily make parts for boat owners and repairers.

When I visited the facility again in March with the IBEX planning team, I noted significant changes to Boat Outfitters from the program I'd seen seven years before. Andrew Brown, who remains at the helm of Outfitters while his father, Pat, and uncle, Dave, run the rest of Teak Isle, walked me through them. The subsidiary now occupies its own building on the Teak Isle campus and has its own bank of CNC routers where panels are cut to shape and size. They're then sent on to processing and assembly crews who finish edges and corners, drill countersinks, and assemble parts for more complex orders before all products are boxed and shipped. A lot of the custom orders are flat pieces cut to size and shape for specific tasks like transom repairs, or door kits, filleting tables, dash panels, and rod holders that ship relatively flat.

Andrew explained that while the more time intensive program of delivering assemblies based on specific dimensions and descriptions from clients remains its core offering, Boat Outfitters has really become an e-commerce site where you can purchase original dimension replacement boat parts made on site to specifications from more than 70 production brands. Looking for a Boston Whaler 330 Outrage console door or a livewell lid for a Mako 236 CC? You can order them on the site, and the dimensions are already on file.

In addition to the parts they make in house, Boat Outfitters is also a source for boat-specific hardware and fasteners, as well as general boatbuilding needs such as electrical system components, epoxy, misting systems, trim tabs, fasteners, gas shocks, and more.

To manage the increasingly complex in-house stock, the new building is equipped with a Kardex Remstar vertical lift module for efficient storage and easy access to parts and hardware on the shop floor. Dave Brown demonstrated how the thousands of parts are called up automatically as orders are processed. A crewmember then picks the correct fitting or fastener to add to the package.

While the site isn't exactly a full chandlery yet, more products are being added all the time. "We're developing relationships outside with vendors who can supply this stuff," Dave said.

Pat Bray explains the efficient CNC production process for custom components at Boat Outfitters to IBEX Director Mary Velline.

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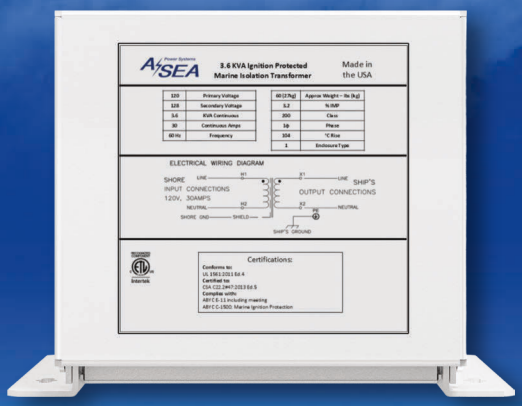

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In addition to the boatowners and DIY demographic the site was created for, Boat Outfitters currently serves more than 1,000 business accounts, ranging from large service yards to independent boat repair and maintenance professionals. The most common orders are for replacement doors and storage cabinet upgrades—the stuff Teak Isle has been doing more efficiently than the custom builders they serve for decades now. Industry professionals and dealers who use the service regularly can enroll in an Boat Outfitters Pro account and get a 20% discount on standard Outfitter pricing.

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—Aaron Porter

Boat Outfitter's Kardex Remstar vertical lift module can automatically select and deliver thousands of different parts to project assembly crews as they fulfill custom orders.

PHOTO AARON PORTER

CLARA – Entering Plymouth Sound, during winter trials off the Southwest coast of the UK

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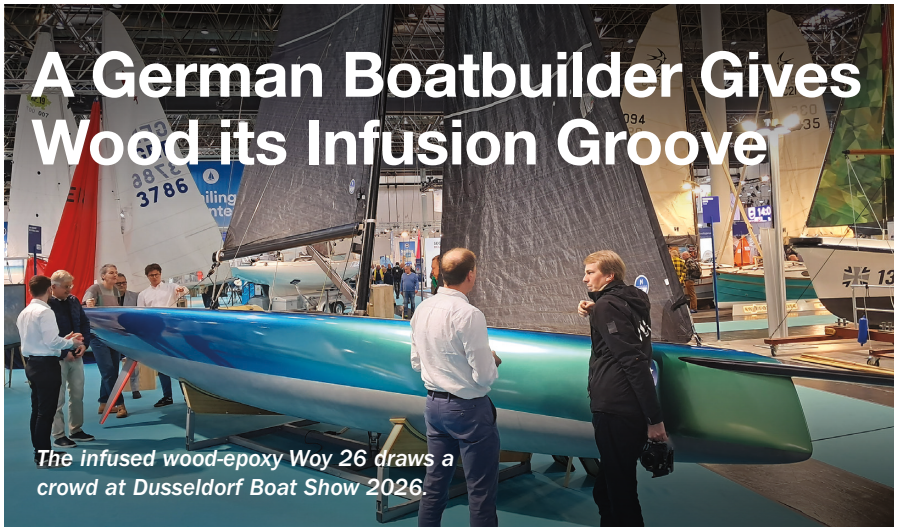
A German Boatbuilder Gives Wood its Infusion Groove



The infused wood-epoxy Woy 26 draws a crowd at Dusseldorf Boat Show 2026.

Amid the palatial multihulls, luxurious sailing yachts, and bluewater cruisers vying for the 2026 European Yacht of the Year (EYOTY) awards, one contender seemed to defy the trends and the odds—German boatbuilder Jan Brügge's Woy 26 daysailer. At just 8m (26'), made of locally grown woods and built using a new wood-infusion process, the hot little rocket designed by Martin Menzner was "one of the most admired and coveted boats by the jury," Alberto Mariotti, one of the judges, wrote in *Superyacht24*. "This newcomer has a strong sustainable soul that integrates perfectly with its technological one."

"Who would have thought there was still room for evolution in wooden construction?" said judge Marinus van Sijdenborgh de Jong. "The Woy shipyard decided to take cold-molding to the next level, perfecting it with a sophisticated vacuum infusion process."

"The Woy 26 is a rare reminder that innovation in nautical design doesn't always come from new materials, but also from mastering existing ones," said judge Morten Brandt-Rasmussen.

And so, Brügge's vision earned Special Mention: One to Watch at the prestigious annual awards, adding to another accolade already on its résumé, a gold German Innovation Award from 2025.

"For ages, people have built boats and ships from wood," Brügge says. The evolution in the 1960s and '70s to fiberglass, he says, "was more suitable for industrial building processes. Looking back, I realized that shifting to plastics was not because that material is better—it is not—but that further development of yacht construction techniques in wood had just stopped. My ambition has been to advance technology for wooden yacht building."

Constructing hulls from wood veneer and epoxy is not new; the Dutch yard Kolibri became known for their wood-epoxy hulls. Van de Stadt Design (also the Netherlands), Bruce Roberts, and others have drawn numerous designs for sailing yachts to be built by amateur builders who wanted to construct their own boat using this method.

Other builders have been using cold-molding and vacuum-infused resins to create strong, lightweight slippery hulls for racing and cruising.

But that's where the technology of cold-molding boats seemed to have stopped, until Brügge teamed up with the Eberswalde University for Sustainable Development to rethink the resin infusion process in wood boatbuilding, a concept manifested in the Woy 26.

Beginning in Wood

Sailing as a kid in the Schlei, a Baltic Sea fjord in northern Germany where a variety of boatyards refit and maintain traditional yachts, or helping his grandfather working on wooden sailboats, Brügge, 38, has been in and around boats all his life. In 2010, he apprenticed at Yacht und Bootsbau Stapelfeldt in Kappeln, a town where the fjord meets the Baltic Sea.

"That is when I started building wooden yachts," he says. "It is a different feeling to sail in a wooden boat. It is such a nice material. Wood, when crafted skillfully, feels so nice to the skin and has this all-natural mood."

Following his apprenticeship, Brügge sought a master's degree, and in 2016, he founded Werft Königstein (Königstein Shipyard), returning to his home waters along the shores of the Schlei. Starting with a few other young boatbuilders, today 25 people work at the yard offering repairs, refits, and winter storage for yachts of all kinds.

Brügge was lucky to get orders to build two new wooden yachts in the yard's early years. These strengthened his love for the material and his determination to develop new techniques to modernize wooden yacht building—a mission further fueled by the assignment to build a 48' (14.7m) racer-cruiser of laminated wood designed by French naval architect Thomas Tison.

Tison designed *Elida* for a client who had a specific racing schedule—including the Fastnet Race—a love for traditional yachts, and who wanted to take his family cruising occasionally. He chose northern spruce as the medium, with four layers of wood veneer laid diagonally over a mold, then vacuum bagged to ensure even resin distribution. The hull was finished with a layer of carbon fiber (Tison calls the consolidated result Exoskin), with locally added carbon fiber for strength where needed for fittings. Brügge added an extra layer of mahogany veneer over the carbon fiber Exoskin to present *Elida*'s wooden character on the outside.

Innovating in Resin Infusion

As a next step, Brügge teamed up with the Eberswalde University for Sustainable Development in a project called Bio-Based Boats. The effort

Jan Brügge has developed a method of vacuum infusing wood-epoxy hulls.

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aimed to explore new ways to process wood to make production more efficient and the resulting hull lighter, without sacrificing strength. They accomplished this by scoring a system of infusion microchannels in the wood itself, spreading out from thicker channels into thinner ones to facilitate the flow of resin between layers.

Once channeled, four of these veneers of 2.5mm (0.098") are layered over a framework, and the entire structure is vacuum-bagged for resin infusion, using a carefully calculated pattern to ensure that resin will distribute equally in between and over the veneer panels.

For the prototype, Brügge and the team chose only local German wood, predominantly Nordic spruce. The first hull, built with a student team, was extensively tested to prove the strength and durability of the new wood-infusion method. It resulted in the Woy 26, designed by Martin Menzner. (Woy stands for "wooden yachts".)

The Woy 26 displaces 1,120kg (1.2 tons); by way of some daysailer comparison, the 28' (8.5m) J/9 daysailer displaces 1,927 kg (2.1 tons); the Saffier SE27 1,900 kg (2 tons); and the 8m (26') carbon-built A-Yachts a27 2,000kg (2.2 tons). With a 21m^2 mainsail (226 sq ft) and a 14m2 jib (150 sq ft), the upwind sail area to displacement ratio is 31.25—indicating indeed impressive speed potential. A 70m^2 gennaker (753 sq ft) adds to the downwind fun. A carbon rig has swept-back spreaders but no backstay for simplified sail handling.

Twin rudders and a lifting keel comprise the appendages; the keel and lifting mechanism belowdecks are forward of the mast at an angle, so with the keel fully down the lateral resistance will be directly under the mast. This configuration raises questions with some sailors, but testimonies of those who have sailed the Woy 26 and videos showing the boat at speed under sail indicate good handling.

"The Woy 26 amazes with its radical lines and pure elegance. And once out on the open sea, it has proven to be suited to much more than the lake conditions for which many daysailers are optimized," European Yacht of the Year judge Mariotti said. "We tested it at the end of a windy day that still offered some fun, and with the gennaker up, we were planing at double-digit speeds. All without difficulty, without any particular effort."

Back on his home waters of the Schlei, Brügge smiles as he describes the results of his efforts to elevate wooden boatbuilding to a new level of speed, performance, and precision.

"On the flat water of the fjord, we easily reached 17 knots," he says. "This is a seriously fast daysailer."

Jan Brügge, Geschäftsfuhrer WOY, Königstein 8a, 24376 Grödersby, Germany, tel. +49 174 1793146, woy-yachts.com

—Hans Buitelaar

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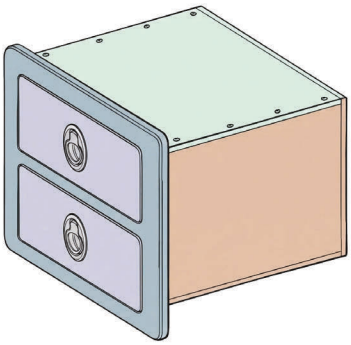

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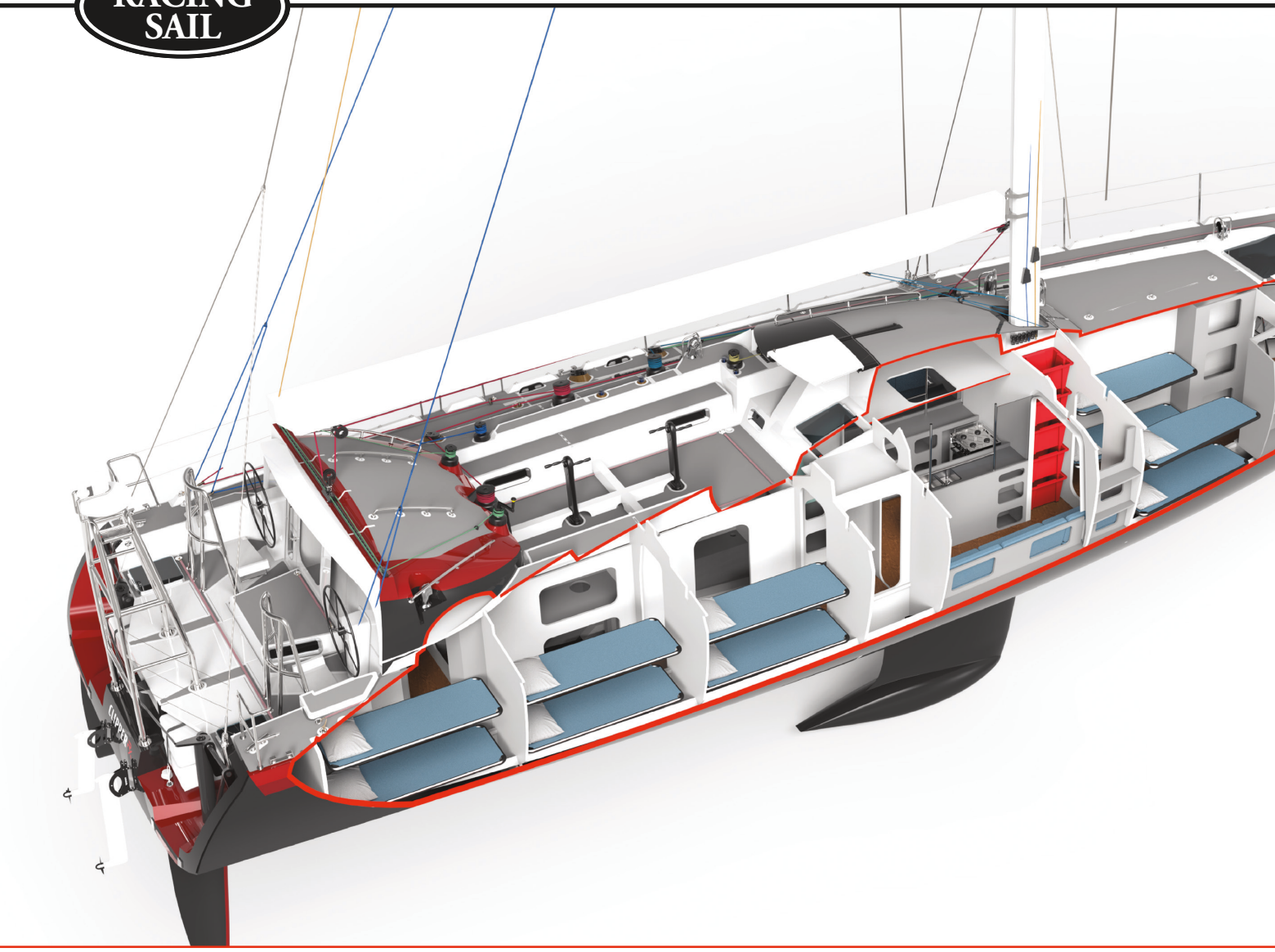


BUILT FOR THE CREW

The latest iteration of the Clipper Race's round-the-world design pushes stability and safety in a racy platform that takes some cues from fast multihulls.

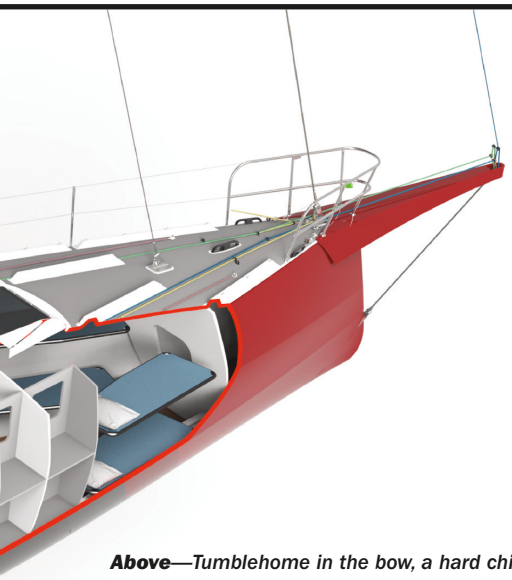
BY NIC COMPTON

It was a crazy idea: take a bunch of paying amateurs on a round-the-world yacht race. After all, it's not exactly a sleigh ride for the professionals, as testified by the number of people lost in ocean races. Yet this is what British sailor Sir Robin Knox-Johnston—best known as the first man to sail around the world singlehanded and nonstop—was determined to do.

And there were plenty of naysayers as the first Clipper Round the World yacht race set sail from Plymouth, U.K., in 1996. Yet, over the past 30 years, Knox-Johnston has waved off an astonishing 14 races and enabled nearly 7,000 people, many of them complete novices, to accomplish one of the pinnacles of human achievement: sailing around the world. Crews are not required to have any prior sailing experience but must undergo a rigorous pre-start training program. They can then sign up for one of eight legs or sail the whole 40,000 miles.

Much of the race's success has to do with choosing the right vessel, which faced a unique challenge, for it had to be fast enough to race as a one-design fleet, yet safe and durable enough to be handled by an amateur crew overseen by a professional skipper. Since that first race 30 years

RENDER COURTESY CLIPPER ROUND THE WORLD RACE



***Above**—Tumblehome in the bow, a hard chine aft, and kick-up rudders are all elements of the Clipper RX designed for safety.*
***Right**—With 14 races under their belts, the Clipper Race organizers have a deep well of design choices and sailed experience to inform the next iteration.*

ago, three fleets of boats have been custom-built for the event, and their designs have evolved over the decades. Now the latest iteration has been announced, with a brand-new fleet of boats that's due to be ready for the 2027-28 edition of the race. And guess what? The latest design, called Clipper RX and devised with the help of legendary multihull designer Nigel Irens, looks surprisingly cutting edge.

It's fair to say that when Knox-Johnston and his business partner William Ward (CEO) were looking for a design for the first fleet of Clipper yachts, they opted for safety. With most of the yachting media screaming at them, "It can't be done! It's not safe!" it was a natural reaction. The Nicholson 58 (aka Bluewater 58) designed by David Pedrick was a rock-solid, long-distance cruiser which, slightly stretched and with a new deck layout, formed the basis of the Clipper 60.

***Above**—Clipper Ventures CEO William Ward, left, and Sir Robin Knox-Johnston.*

PHOTOS COURTESY CLIPPER ROUND THE WORLD RACE

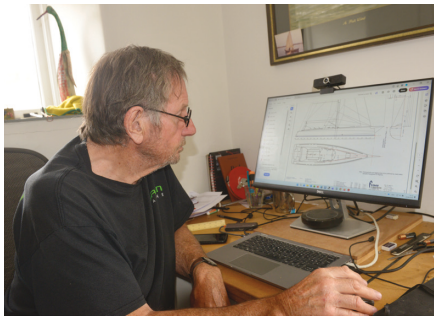
British standard-bearers Colvic Craft in Essex, U.K., built eight boats fitted with that quintessentially British engine, a Perkins M165. All the boats were originally named after famous clipper ships, except for *Blackadder*, named after a popular TV series. Later, as the business model evolved, the boats were named after the cities and companies that sponsored them, first from the U.K., then, increasingly, overseas.

By the time it came to build the second fleet for 2005-06, Clipper Ventures had run four round-the-world races with no loss of life and were no doubt feeling a bit bolder. This time, they commissioned a boat from one of the leading designers of the day, Ed Dubois, which was a bit more exciting than the Nicholson. At 68' (20.7m) long, the new boats were considerably bigger, relatively light, and had a flatter, more racy underwater shape—crews recorded speeds of up to 30 knots. The boats also carried four more paying crew than their predecessors, up from 14 to 18, which no doubt helped recoup their building costs. Ten boats were built, this time at the Shanghai Double Happiness Yacht Co. in China. When a crew lost one boat after running aground on a reef in the Java Sea during the 2009-10 race, race organizers promptly replaced it with an identical boat.

Tony Castro's design for the third fleet of Clipper boats for 2013-14 went a bit further. At 70' (21.3m) long—with a 19' (5.8m) beam, 9' 10" (3m) draft, and 95' (29m) tall mast—the design was much more of an out and out racing boat, emulating the Open 60s that were increasingly dominating other mainstream races. This time, organizers ordered 12 identical boats from Nauticstar & Mazarin Yachts in Qingdao, China. With space for 24 on board (including the paid skipper), this more than doubled the number of paying crew that could take part in each race. The business model was working.

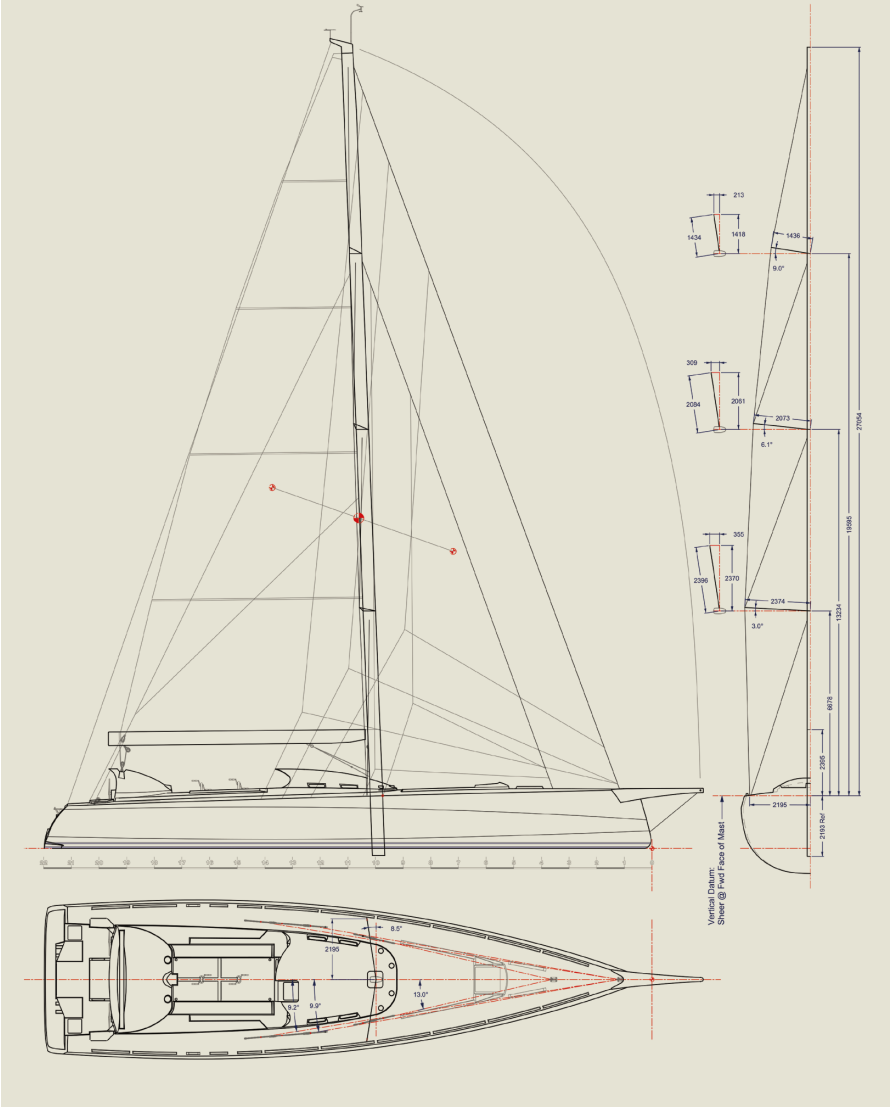
But it wasn't all sunshine and roses. In 2015, the event logged its first fatality, when Andrew Ashman was knocked unconscious when his boat *IchorCoal* gybed and a preventer broke off Portugal. He never recovered consciousness, and with the permission of his family, he was buried at sea. Another fatality happened on the same boat the following year, when Sarah Young was washed overboard in 35-40 knots of wind in the north Pacific. She wasn't wearing a harness at the time and was likewise buried at sea. A third fatality occurred on Leg 3 of the 2017-18 race, when Simon Speirs went overboard while changing a (hanked-on) headsail. A subsequent enquiry determined that his harness was faulty. Only a month before, the race lost a second boat when *Greenings* went aground between Cape Town and Cape Point. There were no casualties.

Such a string of tragedies in the space of three years could have spelled the end of the business, but the truth was strangely the opposite. In the months following the accidents, inquiries for



***Above**—Nigel Irens came up with the initial concepts for the new Clipper RX, with FISH Marine Design developing those into a working design. **Right**—The dreadnought bow is a direct result of the tumblehome forward, aimed to shed water more quickly.*

Clipper RX Sailplan



places on the next race actually went up. This was no doubt due to the extra publicity they generated but also the perception that the race was authentically dangerous, or "tough," and therefore a genuine challenge.

With these events in mind and the subsequent Marine Accident Investigation Branch (MAIB) reports still ringing in organizers' ears, the issue of safety was clearly at the top of the agenda when it came to designing the fourth generation of Clipper yachts. And, with 14 races by now under their belt, the management team had an unparalleled pool of knowledge to draw from.

The New Evolution

"This boat is more evolutionary," says Knox-Johnston. "Fashions change and boat designs change, and in the past, we've sort of gone along with that. But with this boat in particular, we've not looked at anyone else. We said, 'We're going to design what we want, what's best for our race.' Bearing in mind our crews aren't professionals, therefore we want them safe. We want them to enjoy it. It's got to be tough, or they wouldn't want to do it. They want to be able to say, 'I've done something special.' And the route allows for that anyway. But they don't have to suffer unnecessarily."

This time, their designer of choice was Knox-Johnston's old friend Nigel Irens, designer of *ENZA*, the boat Knox-Johnston and Sir Peter Blake set a new Jules Verne record on in 1994. (For a feature-length profile, see "Nigel Irens" in *Professional BoatBuilder* No. 63, page 86.) Irens had just completed a project designing the 50' (15m) ketch *Saecwen* in collaboration with FISH Marine Design, based near Southampton, U.K. It was agreed that Irens would help with the initial concept, while FISH would undertake the nitty-gritty work of turning that into a workable design.

Although more used to designing a range of workboats, FISH co-founders Chris Sherliker and Peter Murphy have a wealth of experience, not least (in Sherliker's case) working with Green Marine (see "Some Like it Hot" in *Professional BoatBuilder* No. 123, page 32) on several yacht projects, such as the Wally Cento.

"Clipper's initial requirements were fairly minimal," says Sherliker. "I think it was about 70' [21m], 3.2m draft, 24 bunks, and a reasonable space in the middle for eating. It was that basic. The thing we fairly rapidly picked up on is that it was all about protecting the crew. So, there was a lot of work on how do you make the boat safe? How do you not just prevent accidents but engineer the shape of the boat and the way people use it and move around such that the accidents just can't happen at all?"

One of the first requirements was to increase the angle of vanishing stability (AVS). Despite Knox-Johnston's insistence that the design wasn't influenced by current fashions, the solution was distinctly of the moment—a hard chine aft, as popularized by Open 60s such as *Pindar* from 2007 onward and now a standard feature

PHOTOS (CLOCKWISE) NIC COMPTON, COURTESY CLIPPER ROUND THE WORLD RACE

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on many production yachts. The effect of the chine not only increases the righting moment, meaning the boat can be pushed a bit harder, but also gives a bit more space below. The new design is also a little bit wider than its predecessor by about 4" (0.1m) on a hull that's about 3' (.9m) shorter overall, which will also give some added stiffness.

So far, as Knox-Johnston suggests, the changes were more "evolutionary" rather than radical, and on paper at least the new design does broadly follow the same principles as its predecessor. The most distinctive feature of the boat was, perhaps not surprisingly, the area where Irens had the most input: that dramatic-looking knocked back stem, also known in the U.K. as a "dreadnought bow" in memory of the 1906 warship that pioneered the concept. That shape is the direct result of another innovation: the tumblehome in the forward section of the hull, designed to shed water off the foredeck as quickly as possible.

"The last 20 years have seen a revolution in the design of offshore racing yachts, led by a strong tendency to move the mast—and all that goes with it—much further aft than it used to be," says Irens. "The result has simply been to replace the 'fat' old bow with a sleek and slippery one that allows the yacht to slide through the sea like the wind itself."

The advantages of the dreadnought hull shape are therefore twofold: there's less seesawing, which means crews don't get thrown around so much, and there's less space for water to accumulate. In addition, the forestay on the Clipper RX has been moved back a few inches to allow more space for crews to work the headsails, which, as in all the previous models, are still hanked on. That means far fewer gear failure modes than are possible with roller furling, and you have plenty of crew onboard to make sail changes by hand.

> **"The result has simply been to replace the 'fat' old bow with a sleek and slippery one that allows the yacht to slide through the sea like the wind itself."**
>
> *–Nigel Irens*

The Clipper RX features a sacrificial bow, a detail common in modern multihulls. The boat's actual structure comes to an end at a diagonal, roughly in line with the bobstay. The area forward of that is foam, covered with a thin laminate, which will smash to pieces if the boat hits a solid floating obstacle, such as a submerged shipping container. The idea is that this will either deflect the object or, if not, then the angle of the solid structure underneath will help the boat ride over the obstruction. It's an idea that's long been used on multihulls, whose sharp bows are particularly vulnerable, but is much less common on monohulls.

"It's another layer of safety," says Sherliker. "It's layer after layer."

There's another new safety feature (also very much in vogue) at the other end of the boat—the kick-up rudders. The earlier Clipper boats were already fitted with waterproof bulkheads aft to protect them in case the rudders were damaged by hitting unidentified floating objects (often whales), but even then, repairing the damage could be costly and time consuming. Kick-up rudders hung from the transom reduce the risk of damage, although they hang slightly deeper than conventional rudders.

Crew Considerations

Another major development in terms of crew comfort (and safety) are the twin companionways, both equipped with cuddies to offer protection from the elements. This not only provides two access points, so crews don't have to walk so far to go below, but it also means the skipper's cabin and the navigation station located under the aft cuddy can be in close contact with the helmsman. And those cuddies will be appreciated on a stormy passage.

"There's a lot more shelter for the crews on deck, because we have had wipe-outs and we've had people hurt," says Knox-Johnston. "The objective is to sail around the world. We're not going to mollycoddle you, you're not going on a cruise liner, but it doesn't mean you've got to sit there and be bloody miserable."

Other considerations for the new design included food storage, with large cool boxes factored in from the start and netting inside the cuddies to store fresh food. Knox-Johnston left the layout of the so-called engineroom, where generator, batteries, tools, and spare parts are kept, to the maintenance team to work out on the basis that, "If they complain about it in future, it's their fault, not mine!" And there

***Left**—The goal of the Clipper Race is to give amateur sailors a chance to challenge themselves racing around the world on a tough, fast, safe platform.*

PHOTO COURTESY CLIPPER ROUND THE WORLD RACE

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was a move toward low-friction rings instead of blocks wherever possible, not only because there's less to go wrong and they're considerably lighter, but also if someone gets hit by one, they are less likely to suffer major injury. That safety issue again.

The MAIB report also prompted another important change. Whereas the paid skipper used to be the only professional onboard, the boats now have a paid mate as well, which means there's always a professional awake to make decisions in an emergency. Although it's an extra cost, it also provides a recruitment framework for future skippers, as people work their way up through the Clipper ranks. The company currently employs around 50 people, ranging from office staff to maintenance teams, boat skippers, and mates.

Achieving Something Remarkable

From the outset, the concept of the Clipper Race struck a chord with the public. People queued up to pay large sums of money for the pleasure of being tossed around in a floating washing machine for up to 11 months at a time. The company's so-called 50:50 ad campaign, showing split images of crews wearing their regular clothes on the left and foul weather gear on the right accompanied by the tag line, "Achieve something remarkable," proved particularly successful. And, whereas in the beginning most of the crews came from the U.K., now the majority come from other countries.

Asked why the Clipper Race has succeeded where so many other races have fallen by the wayside (not least Chay Blyth's Global Challenge, which took amateur crews around the world the "wrong way" and was raced at four yearly intervals from 1992-2004), Knox-Johnston says, "We didn't see how you could run this business on a four-year cycle, which was the normal thing, as it still is for a lot of races. We looked at the math and said it can't work. We're not getting enough use of the assets. So, we've worked on a two-year cycle. That works well for us because it means we've got about a year for the race, then a year for refits and training up the next crews…It's making full use of the boats and keeping them going.

"The other important thing is having the right maintenance team. We've got a very good maintenance team. For instance, they're just back from Panama. At the end of this week, they're flying out to the United States. And it's cheaper for us to send them to these stops to do the work than it would be to hire local boatyards."

The first Clipper RX was due to be delivered to the U.K. in July 2026 where it would be rigged and tested, with the remaining 11 boats following soon after. Thirty years after the first fleet of Clipper boats set sail, the event has gone from strength to strength and more people than ever are stepping up to "achieve something remarkable." PBB

***About the Author**: Nic Compton is a freelance writer/photographer based in Devon, U.K. He lived on boats in the Mediterranean until the age of 15 and worked as a boatbuilder for many years before swapping his chisel for a pen and his router for a computer. He sails a Rhode Island-built Freedom 33, currently based in Greece.*

The new Clipper RX under construction. The first of 12 boats was to be delivered to the U.K. in July for rigging, commissioning, and sea trials.

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The Only Right Thing

ALL PHOTOS COURTESY OF DRAGONFLY TRIMARANS

The Dragonfly 36 won the 2026 European Yacht of the Year in the performance multihull category.

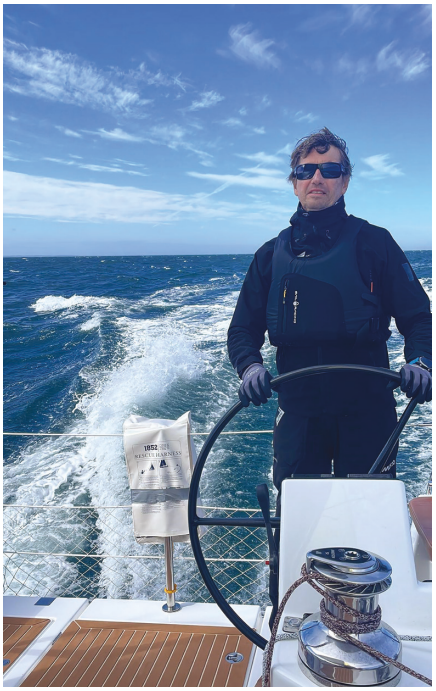
Approaching its 60th year, Denmark's Dragonfly Trimarans shifts into a third generation of family leadership and keeps the pedal to the sailing metal.

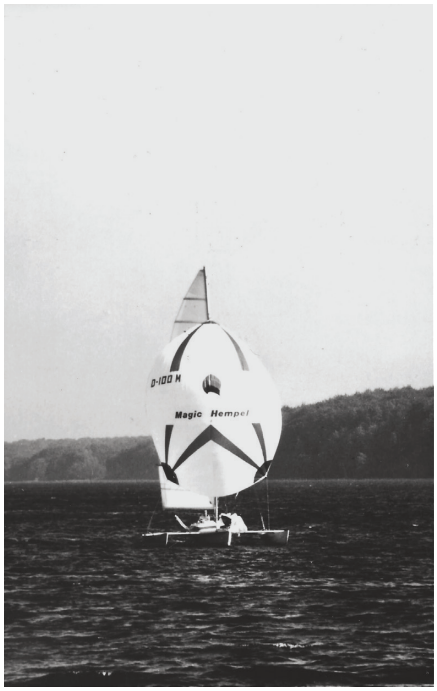
BY WENDY MITMAN CLARKE

The multihull class of the 1985 Two-Handed Round Britain and Ireland Race was a who's who of heavy hitters, all vying for glory—or at least survival—in the 1,800-nautical-mile slugfest through the infamous waters of the English Channel and Irish and North seas. Top competitors included Tony Bullimore and Nigel Irens in the Irens-designed 60' (18.2m) trimaran *Apricot*; Mark Gatehouse and Peter Rowsell sailing the 53' (16.1m) trimaran *Marlow Ropes*, which won the 1984 OSTAR as *Umapro Jardin*; and Walter Greene and Philip Steggall on Greene's 45' (13.7m) catamaran *Sebago*.

That year's race was particularly challenging, as two gales savaged the fleet. At one point, 23 yachts holed up in Castle Bay waiting out weather. Three boats were dismasted, and there were stories of 26-foot (7.9m) monohulls making 15 knots under bare poles. In the end, just 51 of 74 starters finished. And while *Apricot* would win overall, one of the biggest stories was the winner of the Boxall Trophy for the yacht with the highest speed to waterline ratio—the 25' (7.6m) Dragonfly trimaran *Magic Hempel*. The smallest boat in the fleet, the pocket rocket not only survived the onslaught but finished 18th overall.

***Right**—A sailor steeped in racing, Jens Quorning equates fast sailing with fun sailing. **Far right**—Magic Hempel's finish in the Round Britain and Ireland Race in 1985 helped put Dragonfly on the map.*





Sailed by Eric Quorning, eldest son of Dragonfly founder Børge Quorning, *Magic Hempel* was just one entry from the family boatyard based in Skærbæk, Denmark, to drop jaws on the racecourse. Jens Quorning, two years younger than Eric, raced the 35' (10.6m) trimaran *Quick Step III*, a one-off he had built and modified with a new rotating wing section mast and an extreme beam of 31' (9.4m). Finishing second in her class, she also was second for the Boxall Trophy, so the brothers finished 1-2.

"I was only 23 years old," says Jens, now Dragonfly's CEO. "The race was heavy. Not easy." But the brothers' results launched Dragonfly into the sailing headlines, which had been one of the goals.

"A trailerable trimaran that can be launched and rigged in an hour is quite a story. When that same boat wins her class on the rugged, fast track of the Round Britain Race, she becomes an exceptional story," noted a January 1986 story in *SAIL* magazine.

"That was basically our real international start," Jens says. "We didn't have any money to advertise...So, we thought, well, the only way we can get famous or, let's say, to be known, is through racing."

It was a successful if risky public relations strategy, but pushing limits and sailing fast for the sheer joy of it was and remains one of Jens Quorning's measures of a successful design and build. And while that wild-hair approach isn't quite the same method being pursued by Jens' son, Peter, as the third generation to lead the family business, he, too, sees its merits.

"Nowadays, we can come out with our brand in other ways, through marketing. But winning on the racecourse can have the same kind of influence," Peter says. "It's a clear proof of what the boat is capable of."

Boatbuilding is a hard business, and working with family can make it even harder. But as Dragonfly Trimarans approaches its 60th year, its longevity tells a story of balance between speed and steadiness, risk-taking and careful consideration, past and future. While listening to Jens, 64, and Peter, 31, describe the transition taking place at Dragonfly, I could hear this balance—the former, quick with humor and a kind of barely contained boyish energy, the latter more measured and self-contained.

In part, as Peter noted, that may be because as "the boss' son, you're always being evaluated." But it's also clear that he's not the proverbial chip off the old block. He has grown up with the company, but he stepped away long enough to explore other options, and he draws distinctions about the skills he brings to a business that must thrive in a complicated economic, regulatory, and competitive environment—they're a lot different than whether he can whup tar on the racecourse.

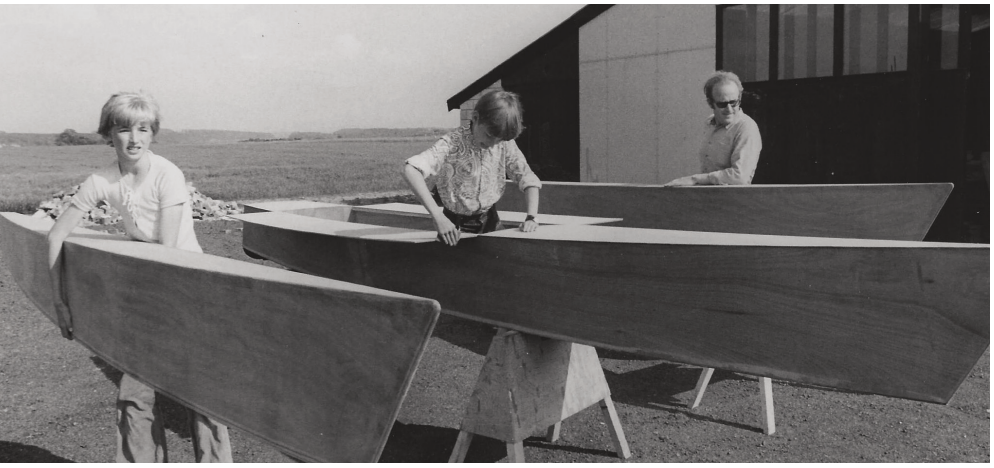
"I come in with another perspective than my father because I'm not a craftsman," Peter says. "I understand, and I can be a part of the discussions when we need to take decisions, but I cannot build the boat myself. I am much more organization oriented and business oriented…my father is a lot more product and production oriented than I am. And we have this collaboration."

Jens sees this distinction as a natural, beneficial evolution.

"I see many smaller companies where a son or daughter takes over and if they are not into management…they go down," he says. "We have reached a level now where management is very important. Everything is important, but don't underestimate management."

Much like the company itself, Peter's move into leadership (he became vice president in 2024) has been measured, gradual, and carefully thought out. It wasn't a given he would choose this path. He had always been part of the business—he spent a year and a half in the service department during

A pair of Dragonfly trimarans in the shop, where the boats have evolved over 60 years and three generations of the Quorning family.



***Left**—Børge and his sons Eric and Jens experimented with trimaran designs from the beginning. **Above**—The Trident 28 was Børge Quorning's first trimaran offered to the public in 1968.*

a gap year and attended boat shows since he was a youngster—but he was also "always on the sideline." After earning a bachelor's degree in international sales and marketing, he worked for a major supermarket chain and a software company. Testing the waters, he learned that "this was the right place to be."

He spent three years essentially apprenticing in every aspect of the company, including the shop floor.

"I was not in production building boats but everything around it, supporting the production—service, supply management, procurement, general management, financial. Sales came naturally with my last name," he says. "I started here as a new guy, and I was under the wings of the general management. I had a three-year schedule of how I needed to understand the whole company and the culture here from the bottom up."

For his part, Jens had measured his expectations. He always held the door open to Peter but never pushed him through.

"Years ago, I told Peter that if he at some stage later feels that he wants to, 'take the tiller, the tiller will be yours.' But I will never ask Peter to take the tiller. He has to come and say he wants the tiller. And I think that's a big difference, instead of me saying, 'Here, you have to take it.' Doesn't work. He has to say that now I am ready, body and soul, to do this. And we didn't know that for many years. Peter was still young, and my wife and I, we told Peter, 'You've got to have some experience from outside us, from working other places.' Because I was missing that. I started very, very young here."

The Boat That Answered All the Questions

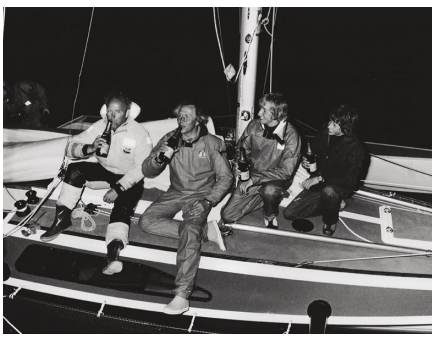
Børge Quorning began a wooden boatbuilding apprenticeship shortly after World War II ended, in 1948. He was part of the shop that built the Finn class dinghy for legendary Danish sailor Paul Elvstrøm's gold medal at the 1952 Helsinki Olympics, and while he built various other designs, he was particularly interested in light, fast rowing shells. In the mid 1950s, he ended up in Vancouver, British Columbia. While building boats there, Jens says, he was invited to try out "this strange boat," an Arthur Piver-designed trimaran. It sailed circles around the next fastest thing on the water, a Star class monohull, and completely turned Børge's head.

"He loved skinny, lightweight boats, and he hated to put weight under monohulls," Jens says. "Suddenly, you had this skinny hull, lightweight boat that answered all his questions."

Inspired to bring these boats to Europe, Børge and his brother bought property in Skærbæk, a small town in southeast Denmark, and started a shop. A year later, they built Børge's design, the Trident 28. It was received, as multihulls often were then, with some guarded interest but mostly open skepticism. The first boat sold right away, but it was the only one.

"It was way too early," Jens says. "So, my dad started to build small fishing boats, then went into leisure boats, 19 feet (5.8m), 26 feet (7.9m), 31 feet (9.4m). We built a range of double-ended displacement power boats for many years. That was the day work. In the evenings, we started to play with trimarans."

Børge kept building tris on the side, experimenting with materials, designs, and rigs. In 1972, he built a 16' (4.8m) plywood-and-foam trimaran for 10-year-old Jens and 12-year-old Eric. Nicknamed *Den Lille Gule*, or *The*



***Right**—Celebrating the win at the Round Zealand Race in the* Quick Step; *Jens and Eric were 16 and 18 years old, respectively.*
***Far right**—The floats on the 16'* Yellow One *were attached with lines.*

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***Left**—Jens raced* Quick Step III, *a one-off with rotating wing mast and radical beam, to the podium in the challenging 1985 Double-Handed Round Britain and Ireland Race.* ***Right**—The third generation of the family to take the tiller at Dragonfly Trimarans, Peter Quorning brings a focus on business and organization management to balance his father's emphasis on design, innovation, and build.*

Yellow One, the hull and crossbeams were tied together only with rope lashings. By 1974, Børge's brother left to start his own powerboat company, while Børge developed the Trident 27, his first real production tri, built of foam- and balsa-cored GRP.

In 1978, Jens joined the company at 16 years old, and the latest design, called *Quick Step*, hit the water. It was a 28' (8.5m) tri based on the Trident but with modified, longer floats. It quickly drew attention when Børge, Eric, and Jens won the prestigious Sjælland Rundt, or Round Zealand Race, with it. Two years later came the first production series Dragonfly 25, designed by Børge and Jens.

The business was a struggle. But the focus never wavered.

"The trimaran was, for us, the only right thing," Jens says. Experimentation was a necessary part of learning and growing, and pushing boundaries eventually became part of their identity.

"We didn't have the bible or the manual, how to build the right trimaran. So, we built a lot of experimental boats, for hull design as a whole, design for material, rigging, you name it. Everything was new, because we had to find a way to combine all this," Jens says. "I admit I broke a lot of masts. But that was a part of our process. Then we knew, OK, this is how far we can go. Then it's one step back again, make it stronger, and test against it.

"We wouldn't be where we are today if we hadn't been, let's say, loyal and true to our DNA, all our history," he says.

A Singular Finishing School

In 1982, Jens wrote to legendary American multihull designer and builder Dick Newick, sending him some photos of the boats he and his father were designing and building.

"I asked if he could get me a job. I just want to see the world," Jens says. "'I'll get you a job somewhere on one of my designs,' he said. So, I came to Martha's Vineyard and stayed with Dick for a weekend, and two days later he said, 'You're not going anywhere. You stay with me.' I ended up staying with Dick and building his own 52' (15.8m) trimaran. And I did a lot of work on *Rogue Wave* and on *Moxie*."

Jens worked with Newick from 1983 to 1984, immersing in the rarefied, radical world of the fastest sailboats on the water.

"You can imagine, I was here from a small fishing village and suddenly come to Dick's place and see all these big boats and meet all these characters like Dick and Walter Greene and many other sailors," Jens says. "It was an extreme experience to come to the Vineyard and see these boats, work on these boats, and sail these boats."

***Left**—Jens and Børge presented the Swing Wing system in 1989.* ***Right**—With floats folded, the trimaran fits easily into a standard slip.*

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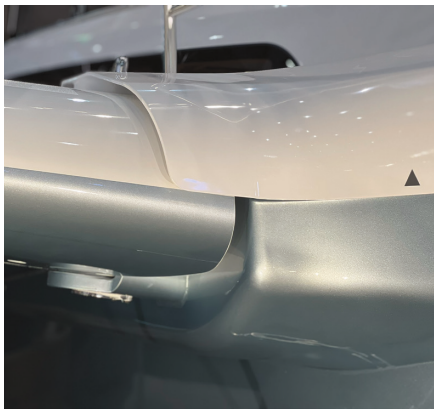

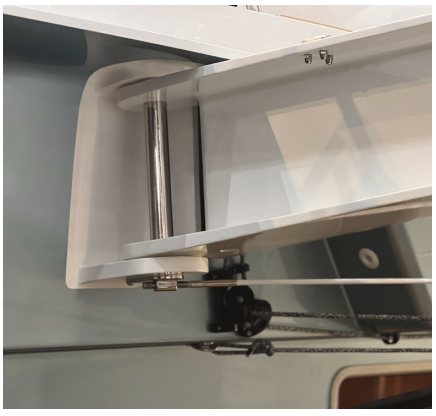

***Clockwise from top**—The previous iteration of the Swing Wing included a lot of heavy-duty hardware. With the Swing Wing redesign developed for Dragonfly 36, all of that is eliminated except for a single bolt.*

He also saw multihulls with folding floats (amas) for the first time in Ian Farrier's hinge method that he would patent and use on his famous F-27 and its successors (see John Marples's "Know When (and how) to Fold 'Em" in *Professional BoatBuilder* No. 201, page 18). When he returned to Denmark—via transatlantic passage on the 60' (18m) *Rogue Wave*, which Newick had designed for Phil Weld and Gougeon Brothers had cold-molded in 1977—Jens told his father that folding floats would be the key to their success.

"We spent three years developing what we call our Swing Wing system," Jens says. "We knew that if we could crack that we had a future, otherwise it would be limited. So, we presented the first Dragonfly Swing Wing in 1989." A year later, Paul Elvstrøm had his own Dragonfly 800 Swing Wing built and experimented with it for 10 years, providing the company valuable design and construction feedback.

The Swing Wing has since remained on all Dragonfly models. Deceptively simple, using only winches and lines handled from the cockpit, it reduces the beam by half in about two minutes, letting the boats fit easily into a standard slip.

In the latest design, the Dragonfly 36 launched in 2025 and winner of the 2026 European Yacht of the Year in the performance multihull category, the system underwent a sea change with the help of naval architect Steen Olsen—Jens' collaborator on Dragonfly designs since 2002. The heavy, external stainless-steel brackets and bolts that attached and constituted the folding mechanism were replaced with a CNC-cut, vacuum-infused composite structure embedded in the carbon reinforced bulkheads; only a single stainless-steel pin is still visible. The composite bulkheads are continuous structures that run through the hull, fore and aft, and meet the beams on either side on the outside freeboard, distributing the forces through the entire structure and making it stronger and easier to maintain over time.

"It's been a dream for many years, but we had to be sure we got it right," Jens says. "It's a symbiosis of engineering and our experience in composites. Because when you just

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The Dragonfly 40 is the builder's largest model. A carbon version saves a ton of weight, ramping up the performance even more.

operate in steel constructions, you can get much more direct calculations, but as soon as you are in composites, it has to do with the direction of fibers. Manufacturing that is difficult to calibrate down to 100%, but we have succeeded in that, and we have made a lot of physical tests. This complex design has also been backed up with computer finite element analysis (FEA) to understand how best to control the big forces we see on the beam and hull structure."

Beyond the refined aesthetics, the new design saves weight and production time, a key consideration in a country where labor rates are extremely high, in a business with 60 employees.

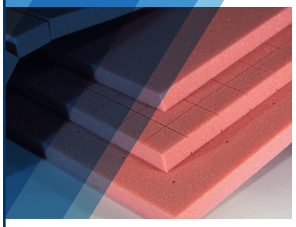
"We always try to raise the bar higher each time we develop a new boat—how can we do things smarter? Smarter in a way for innovation, for costs, for manufacturing," Jens says. "We design here, we develop here, we have all aspects under the same roof here, except Mr. Olsen. So, that's probably an advantage for us compared to other yards…we have everything here, and we have crazy experience in what we are doing."

Nearly everything is built in-house, with a few strategic exceptions. For the 36 and Dragonfly 40—the company's two largest designs—decks, main hull, and floats are built by fellow Danes X-Yachts' facility in Poland. Beams, bulkheads, floats, and some hulls for the smaller models—the 25, 28, and 32—are built in-house; some hulls are built at a nearby boatyard. Sandwich construction is Divinycell foam core sheathed in biaxial and unidirectional fibers, which take less resin than woven roving and CSM, increasing strength and reducing weight. For the larger boats, carbon is applied in high-load areas, and vinylester is added to the laminate. All structural parts laminated in vinylester resin are tempered in an oven at the yard to get maximum strength in the structure.

Crews assemble spars on site from lengths of industrial carbon tube glued together with a carbon insert at the joints. All rigging and mast fittings are designed and fabricated on site. The 60-person workforce includes three to four youngsters in a four-year, in-house boatbuilding apprenticeship, as well as employees with 20 to 30 years in the company.

"To build complex boats takes many skills so we have many types of skilled workforce here, from high-end wooden furniture craftsmen to electricians to lamination people to spray paint skills and steel welding to mast manufacturing, etc.," Jens says. "It takes a long time to build up this strong workforce and…to establish the right team to run the boatyard on a daily basis. It is also not easy to get the right people, but it is possible when you have time to wait for the right hands (and head) to show up."

The 36 and 40 can be upgraded to a carbon version. While the hull is still glass and epoxy, remaining carbon parts—including bulkheads, floats, wings, and mast support—are cured in a massive autoclave at Marstrom Composite in Sweden. Special full, single-skin, carbon laminate molds are built to withstand the autoclave's high pressure and temperature. In the Dragonfly 40, this build technique saves a full ton of weight, improving the model's already high performance.



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Beams, bulkheads, and floats for the smaller models—the 25, 28, and 32—are built in-house. Dragonfly's 60-person workforce includes three to four youngsters in a four-year boatbuilding apprenticeship.

Half of the 40s they have sold have been carbon, Peter says, adding, "It's the version with the most horsepower."

"We expected only 10%," Jens says. "Our Dragonfly 40 is probably the most expensive production 40' boat on the market, I'm afraid so. But there's a group of people who want to pay for that extra fun. Not all of them are racers. They just want the extra thrill and the fun."

The Long Binocular

In January 2022, Dragonfly celebrated its 1,000th boat launched; three months later, Børge died at age 90. Visiting Dragonfly today, one is keenly aware of the importance of history. The core of the shop remains what Børge created in 1967, and there's clear pride in the fact that every new boat has emerged from the same doors ever since.

"Six feet from where I am sitting, that's the first hull that my dad built. From my office, when you walk into the first part of production, that was the start," Jens says. "And we still have the same phone number!"

The shop expanded when they purchased the boatyard next door in 2011, followed by its production facility 2013. Dragonfly is now 12.5 acres (5.06 ha), with two acres (8,093m^2) under a roof—half for production, half for boat storage.

"It is a humble facility," Peter says. "We are not in a big flashy facility here, which also indicates that we try to run the business conservatively and also follow the market, because we have to be ready to adapt to the market. Having big facilities also means that you have lots of risks, costs. You have seen many companies doing big investments with big facilities and two years after, the demand from the market is in half."

He notes that while all five boats in their range are in current production—their order book is full until 2028—they're resisting the market trend toward bigger boats because it would mean an expansion they're not convinced is merited. Nor is chasing the latest trend really their M.O.

"It's been in a natural flow," Peter says. "We are kind of down to earth and want to take things slow and think things through before we take a decision."

"I would say we are fast on the water, but we are little bit slow," Jens laughs. "For me, for us, it's very important to keep focus on developing new products. Not to go to sleep. To keep pushing…compared to our size, we have spent a lot of money and energy into developing our boats over the years. That's our success today."

While Dragonfly has expanded its footprint over the years, boats are built and assembled in the same shop that Børge Quorning built 60 years ago.

As Peter takes the tiller, Jens says, Dragonfly can be "like the old seaman…take the long binocular and look much farther forward…And today, I can see how I helped assist my parents when I went into the business. I can see now with Peter, he comes in here and says, 'Well, Mom and Dad, I can do that, I can fix that.' And we say, 'Wow, great!' And also, clients and employees are very happy with Peter here and so are we, to see still a family business, and it will be like that for many years to come." PBB

***About the Author**: Wendy Mitman Clarke is* Professional BoatBuilder*'s senior editor, and a lifelong sailor.*

STRIVING FOR Straight and Level

A team of boat designers, pilots, and NASA shuttle program veterans looks for power boating's Kitty Hawk moment.

BY JOE EVANS
PHOTOGRAPHS COURTESY AVIATOR BOATS

We don't often talk about performance boat concepts and designs in aeronautical terms such as flight dynamics and fly-by-wire stability. The team at Aviator Boats believes we should.

Aviator's founder, Russell Belden, explains, "In 2011, I was involved in a prototype defense project, and the boat was doing what it was designed to do, but the human element couldn't withstand the pounding. A crew member was severely injured. This got us thinking, there must be a better way. Why should we accept that boats are bucking broncos? Why can't we control a boat like an airplane to keep it level and stable? What if we were to design an airplane and build a boat around it?" The challenge of course is, unlike an airplane, a boat must perform in the often-chaotic interface between two different fluids: water and air. Waves are the problem.

Belden has plenty of experience in modern boat design and fabrication. In 1995, he formed Timeless Marine–a yacht design, renovation, and service business in Seattle, Washington. The company's first production boat was the Synergy 1000, a Carl Schumacher-designed, carbon fiber-reinforced sailboat, which won *Sailing World*'s Sport Boat of the Year award. In 2000, Belden led the Seattle Challenge *America*'s Cup campaign. Subsequently, he transitioned to defense industry work designing and building unmanned surface

***Facing page**—The cold-molded* Kitty Hawk *in the slings. The new hull concept incorporates three near-surface foil/wings fore and aft of the center of gravity.* ***Right**—The* Kitty Hawk *is set to use aeronautical engineering to make boats handle with less impact on the humans occupying them.*

vessel (USV) prototypes and anti-piracy patrol vessels. He notes that much of that work focused on creating stable nautical platforms and preventing injuries.

In 2011, Belden coauthored a paper for the U.S. Naval Institute's *Proceedings* publication titled "Robots in the Age of Pirates" encompassing the argument for military patrol USVs. He subsequently designed the 52' (16m) *Piranha* USV and the long-range, 57' (17m) *Shomari* counter-piracy boats. "Anti-piracy boats taught us a lot," he recalls. "The boats maintained efficient cruise speeds with almost no bow rise, but they came at a steep price using vacuum bagged and baked prepreg carbon fiber, and they lacked active pitch controls to deal with waves."

Belden had some aviation experience. "I flew a plane before helming a boat, and my defense work included unmanned aerial vehicles (UAV/drones)," he says. In 2018, he met Colonel (ret.) Tom "Hawkeye" Henricks, an Air Force Academy graduate with a civil engineering degree who commanded or piloted four space shuttle missions logging more than 1,000 shuttle flight hours. Along the way, Henricks earned nine service medals including the Distinguished Flying Cross. He served as an F-4 pilot, F-16 test pilot, and commander of the 57th Fighter Weapons Wing at Edwards AFB. He has more than 6,000 flying hours on 30 types of planes, and he holds an FAA commercial pilot rating. In retirement, he flies his Cirrus SR-22 single engine plane, and he likes to go boating.

"Our conversations helped crystallize a vision," Belden recalls. "If boats could be engineered like airplanes to be safe, level, stable, and controllable, it would be a game changer. In 1902, the Wright brothers sorted out that an airplane operates in three axes—lateral (pitch), longitudinal (roll), and vertical (yaw). The same is true for boats, but mariners typically have control of only one—yaw, which is the rudder or steerable outboard propulsion. In those days, there were all kinds of kites, but they were not under control. The Wright brothers brought three-axis control to flight, and we believe we can do the same for boats."

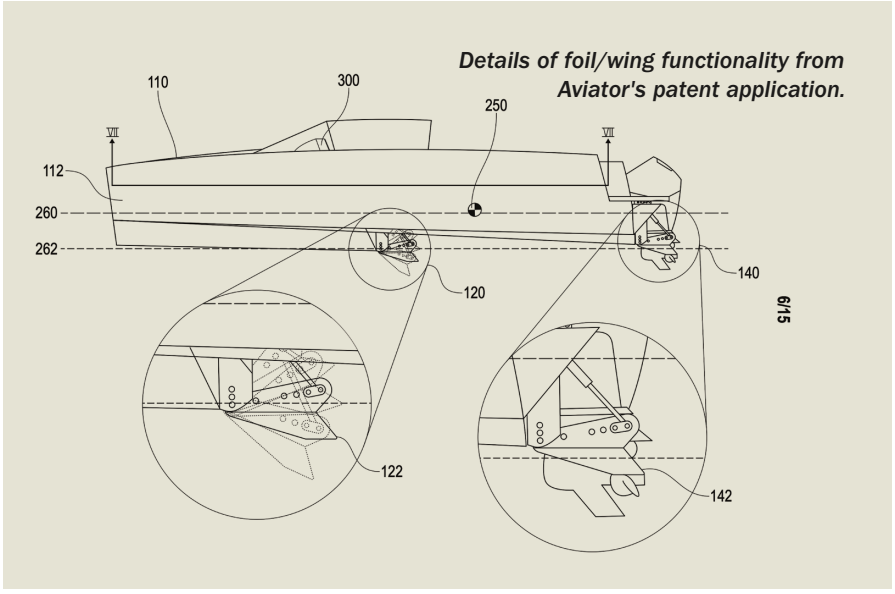
Henricks notes that, "F-16 wings and stabilators produce lift. That concept could apply to a boat." So, the Aviator design brief was "to design three-axis control surfaces to actively counter waves from any direction—essentially controllable wings for dynamic lift, which will eliminate bow rise and provide real-time wave-by-wave adaptation. Trimtabs can't deliver this."

"Our breakthrough came by reversing the design process," Belden says, "starting with near-surface foils (we call them wings), then wrapping a hull around them."

"Fly-by-wire control made the F-16 and the space shuttle stable." Henricks adds. "It should work on boats as well."

Belden says, "Near-surface foils looked to be a better way of lifting and controlling a boat to mitigate bow rise and the adverse effect of wakes, chop, and oblique waves at pretty much any speed. Our concept is to have a planing hull with three dynamically adjustable near-surface foil/wings fore and aft of the center of gravity to provide pitch and roll control, operated by fly-by-wire while using conventional propulsion. That's the basis of our primary patent."

In 2024, they brought in Jerry Baty, a certified JD and CPA with a background in business aviation, to serve as CFO, and together they incorporated Aviator Marine LLC to develop, build, and test a prototype. Commercial fishing



Details of foil/wing functionality from Aviator's patent application.

The patent-pending, airplane-style yoke handles the boat's steering and provides complete three-axis control.

magnate Tor Langesater came onboard as lead investor, and the project began to take shape. Belden designed the test boat with scantlings analysis from renowned designer and *Professional BoatBuilder* writer Dudley Dix, and the team cold-molded a 30' (9.14m) by 8.5' (2.6m) boat and named her *Kitty Hawk*, of course.

While the boat was coming together, the team brought in Jim Doub, a Hewlett-Packard engineer with NASA space project experience, to design the fly-by-wire control system. The steering is handled through a patent-pending, airplane-styled yoke, which provides complete three-axis control.

"Each near-surface foil/wing is actuated by a hydraulic ram, and above 18 knots, they are typically moving plus or minus five degrees," Belden says. "The forward wing primarily provides lift efficiency while aiding pitch control. The aft wings essentially perform the same function as airplane stabilators by making nearly constant roll adjustments to keep the boat level. They also provide some lift at speed."

"The fly-by-wire system provides real-time pitch control from the helm, just like an airplane," Belden says. "There is a central computer and an inertial measurement unit (IMU) that senses changes and the rate of change in the boat's attitude, and it commands actuators to extend or retract the wings' hydraulic rams. The computer is programmed to keep the boat level, and it commands the wings to keep it there unless you override it with the helm. If you want to go up and over a big wave, just pull back on the yoke. Otherwise, with no driver input, the computer constantly keeps the boat level.

"At rest, the wings nestle in pockets clear above the hull bottom for trailering and beaching, and they have steep leading-edge angles, so they won't catch debris under way."

For prototype testing, Mercury Marine stepped in to assist the team's power integration, and Dometic tied in a DG3 gyrostabilizer to keep the boat stable at rest. However, "the gyro does nothing at speed. It is still spinning but not processing under way," Belden says.

Belden reports, "early tests proved that the system keeps the boat level in at least four-foot waves with no bow rise at any speed. The boat heaves slightly but slices through cleanly and imperceptibly transitions from displacement to planing and feels like she's on rails." He notes that the wings are not intended to, and will not, lift the boat completely out of the water. "Under way, she looks like a regular boat. She just performs more efficiently." He adds that the boat banks a bit in the turns, "but only so much that it still feels like it is level."

It's important to note that the patented Aviator StableGlide system is not an add-on to existing hulls. It is an integrated feature in a new hull concept incorporating three near-surface foil/wings fore and aft of the center of gravity. Aviator is offering the technology and design services to builders and designers via licensing. Their hope is that a new generation of boats will emerge and grow the boating market by offering safer, more comfortable, and more efficient boating experiences. They are talking with interested boatbuilders now, and they intend to present their work at IBEX in October. They are also considering testing *Kitty Hawk* in Miami's infamous Haulover Inlet around that time. Not quite Cape Canaveral, but the boating world will be watching closely. PBB

***About the Author**: Joe Evans was a sail designer (North Sails) and sail loft production manager before building Bruce Farr- and German Frers-designed ocean racing boats, as well as tooling for sportfishing boats and a pair of Rob Humphries-designed, carbon fiber on Nomex honeycomb racing sailboats for the professional Ultimate Yacht Race series. He subsequently produced films and articles for* National Geographic, CuriosityStream, HBO Max, *and various flyfishing and sporting magazines. He was* Chesapeake Bay Magazine*'s editor-in-chief. He currently freelances articles and documentary scripts, and he occasionally guides fly-fishing trips on Chesapeake Bay.*

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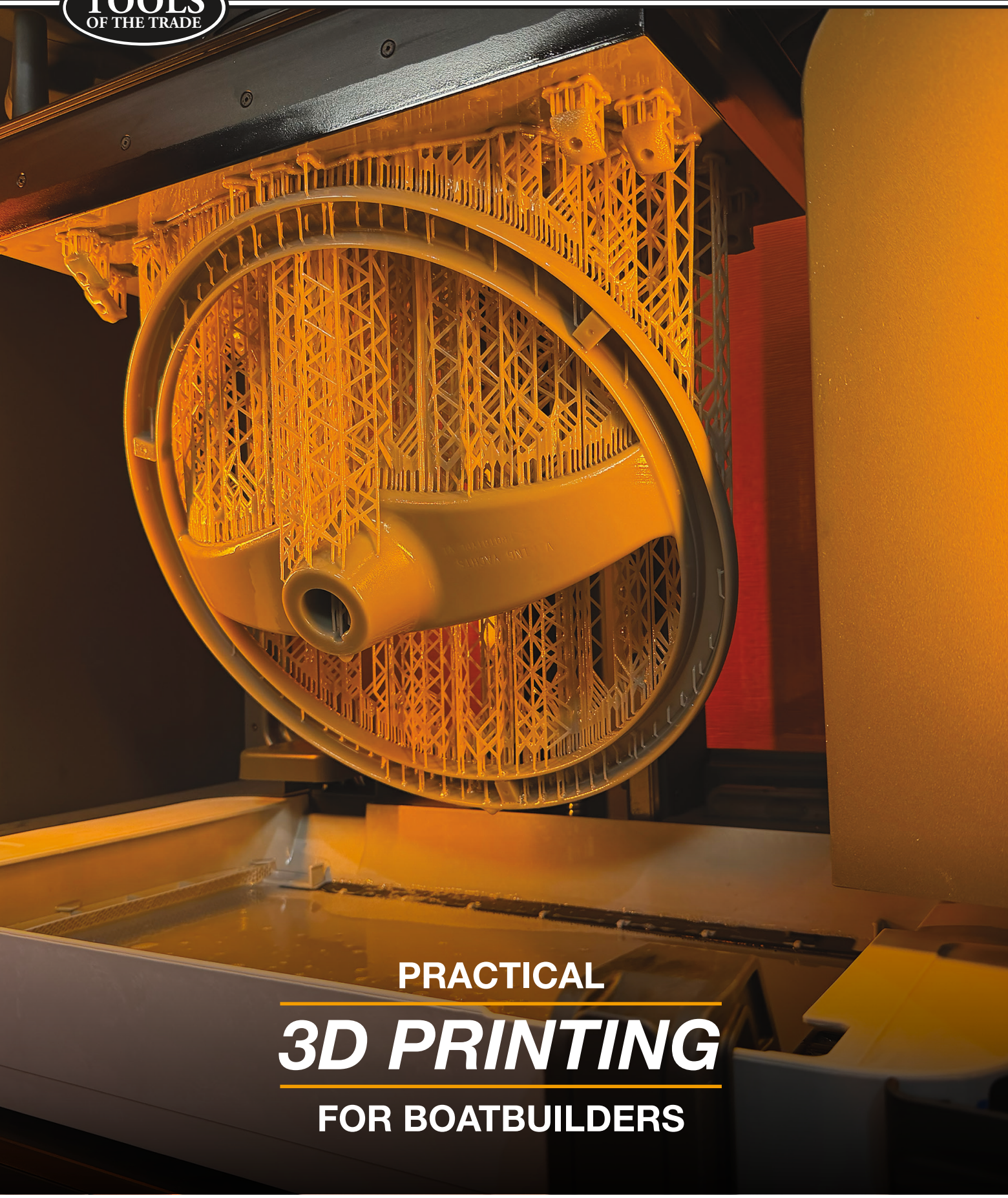
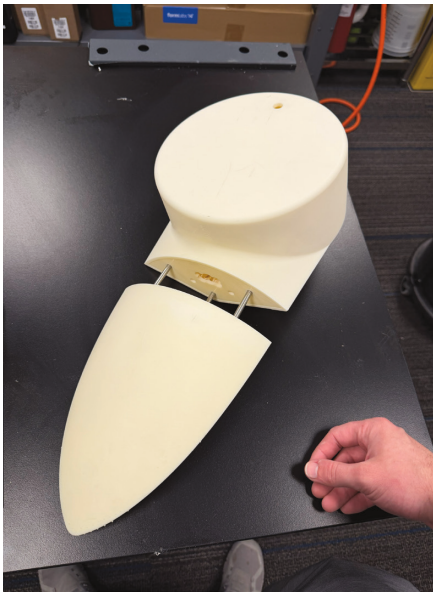


PRACTICAL
3D PRINTING
FOR BOATBUILDERS

Viking Yachts' advanced manufacturing engineer explains how today's desktop filament and resin printers make 3D printing attainable and useful for every kind of boatbuilder.

TEXT AND PHOTOGRAPHS BY WINSTON ZEBERLEIN



***Left**—This split-part resin sonar mold illustrates the smooth surface quality that's achievable with engineering resins.*
***Below**—AC vents are an example of a part that's used repeatedly and are easily produced using 3D resin printing.*

Boatbuilding has always rewarded the problem solver. Our industry is hands-on manufacturing where the geometry is rarely forgiving, the systems are densely packed, and no two installations are quite the same. A relatively "simple" task involves fitting to or finishing a curved surface with limited access, and the tolerance stack of raw laminate has a way of humbling even the most careful planner. That's exactly the environment where 3D printing has proven its worth.

I've been using 3D printers at Viking Yachts (New Gretna, New Jersey) for the past seven years, and what began with a single printer turning out prototypes and simple installation templates has grown into a five-printer operation. Today, those machines support thousands of end-use parts in regular applications, along with hundreds of fiberglass tools, molds, and mold inserts. The impact is hard to overstate. Used well, this technology has something to offer every boatbuilder from the one-man restoration shop to the production builder running boats off the line every week. In making a case for 3D-printing in the shop, my goal isn't to print everything. It's to find where the technology can make a difference and start there.

Filament and Resin 3D Printing

3D printing isn't as exotic or expensive as it was a decade ago. Today's desktop filament and resin printers—machines well within reach of any shop budget—are faster, far more reliable, and print a range of materials that hold up in marine and shop-floor environments. More advanced printing technologies have been mainstreamed in recent years—metal sintering and large-format robotic systems—but filament and resin offer the widest practical impact at the lowest investment. They overlap in capabilities but excel in different areas, and both are burdened with reputations that no longer reflect what they can actually deliver.

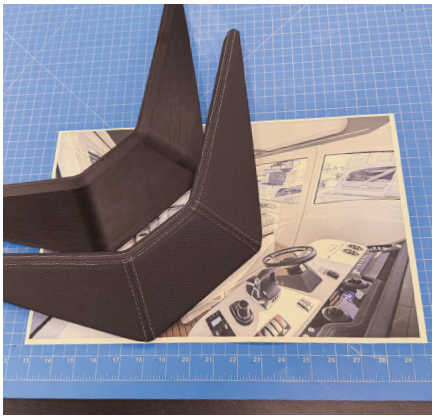
Filament 3D printers build parts by extruding molten thermoplastic in layers. The common misconception stems from polylactic acid (PLA)—the basic, brittle printable material most people encountered on their first exposure to the technology. Now, alternatives like acrylonitrile butadiene styrene (ABS), acrylonitrile styrene acrylate (ASA), and nylon produce parts that are tough and built for real use. Not long ago, printing reliably with these materials required six-figure enterprise machines, but modern desktop printers have brought them within reach as low as $4,000.

With their strength issues resolved, the real tradeoff for filament—compared to an injection-molded part—comes down to surface texture. Layer lines are part of the process, and while that doesn't matter for mechanical or structural parts, cosmetic components often require significant sanding and surfacing as part of finishing.

Resin 3D printers cure liquid photopolymers with ultraviolet light and suffer from a similar misunderstanding about their capabilities: stunning detail, but too brittle for anything other than prototypes. Early "standard" resins earned that reputation, but engineering resins are a different story. Formulated specifically for functional use, they bring impact resistance and flexibility that make them viable for end-use parts and fiberglass tooling. Resin's genuine advantage over filament printing is surface quality; parts come off the printer far smoother, which reduces post-processing labor for cosmetic or fiberglass mold parts.

For filament and resin technologies, printer size is less of a limitation than it initially seems. Your printer's maximum print dimensions needn't be as large as the part you are planning to print. Large molds and end-use parts can be split across multiple prints and assembled afterward, opening applications well beyond what the build plate would suggest.

Most people's first association with 3D printing is prototyping—and that's a fair starting point. A quick mockup is still one of the most effective ways to validate fit, test ergonomics, and make confident design decisions. Holding something in your hand that previously existed only in a CAD file



***Left**—A range of filament-printed parts; this type of 3D printing can support quantities of repeated-use parts without big upfront costs. **Top**—ASA filament-printed insulators, UV-resistant, tough, and ready for use with no post-processing. **Above**—Upholstery-wrapped helm brows are another example of repeat-use parts ideal for the 3D option.*

has a way of revealing problems that didn't appear on the screen. But for boatbuilders, the more meaningful gains come when printing moves out of the design office and onto the shop floor.

End-Use Parts

End-use 3D-printed parts make the most sense when they reflect the realities of boatbuilding: low volume and high variation. Even production boats have multiple unique details specific to each model or individual order. Material cost rarely matters here. The real pain builders face is lead time, minimum order quantities, and parts that show up just a little bit off dimensionally.

The most natural place for a builder to start is functional components such as mounts, brackets, angled shims, and spacers. These parts work particularly well in mechanical spaces where function matters more than appearance. Printed in ASA straight off a filament printer, they're UV-resistant, tough, and ready for a marine environment without any post-processing. And because you're designing the part anyway, details like labels and countersinks can be printed in with no downside—features that would require additional operations with any other manufacturing method.

For parts that repeat across builds, filament printing can support useful quantities without the upfront investment or minimum orders that come with injection molding, and the design is never "locked in" as it is with an expensive mold. If an installer finds a clearance issue or suggests an improvement, the model gets revised and the updated part is ready for the next install. That kind of iteration is slow and expensive in traditional manufacturing. With printing, it's just an average Tuesday.

Cosmetic components are also practical in boatbuilding precisely because volumes are low. If a one-off or option-specific detail needs to look intentional, printing is a reasonable path. Filament and resin parts can be finished like any other substrate, sanded, primed, and painted to match surrounding surfaces. You can also have them wrapped in fabric or stitched upholstery, which looks fantastic.

For a single boat, fabricating a custom part with traditional methods can be hard

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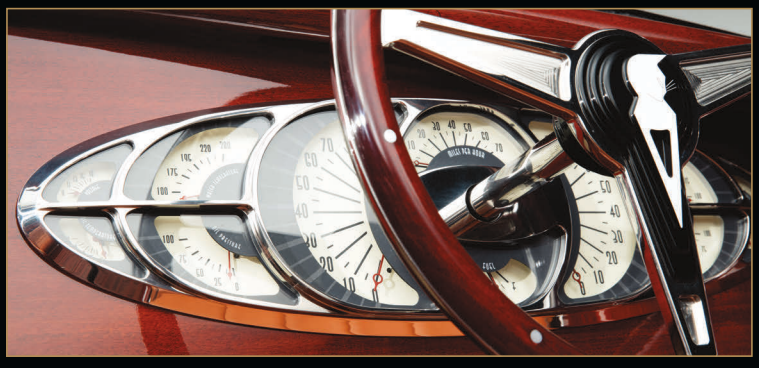

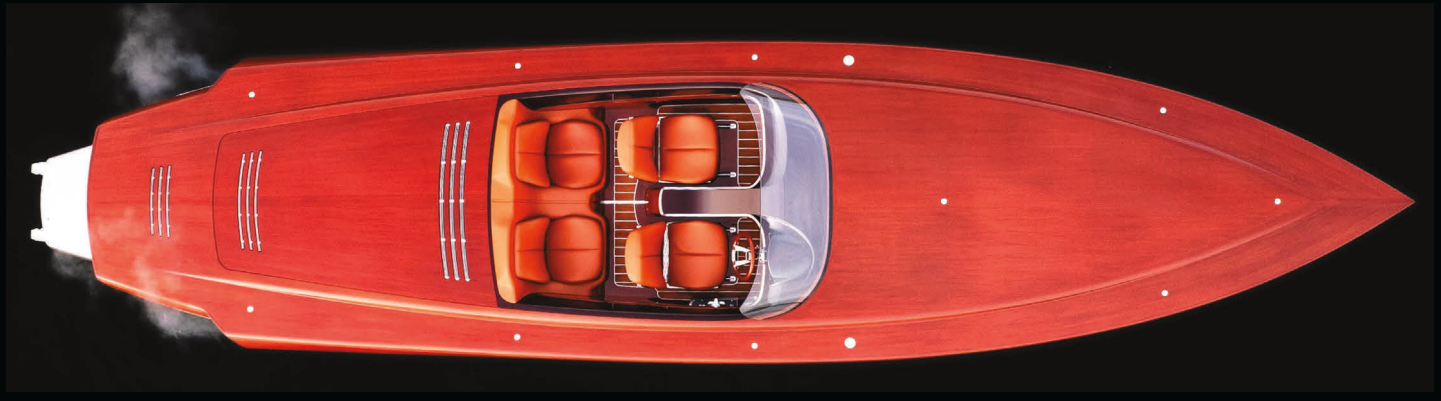

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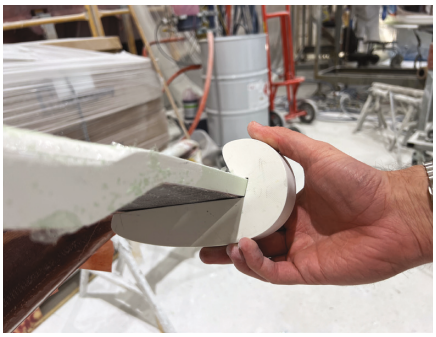

***Clockwise from right**—A cut template for anchor hardware; a helm pod drill template; and a fiberglass thickness template. 3D-printed templates like these speed up the typically repetitious and slow work of locating hardware on soft edges and mirroring operations across port and starboard.*

to justify. With a good printer and a skilled in-house technician, that same part gets designed and produced in the same week, if not the same day.

Templates and Fixtures

In my experience, the one category where 3D printing pays for itself fastest is in producing templates and fixtures. Boatbuilding routinely demands measuring off soft edges, locating hardware on curved surfaces, and repeating mirrored operations across port and starboard. Even done carefully, it's slow

work, and the outcome depends on who's doing it. With a 3D printer in the shop, a template can be designed in a few hours, printed for a few dollars of material, and reused every time that option comes up.

In practice, the most useful printed templates fall into a few recurring types. Cut templates handle openings in difficult geometry such as vents, drains, lights, and hardware pockets. Drill guides use bushings to control hole location and keep bits square, or intentionally angled. Locating fixtures index off nearby features to consistently place hardware or mold inserts without measuring. And for fiberglass work specifically, trim and thickness guides take the guesswork out of flange trimming after demolding and confirming laminate buildup to a target thickness.

Having the ability to create these specialized tools in house quickly becomes a natural part of problem solving and error prevention in boat production.

Fiberglass Tooling and Molds

For most builders, fiberglass tooling is outsourced. Molds get built by outside vendors, and any modification—a missed detail, a recess that only became obvious after the first build—means hand- or CNC-cut inserts, pulling the mold from production, or another call to the tooling vendor. Tying up a mold for rework has a real production cost that usually is enough to delay the fix indefinitely, which leads to inefficient or less than ideal workarounds becoming standard to the build. Now you cut and patch the finished part every time until someone decides the disruption is worth fixing.

3D printing can break that cycle. Once you can print a tool overnight and install it in a mold by morning, the fix becomes easier than the workaround, and a better boat is the result.

At Viking, this has become one of the most powerful applications of 3D printing in our plant, and it goes well beyond mold modifications. We directly print small production molds for parts like light housings. For parts with negative draft that won't release from a hard mold, we print the pattern and pour a flexible rubber mold. The range of what's possible keeps expanding the more you use it.

Part of that expansion is making practical what wasn't before, such as mold inserts for rarely ordered options and one-off customer requests. The tooling investment for a detail you might build twice a year has always been hard to swallow, but low print cost and fast turnaround changes that. The insert is printed, installed into the mold for that build, and the detail comes out right the first time.

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Cutting and patching a part to accommodate the option gets the job done, but a designed mold-insert is intentional by nature, and that shows in the finished product.

Filament and resin printing work well for fiberglass tooling, but they follow different finishing paths. Filament-printed parts require more work, though how much depends entirely on the application. A one-off insert can be paste-waxed straight off the printer and put to work. A long-running production tool might warrant the full process of sanding the layer lines, priming, spraying tooling gelcoat, and polishing to a mold-ready finish. Most applications fall somewhere in between. You take it as far as the part demands.

For resin-printed parts, after a quick clean and UV post-cure, they come off the printer smooth enough that a light sanding and 10-20 minutes of polishing is typically all they need before applying mold release. Reductions in finishing time and labor have made resin printing my default for tooling.

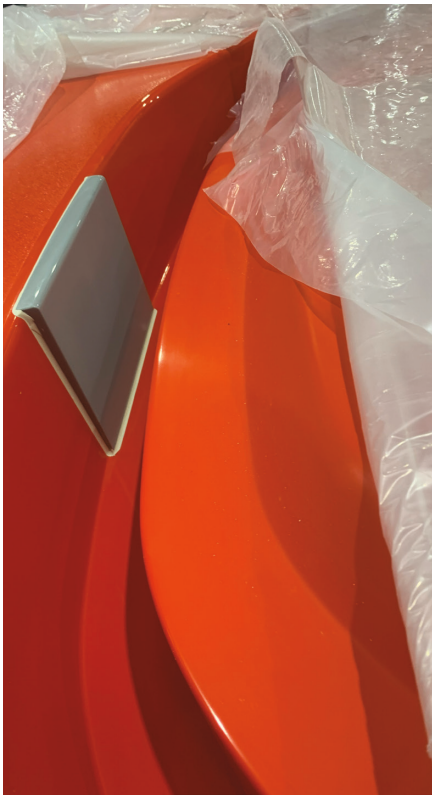
Bringing 3D Printing into Your Facility

As you strategize whether to invest in 3D printing capacity for your shop, remember the goal isn't to buy a machine—it's to grow a new capability, and how you structure that in your company matters as much as which printer you choose. In my experience, the most effective path is a dedicated person who will "own" the technology, someone with hands-on printing experience, CAD skills, and genuine curiosity about ways to improve your boats. Treat it as a full-time role, not a side task. If it's not realistic to find a skilled 3D-printing technician from outside, grow a champion from within—look for the tinkerer who already has a printer at home, and make additive manufacturing a formal part of their role with protected time and leadership support.

I may be biased here, but to maximize the value with 3D printing, I don't recommend placing a communal printer in the engineering department. Without a named champion and protected time, the printer becomes a novelty instead of a capability. The usefulness usually stalls at prototype prints and maybe the occasional template. And end-use parts, when they appear, tend to have questionable strength or be cosmetically rough. Those are things a skilled additive-manufacturing employee would tweak for strength, tolerance, finish, and print speed. Without ownership, there's no one overseeing project intake, no extensive post-processing SOPs, and no one identifying new uses for the technology you've invested in. However, if you're forced to choose between no printer and a communal printer, get the printer. Once it's on site, it'll likely attract the attention of your latent in-house 3D printing champion.

Boatbuilding remains a craft industry. Hands, eyes, and judgment still matter most. 3D printing doesn't change that. It lowers the barrier to executing some

***Left**—The toe kick recess needed around a livewell fitting in this Viking deck part wasn't included in the original tooling.*
***Right**—The gray 3D-printed insert was printed, prepped, and installed in the tooling to produce this variation.*



essential craft decisions consistently, even as boats grow more complex. The value isn't found in any one part or tool. It comes from the shift in mindset as you look at your operation and apply the technology where it has the most impact. PBB

***About the Author**: Winston Zeberlein is an engineering professional with more than a decade of experience in additive manufacturing and a lifelong passion for advanced production technologies. He specializes in applying innovative manufacturing methods to streamline workflows, improve efficiency, and solve complex industrial challenges. He led Viking Yachts' development and expansion of the company's 3D printing capabilities, and his work now include process automation, manufacturing optimization, and new product development, helping drive innovation across the organization.*

***Left**—DIrectly printing small production molds for parts like this light housing has become common at Viking. **Above**—These filament-printed patterns for a rubber mold will yield parts with shapes that couldn't be created with traditional FRP molds.*

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BY AARON PORTER

The helm station and illuminated bow compartment on Victoria Z, *a 35' (10.6m) Michael Peters-designed stepped-vee ventilated tunnel (SVVT) speedboat typifies Van Dam's equal attention to details in the boat's flawless finished exterior and the exposed interior hull structure.*

PHOTO COURTESY VAN DAM

If you haven't heard of Van Dam Custom Boats (Boyne City, Michigan) before now, feel no shame. It's a company that eschews the modern mercantile tactic of puffing up a brand name to carry the company reputation to hordes of people who have never seen the actual product. For the name to mean anything, you need to actually encounter the boats and the people who create them. With just 66 hulls built since Steve and Jean Van Dam founded the company in 1977, chances are slim you've ever run across one of them in the wild.

Before visiting the shop last February, I'd seen their work pictured in a few specialty magazines. I got to know Steve and Jean's son and current company president, Ben Van Dam, at IBEX and while serving on a boatbuilding school advisory panel. We'd talked about projects, materials, and the vagaries of running a small custom boat shop in the 21st century, but Ben's unerring modesty about his yard left me unprepared for what I found in Boyne City.

Financial expedience dictates that, like most comfortable middle-class Americans, I am not a regular consumer of bespoke luxury goods. Sure, we all might have a few mass-produced luxe branded trinkets in a closet, or some custom furniture or even small boats made by talented friends, but we possess very few items of truly extraordinary quality, and none of us suffers for the lack. To be blunt, today's Van Dam boats are not built for us, but they are built by people like you and me to meet the expectations of those who can afford to aspire to near perfection in a one-of-a-kind boat of their imagining.

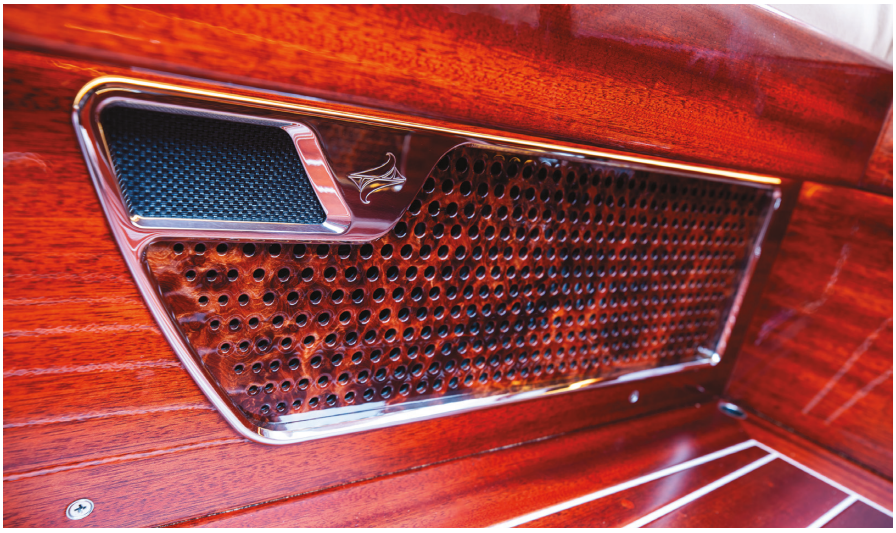
The Van Dam palette comprises exotic smooth and figured woods, soft textured leather, etched metalwork, graceful curves, and flawless clear and opaque coatings. Each project is defined by personal expectations, materials, finishes, and custom machining I'm accustomed to finding exclusively in superyacht yards. But instead of 300-footers, Van Dam boats average in the 40-foot (12.1m) range.

The snow-covered winter roads I navigated through Boyne City, a city of 4,000 on the shores of frozen Lake Charlevoix, were a reminder that we're not in Viareggio or Fort Lauderdale. But Van Dam's tidy industrial headquarters wouldn't be out of place in any superyacht haven. Lobby and conference-room furnishings showcase the company's joinery and finish, shelves hold samples of custom hardware, and the walls a tempting gallery of boat photos—all Van Dam builds. Looking at them, I had an inkling of what prospective clients experience when they walk through the doors full of hopes and inspiration and a nagging question as to whether these people can build the boat they are dreaming of. The gallery puts their minds at ease.

Van Dam Design Experience

"They come to us because they want a boat built by us," Ben says. "But we're not an everyday brand." The company counts on word-of-mouth owner references and the boats themselves to find new clients. However, this is not a process that starts with an existing model Van Dam just stretched or tweaked into a slight variation thereby minimizing risk, design work, and innovation. Indeed, one of the company's selling points is assurance that every boat is built to a client's specifications and taste and that they won't build the same model for anyone else—guaranteed unique.

So, after determining the basic use case for the new design, prospects bring pictures of boats they like, accounts of experiences on boats they didn't like—bad sight lines, balky steering, lack of cupholders—and some design elements from cars or houses they want to replicate. They assemble mood boards of stylistic elements, things clients admire, things that excite them. "We've literally gotten a picture of the Batmobile illustrating an element they prefer on the dash," Ben recalls. These drips of information and inspiration all narrow the focus.



***Top**—From astern,* Victoria Z *is a showcase of molded wood curves and custom metalwork including the twin gunmetal finish outboard rudders and stainless spoon exhausts.*
***Above**—This figured redwood burl set in stainless trim is a recurring visual theme on the new 26' (7.9m) bowrider* Arline.

This first stage, paid for at a flat fee, seems as much psychotherapy as boatbuilding. Ben says the hard work is learning to listen and making sure the owner's wishes are clear before you start designing a boat, and then to not hijack the process in the shop once the design and build are under way.

"It's our job to understand what the customer is trying to create. It's our job to figure out what that boat is," Ben says.

A glance at the photo gallery confirms that there isn't really a Van Dam type. Ben credits the quirkiness and diversity of customer preferences with driving the shop outside of a comfortable steady diet of classic runabouts or the sailboats that defined some of their early projects.

It takes between two months and a year of regular or sporadic consulting to complete a concept design—plan and profile sketches and color renderings. By then, everyone has a good sense of what the boat will look like.

"That experience becomes a big chunk of what they are excited about," Ben says.

The next stage involves a project manager and relevant in-house specialists weighing in on how some of the design ideas could be

PHOTOS COURTESY VAN DAM

The helm and cockpit of the 30' (9.1m) runabout* Catnip *reflect her owner's passion for Art Deco styling in the trim, custom instrument panel, and banjo steering wheel, all built in house.

executed. It's also when clients sign a design and build contract.

"Usually by the time they get here, they've emotionally made up their minds," Ben says.

Refining shapes and modeling structures is high-stakes work, and while Ben and Thomas Motyka are degreed in-house naval architects, this is when they engage an outside naval architect if necessary. Especially for high-speed, high-performance boats Ben embraces working with experienced specialists like Michael Peters Yacht Design in Sarasota, Florida, and DLBA Naval Architects of Chesapeake, Virginia.

"That has proven to be a healthy thing," Ben says. Relying on Peters' or DLBA's offices for design and engineering especially with stepped hulls is a practice that protects and prods the Van Dam crew. Ben points to the 1998 build of the Peters-designed *Alpha Z*, a 33' (10m) stepped-hull, 805-hp surface-drive runabout, as a build that pushed the shop to a higher level of quality, innovation, and performance.

"Michael Peters took us up to another level," Steve recalls. "Complexity of design, the engineering of mechanical systems, the drive system, the style, the degree of perfection that was asked for, even the kind of finishes used. It wasn't going to be brushed varnish."

"It's the epitome of timelessness." Ben says. "That boat is still cool in 2026. It changed the trajectory of our business."

Alpha Z was also the last boat they lofted manually, Ben recalls. Now he and Motyka, who graduated from Webb in early 2025, rely on 3D modeling in the Van Dam design office where they primarily support whatever build is under way, producing detailed drawings to move the design into reality. Motyka contrasts his work at Van Dam with experience designing for production builders: "Here ergonomics and style can fully drive how we're going to build something, as opposed to having manufacturing driving it…where the angle of every single face is determined by that."

Freedom from the tyranny of mold draft angles is one of the essential differences that defines the look and style of a Van Dam. Indeed, the boats are devoid of the hallmarks of production manufacturing—flat expanses of white gelcoat, off-the-shelf electrical panels, throttle controls, or through-hull hardware. The tradeoff is that every defining custom-carved dash, fabricated helm seat, or popup cleat is a time sink.

A Brief History

Behind the business and design offices is the main build hall comprising three 80' (24.3m) bays, where Ben introduces me to Thor Purinton, who's fitting the wood armrests to polished stainless upright supports for seats on the new 26' (7.9m) bowrider *Arline*. Nearby, sculpted dashboard panels of redwood burl are being fitted to custom stainless elements. It's all fussy work with very expensive materials. Purinton, a 2002 graduate of the small boats program at the recently defunct Landing School (Arundel, Maine), has worked at Van Dam for 23 years. On top of superlative boatbuilding and joinery skills one co-worker describes as "insane," he has become the company's CAN bus expert designing, installing,

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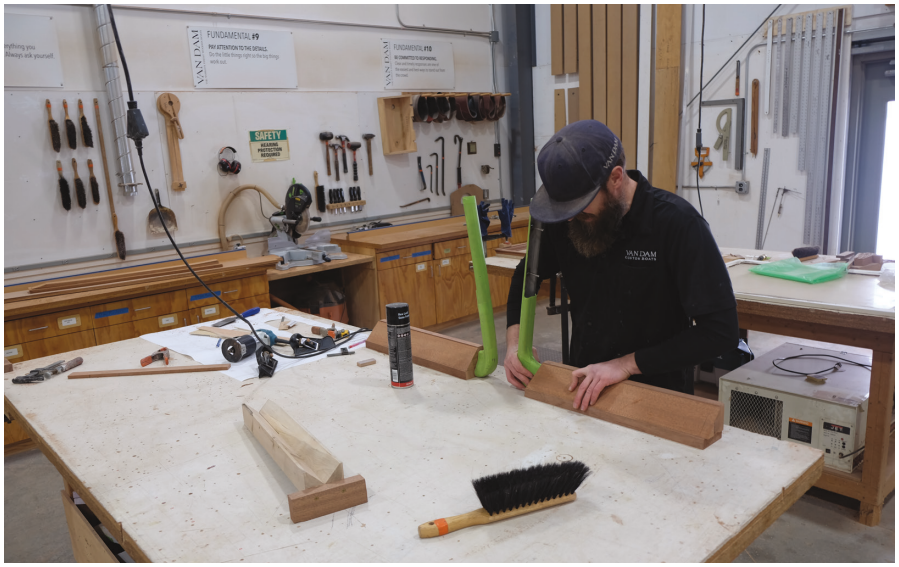


Thor Purinton assembles intricate wood and stainless armrests for* Arline *in the main build hall.

programming, and troubleshooting complex digital switching systems.

"I get bored very easily," Purinton explains. "Variety is what keeps me coming back." That's a common sentiment in this custom shop's staff of 25.

"If we had to do the same thing over and over again, I'd probably lose half the crew," says Ben. "It's just not how we're wired."

The company has always focused on solving boatbuilding problems rather than optimizing production manufacturing processes. Steve, who received the bulk of his boatbuilding education in four years working under legendary builder Vic Carpenter in Port McNicoll, Ontario, was an early proponent of wood/epoxy construction. While most builders in the 1970s were embracing molded fiberglass, and consumers were leery of wood's reputation for rot, Steve Van Dam opened his doors in the resort town of Harbor Springs, Michigan, to build custom boats in multiple layers of epoxy-saturated wood veneers. In that simple shop with a table saw, bandsaw, and planer, Steve and Jean built their first commissioned boat, the 30' (9.1m) double-ended cutter *Silvan*, which launched in 1980 and is now back in the Van Dam service fleet 46 years later.

While some early wood/epoxy boats suffered from water intrusion and rot, Van Dam boats, by and large, did not. As a foil to any concern clients may have about the material integrity of wood structures, the yard still offers what Ben describes as "a lifetime warranty against rot and leaks in anything we built." That's contingent on annual inspections and execution of necessary repairs.

Early builds featured a few custom powerboats and numerous sailboats including competitive racing models, but by the late 1980s, a few custom powerboats were introduced "and suddenly it was all powerboats," Steve says. Van Dam became known for building classic looking speedboats, all varnish and gleaming metal cutwaters, but with the structural advantages of wood/epoxy construction.

In 1991, a distressed boatyard property of 16 acres, three buildings, and a hoist well on the Boyne City waterfront became available. Steve and Jean pounced, recognizing the value of having a footprint on the water and the possibility of adding a service yard to their operation.

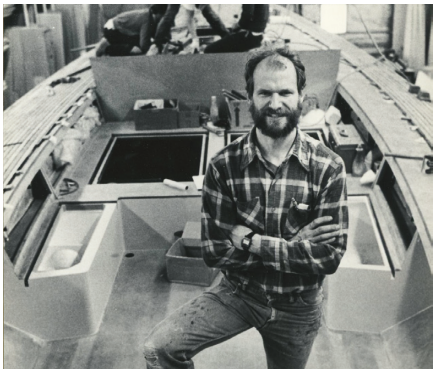
"It took us a little while to figure out why we should be excited about the service business," Ben concedes. But now they store about 220 boats in five storage buildings. Their own builds comprise 30% of the fleet cared for by the 12 employees of their independently operated Boyne Boat Yard.

Through the '90s and aughts, an elegant series of classic powerboats, quotations of mid-20th-century barrel-backed runabouts, gentleman's racers, limousine launches, and modern sport cruisers flowed out of the Boyne City shop.

Chad James, a 32-year veteran of the yard and a regular build team leader, describes the evolution of building through those years as constantly embracing greater complexity. He says simple plans and profiles fitted inside, with boxes of different shapes and some seats attached to them, constituted the design information for early boats. Now, there's a lot more focus on the intricacies of the helm stations, and the seating itself isn't just bench seating; there's custom-shaped foam, and the bases are decorative with stainless steel inlays. Structural and aesthetic elements tie into one another.

"As you get that elaborate, the design has to ramp up as well," James says. "We want to proof the ergonomics, we want to proof everything, so we build these CNC-cut, full-size mockups and bring the customers in, sit them in the seats, and evaluate every aspect of that station and make adjustments."

The cold-molded hull structures have become more complex as well, sometimes including a layer of carbon fiber.



Top*—*The first commissioned build to emerge from Steve and Jean Van Dam's Harbor Springs, Michigan, shop in 1980 was the 30' (9.1m) cutter* Silvan. ***Above*—*Steve Van Dam made an early commitment to wood composite construction at a time when fiberglass dominated production boatbuilding.

PHOTOS (TOP TO BOTTOM) AARON PORTER, COURTESY VAN DAM

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The Van Dam crew builds stiff monocoque hulls by gluing up multiple layers of diagonal fir, spruce, and mahogany planks set in epoxy. Note that the thin planks are all book matched on the port and starboard sides.

"The times we've done carbon layup, we haven't really fallen in love with it," Ben says. Wood remains their material of choice for hulls and decks, ranging from Sitka spruce, Douglas fir, and Alaskan yellow cedar to multiple mahogany varieties and teak.

James recalls that in the 1990s, Steve would buy pattern-grade Honduras mahogany as four-quarter stock, and they'd have it re-sawn and dressed to ¼" planking in matched pairs. Today they buy full trees, usually of sipo mahogany, and have it milled to their specifications and re-saw it in house.

"The boats are book matched," Ben says describing the hull construction. "All the planking on the starboard side is exactly the same as the port." Building this visual and structural mirror image requires meticulous logistical recordkeeping.

"We've got to document each bit of lumber that comes out of the rack and label it, so when you cut it you still have a label on the cutoff that says where that board was used and its orientation in the boat," James explains.

Wood for a given build is kept in containers off the shop floor and moved to racks and mobile carts in the build hall when needed. That includes special decorative varieties like that redwood burl I see throughout *Arline*.

The Finish Shop

We catch up with the new build as she's being readied for final clear coating by Trevor Brazell, who leads Van Dam's paint and finish shop. He says the company moved away from using strictly marine finishes about 10 years ago. They weren't happy with the customer service from some manufacturers, and then automotive coatings specialists Glasurit approached them about trying a sprayed clear coat. The results speak for themselves. The gloss finishes I see, even on older Van Dam

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builds in the storage buildings, are flawless. Brazell assures me the shop still offers conventional marine paint and varnish as well.

While he praises the Glasurit for durability, acceptable finish right off the gun, and ability to be cut and polished, Brazell gives a lot of the credit to the crews who fair and prep the surface before and between finish coats. He makes sure their attention to detail is obsessive.

"There's a lot of dirty work behind the scenes," Brazell says. "And they have a sanding block in their hand every day."

The finish shop is about more than just smooth, clear coatings. Ben explains how they painted an Escheresque fading geometric pattern on the bottom of the 30' (9.1m) 2024 runabout *5-Star*, creating a unique visual transition from a black painted bottom to her wood topsides.

On *Arline*, he shows me a decorative motif from the owner's former yacht that reads as a

PHOTOS COURTESY VAN DAM

In a shop where varnished finish perfection is standard, fairing and sanding are high-stakes processes with no room for error.

mirage-like shape that will show up when the light hits the varnish of his new boat at the right angle. Inspection of *Arline*'s engineroom confirms the Van Dam point of pride that all interior surfaces, including those in mechanical and service spaces, are beautifully finished even if they're rarely seen.

This decorative motif being set in* Arline's *bright finished woodwork will be visible when the light hits it right.

Metal and Machine Shop

A factor that sets Van Dam apart is its custom hardware and fabricated metalwork. It wasn't always that way. Until the early aughts there was just a small room equipped with a lathe, a welder, and a grinder. Then Jesse Brown joined the company fresh out of the Landing School in 2002. With some prior machining experience, he saw what a better metal shop could mean for the yard. He advocated for a Bridgeport, a bigger lathe, and eventually a CNC machine, all of which is there on the day we visit Brown and technician Kate Brandsma as they finish some custom popup cleats, add cavitation plates to a stainless rudder, and rough out some hinge parts.

"We've gone from super simple bracketry and cutwaters—now it's almost everything," Brown says. "We buy very little off-the-shelf hardware because we're able to make whatever we need."

"I think it gives us that much more creativity and freedom," Ben says. They're no longer constrained by subpar off-the-shelf solutions, which is particularly important as the boats become more complex and personalized.

"Today we're machining every individual button that you press," Steve says with equal parts wonder and admiration.

Ben shows me a sample of the portlights created for the 44' (13.4m) Stephens Waring-designed sloop *Italmas*, built in 2019. He says all readily available portlights suffered from poorly polished castings with a rippled finish and screens held in by "a big, awful gasket." The custom opening portlights with fitted screens they built in house were CNC cut, fabricated, polished, and fitted with cam closures, not twist locks.

The custom throttle and shifter fabricated for *5-Star* highlight the shop's ability to customize and incorporate existing tech when necessary. The functionality comes from standard Glendinning engine controls, which pair well with the

PHOTO AARON PORTER

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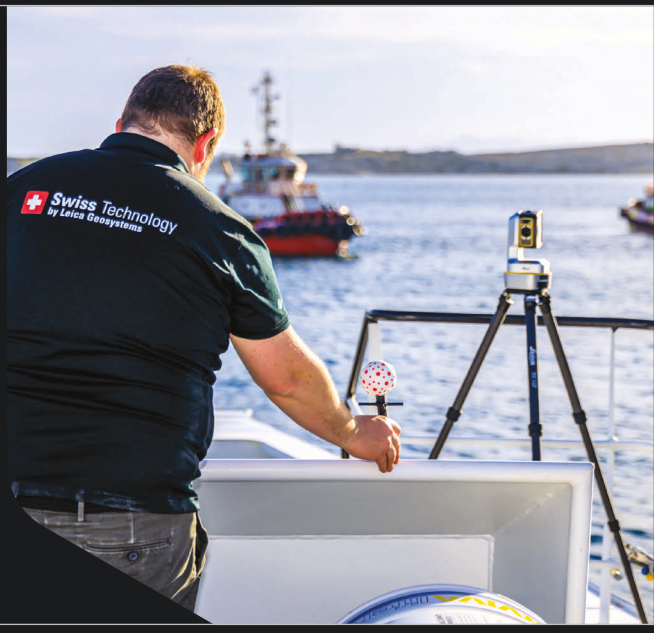

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One of Catnip*'s rudders, originally CNC-cut from a billet of stainless, in the metal shop for fine tuning.*

boat's Ilmor engines, but the visible and tactile levers and surfaces are all Van Dam custom wood and metal.

Succession and Future

Custom yards often suffer as their founders age and markets evolve. Not so Van Dam. Steve and Jean knew they'd need to pass yard management off to someone eventually but insisted that Ben go to college before he decided to settle in at the company for the long haul.

There was little doubt about the future in Ben's mind. He graduated from University of Michigan's naval architecture program in 2005, drafted a succession plan with his parents, dove back into the build shop, was named company president in 2016, and, with his wife Erika, took ownership of the yard in 2020, following a protracted planned buyout of his parents. Today, he and Erika, who worked running a public health organization until five years ago, share management responsibilities at Van Dam. He oversees the shop and build operations, while she handles the business office, forecasting, HR, and bookkeeping. Ben says his last hands-on project as a build leader was *Victoria Z*, a 35' (10.6m) Michael Peters-designed stepped-vee ventilated

Kate Brandsma drilling out some custom hinge parts. Almost all hardware is now made in house at Van Dam.

PHOTOS AARON PORTER

***Above**—The comfortable, well-lit interior of the 44' (13.4m) Stephens Waring-designed sloop* Italmas *is typical of the yard's cruising sailboats. Note the custom opening portlights.* ***Right**—Erika and Ben Van Dam.*

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tunnel (SVVT) speedboat launched in 2025. There are days when he misses it.

Their challenges will be familiar to any boatbuilder in 2026: how to implement strategic measures with a small team, employee recruitment and retention, affordable housing, cost and sourcing of materials, market dynamics, client expectations…

Van Dam has been an open-book company since 2012. That, coupled with profit sharing, means employees are informed and invested in overall performance. The number of 20- and 30-year employees I met tells me something about the steadiness of the workplace and company culture. Ben and Erika say recruitment is a mix of prospecting from boatbuilding schools like the Marine Trades Institute (Cedarville, Michigan), promising high school graduates, and skilled workers from related trades looking for a challenge. Working interviews are mandatory.

They agree that intelligence and fitting into the company culture are as important as specific skills, and complacency isn't part of the company culture. There will be problems to solve every day, and collaboration is not optional. When it comes to workforce, "subpar won't do. We're just driving too hard," Ben says. "We couldn't build a 30-footer for the same labor hours we build one for 20 years ago because we're focusing now on a higher bar."

As those build standards have risen, so have the dreams and expectations of the average Van Dam client. Which rose first? Who knows. What's obvious when you look at the historical builds is the newest boats consistently define the next level, and the trajectory is always up. PBB

***About the Author**: Aaron Porter is editor of* Professional BoatBuilder *magazine.*

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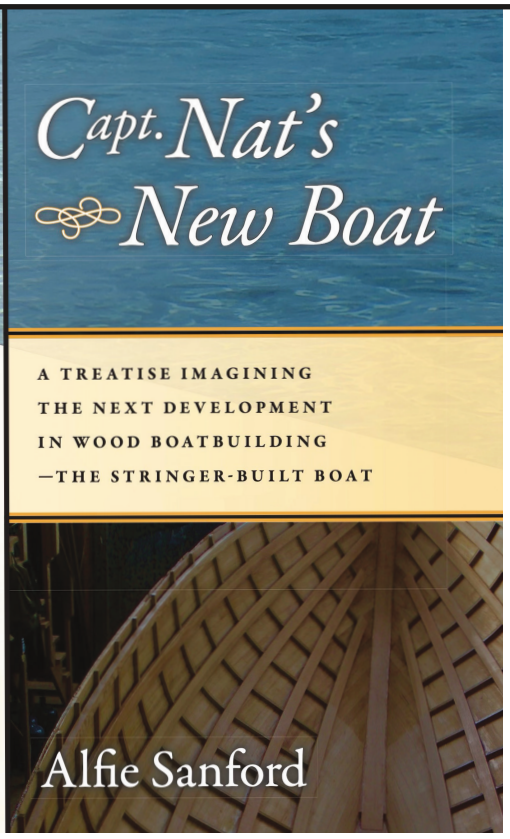


The Stringer-Built Boat

A new book from longtime sailor and builder Alfie Sanford details a fresh technique for efficient wood boat construction.

TEXT AND GRAPHICS BY LAURIE MCGOWAN

Five years ago, I completed a review for *WoodenBoat* magazine of Alfie Sanford's boatbuilding book *Wooden Boats for Blue Water Sailors—Philosophy on Sailing, Design, and Construction*, and was impressed with how well he explained with text, photos, and excellent drawings the concepts he'd brought to life over 45 years of modern wooden boatbuilding. These include the timeless Alerion Class sloops, composite replicas of N.G. Herreshoff's final personal sailboat that remain competitive on racecourses today and are collectors' items. He also designed and built two other proof-of-concept cruising boats. Sanford's efficient, elegant, and strong construction solutions are time- and material-savers, and it gave me hope for, especially, custom boatbuilding shops who might use these methods.

At the time, I thought *Wooden Boats for Bluewater Sailors* was a lacking in one area—an equally good method of finishing the interior after the hull is flipped upright. Because finishing the boat may total up to 60% of the building costs, it's a perfect target for a breakthrough in build efficiency.

Now comes Sanford's latest book outlining his newest technique, which solves this conundrum: *Capt. Nat's New Boat: A Treatise Imagining the Next Development in Wood Boatbuilding—the Stringer-Built Boat*.

When Sanford asked for some help illustrating this book, I quickly realized it may indeed help shops survive and ultimately keep people working and sailing (or motoring). This construction is suitable for traditional sail and powerboat shapes and is equally suited for lighter canoe body type hulls—or those that don't have a full, or built-down, keel. The savings should work correspondingly well for one-off builders, and amateurs even though homebuilders are not as likely to be as process-minded as professional shops.

This book is all about process, sequence, and efficiency, with the help of CAD design and CNC milling—how you can take the same materials that are in that boat over there, and make this boat stronger, lighter, and quicker to build.

The new book starts with a lighthearted imagined cast of angels in heaven led by a "history angel," plus "a chorus of sailors past" conversing with preeminent yacht designer, Nathanael Greene Herreshoff, who declares, "I want for a new boat!" After admitting that, sure, he and his brother, John Brown (J.B.) designed and built some of the best yachts in history, he acknowledges that those boats just didn't last and required incredible crews and materials to build them. Today he'd use epoxy to hold the wood together and, as he had used on several boats, would construct it around several longitudinal stringers (including those in the main deck), but now placed accurately on a CNC-cut mold of panel material. With that we're off on Sanford's quest for Capt. Nat's boat for the early 21st century, the pretext for his account of developing and refining his preferred build method.

The Third Boat

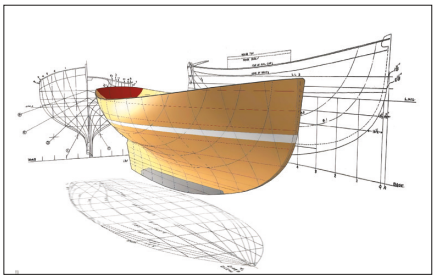
After launching 22 of the Alerion Class Sloops, Sanford built the two larger cruisers to his own designs—the 53' (16.15m) sloop *Fancy* and the 40' (12.19m) yawl *Starry Night*. In these last two, he refined the stringer-built method. His father had taught him that, "It takes three tries to make something new. On the first try you are searching; you know not quite what for. On second effort, you make a pretty nice job of your new idea, and on the third, you perfect it."

Although he proved and learned a lot with the production Alerions, Sanford chose another famous American yacht designer, William Atkin, and his lovely 28' (8.53m) cutter *Fore an' Aft* to illustrate the construction in this book, and I think that this third boat, though imaginary, goes a long way to validate his construction method.

Sanford believes the CAD technician, or "loftsman," who works out the build sequence and defines the parts, is a most important member of the team involved in his method. This person has to take the design ideas and virtually model and assemble the mostly CNC-cut parts that will get puzzled together into the real boat. More forethought needs to go into the process than what is common in modern shops and design offices today, but not a lot.

The stringer-built boat uses a new mold design that greatly simplifies the building of her hull and cabin. By dividing up the hull into three key area molds, Sanford is able to zoom in and show how to explain and simplify each area.

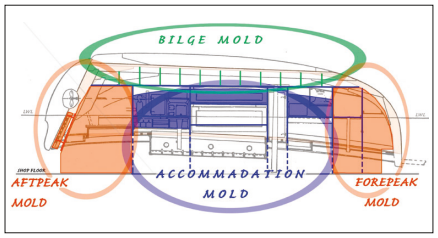
When looking at the setup of the mold, stringers, and frames, one might ask why use stringers, when you could use big, widely spaced laminated frames and bulkheads, plus a thicker hull than what is shown here. This is a common custom construction method, and the hull fairing time required is often monumental. The quick answer is that freestanding frames are hard to form and stringers are easy. The structure of the stringer-built boat is stronger and lighter, and more importantly, is much easier to build.



The hull, based off of William Atkin's 28' cutter Fore an' Aft.

In all, nine innovations are required to create a Sanford-method stringer-built boat:

- **Stringers:** The stringer-built boat begins with the realization that the diagonal layers of a cold-molded shell (some strip planking would work, too) structurally replace traditional frames,



By dividing the build into mold areas, Sanford can zoom in and show how to explain and simplify each one.

leaving the builder free to shape the hull and stiffen its shell with easy-to-form stringers.

- **Accommodation molds**: These position the bulkhead blocks precisely on the stringer, which renders installation of the cabin accommodation almost trivial.
- **Bulkhead blocks**: These join bulkheads and stringers, accommodating the continuously variable angle between the two.
- **Mortise and tenons:** Precisely cut by computer-controlled machinery, these allow quick assembly of the molds without measuring or aligning.
- **Plywood beamshelf:** This joins hull to deck and becomes a landing for decking and fittings while stiffening the hull, especially after it is turned upright. This is a plywood ring around the sheer—including at the stem and transom—joined with puzzle-joints. It may replace quarter knees and breasthook on many boats.
- **Intermittent sheer clamp:** This avoids the need for cutting a long, variable-angle bevel in a full-length sheer clamp. Instead, these are blocks between the frames, against the hull and below the deck, and are easily fit and installed before planking starts.
- **Frame directors:** These precisely form the upper topsides by aligning the sheer-ends of the frames.
- **Stringer landings:** These simply and precisely help form the ends of the stringers.
- **Fiberglass (or Kevlar) taping:** This carries tensile loads around sharp corners. Imagine the strength that long, welded custom metal edges along angled joints would add in the hull-to-deck, or deck-to-deckhouse joints, but replace them with (nonconductive) laminated fiberglass angle, made in-place, and glued to the boat.

The Setup for *Fore An' Aft*

Sanford illustrates how these defining elements come together when he describes the setup and build of *Fore An' Aft*. This excerpt from the book describes it best:

"One day a truck from the cutting shop arrives at the yard with 52 pieces, computer-cut, nested on five or six sheets of plywood. They are:

- 6 bulkhead molds
- 13 bilge molds

- 9 panel molds
- 2 peak molds
- 9 surface molds
- 1 transom mold
- 1 sole mold
- 2 transom radius molds
- 9 sole beam molds

"A couple of craftsmen bring them into the shop and begin to fit them together, self-aligned with their pre-cut mortice and tenon joints. As they go, they hold the pieces together with 2 x 2 cleats, cut to length in the shop. The cleats are glued (white glue) and screwed to one side of the cleat and screwed to the other so that the mold can be taken apart after use for storage and reuse building future hulls.

"They will add to their construction a few specialty pieces made in the shop of solid 2" wood, cut to length and beveled as ordered by the loftsman:

- 7 stringer landings
- 6 stringer blocks on the transom mold
- 32 frame directors

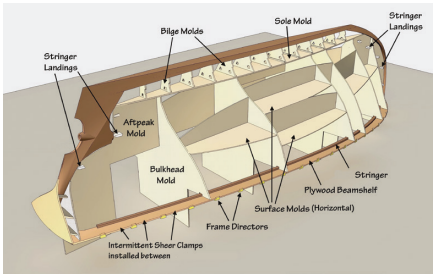
"By the end of a few of days, they have completed a precise, rigid and strong mold ready to accept the structural members of *Fore An' Aft*. The mold has, as you know, many features built into it which will make the building go fast and easy. So now, we start building."

One of the biggest changes is the finished interior, built away from the dust of the hull construction, and quickly and cleanly installed by switching it out with the accommodation mold.

Sanford beautifully prebuilt and finished the interior of *Fancy*, which also served as the building mold. But try as he and the crew might, they couldn't keep the interior clean, and stray epoxy eventually got on many surfaces. Keeping ahead of the blobs of epoxy on a beautifully varnished piece of interior negates the intended efficiency of prefinishing. To avoid that setback, the book specifies that the finished interior stays off the boat for as long as possible—until the main deck and coachroof are to be installed.

Excellent-grade plywood is used for the finished bulkheads and interior furniture. Rail, stiles, and paneling of solid woods can be used to good effect to hide plywood end grain, and the sealed and

View of the molds and plywood beamshelf before stringers are installed.



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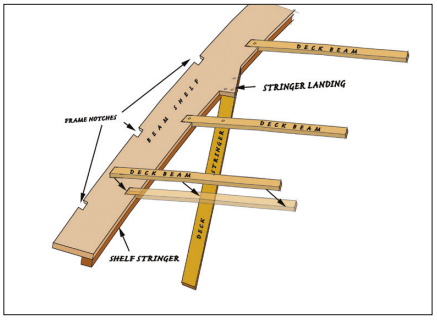

Drawings for the deck framing.

varnished components may be finished in a dust-free space. The tabbed, slotted, and blocked interior molds are unscrewed from the stringers in the boat and are simply replaced with the pre-finished interior accommodations that have compatible tabs, slots, and attachment blocks.

Next comes finishing the deck, cockpit, and trunk cabin. In this stage, the beamshelf is nicely marked and notched for deck stringers and beams, which are quickly installed. Then the main deck and cockpit are installed over them.

The deck edge is an especially busy place, but with forethought and planning, Sanford's method assures there is space for proper waterways, bulwarks, and hardware attachment points.

A New Method for the Sailing Marketplace

Sanford sums up his boatbuilding method: "The superiority of the stringer-built boat lies in its greater longevity and lower cost, achieved without compromise to beauty or strength. The stringer-built boat begins to fulfill the dream of NGH—and most of the rest of us sailors as well.

"The stringer-built boat, though unproven at this point, presents a great opportunity to the small- and medium-sized boatshop. While there is much still to be done—no boat yet has been molded by mortice and tenoned accommodation mold, nor built with a plywood beam shelf or discontinuous sheer clamp—the stringer-built boat, once mastered, will generate a disruptive competitor in the sailing marketplace. It will assure success for builders and satisfaction for their customers."

This book is a labor of love by a man who wants beautifully built boats and the shops that build them to thrive. Sanford is a lifelong sailor and builder of boats in Nantucket, Massachusetts. That experience and his MIT training have helped him create unique boats and building methods. His work may be seen at Sanford Boat Co. Inc. where you can purchase his latest book or download a digital version for a much-reduced price (sanfordboat.com/capt-nat-s-new-boat). PBB

About the Author: *Laurie McGowan runs a full-service boat design office,* McGowan Marine Design Inc.*, in Nova Scotia, Canada, and some of his work may be seen at mcgowanmarinedesign.com.*

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Composing Technician Tests, Building Trust

BY MIKE TELLERIA

My job often scares the daylights out of me. The outfit I work for builds trawler-style boats that owners take all over the world. This always amazes me—not only the daring spirit of adventure it takes to cross oceans in a relatively small vessel, but the enormous trust these owners place in us to safely and comfortably deliver them and their kids, or parents, or friends, or beloved cats or dogs from one continent to another.

Contemplating all that could possibly go wrong keeps me up some nights. But we are a credible builder with a proven process, one that has earned us the trust that makes what we do possible in the first place.

This thought that credibility and trust are deeply connected was top of mind recently as I participated in a weeklong session to review and rewrite the American Boat & Yacht Council (ABYC) Marine Systems Certification exam. I'm embarrassed how ignorant I was of the heavy lifting and effort it takes to create a certification exam and curriculum that ensures a high level of credibility. It's a process that, if done right, yields the commodity valued above all others in the trades—trust. Trust that technicians have the knowledge to understand and work on a consumer product that people routinely trust with their lives and the lives of those most precious to them.

Just as with the standards they produce, ABYC relies heavily on outside expertise to create, review, and revise their certification exams. In this case, the team included four ABYC instructors who routinely teach certification courses. One is Zander Parker, a professor at Maine Maritime Academy; another is Mike Reese, an instructor at Skagit Valley College in Washington; and a third is industry veteran Roger Hellyar-Brook, who developed and taught the marine systems curriculum at The Landing School in Maine. They collectively possess a vast bank of practical technical knowledge from extensive, long-term professional boat service careers and personal experience. The fourth and final instructor was me, the relative newbie. Also in the room were ABYC Lead Instructor Mike Bonicker and Education Director Tim Murphy, each with decades of professional boating industry and technical experience.

The final and most important member of the team was Tina Koeph, a PhD-level psychometrician from the National Occupational Competency Testing Institute (NOCTI). NOCTI has been around since the '60s helping numerous industries develop credible assessment programs—automakers, healthcare, government, legal, manufacturing, etc. And what, you might ask, is a psychometrician? The Google answer is, "A scientist specializing in measuring knowledge, skills, abilities, and personality traits through the development, validation, and analysis of tests and assessments." I prefer the simpler term "test engineer."

Koeph taught us any number of illuminating facts about those A, B, C, D bubble-sheet tests we've all taken, and just how incredibly difficult it is to create a targeted, succinct question with one right and three wrong answers that does a good job of really assessing someone's knowledge. For example, if the "stem" (the question) is long, then it simply takes more time to read through and understand the question. Same goes for the "answer" (the one right answer) and the "distractors" (the three wrong answers). With a total of about 200 questions, overall word count can impact a student's ability to get through the entire exam, so being concise is important.

Answer length is also important. Because one long answer and three short ones usually signals the long one is the correct one, it's important to try and keep them all about the same length.

Research has also found it's best to avoid NOT/EXCEPT and ALL THE ABOVE questions. Some students will read the question, see a correct answer, mark it, and move on, not realizing there are additional correct answers as well as ALL THE ABOVE. The NOT/EXCEPT questions ask the student to pick the one wrong answer out of the bunch. These are easier questions to write because it's easier to come up with three correct answers and one wrong one versus the other way around, but studies have shown these unnecessarily trip students up, especially double negatives with a NOT in the question and a NOT in the answer and distractors (we spent several painful hours unknotting many NO/NOT questions).

Add to that the need to create questions with varying levels of difficulty. Here's where Koeph applies something called Blooms Taxonomy to help us visualize how questions can range from lower-order thinking to higher-order thinking using a pyramid that starts with Remembering at the base then moves up to Understanding, Applying, Analyzing, Evaluating, and, finally, Creating.

Oh, and as much as possible, include some image-based questions to add visual variety to the mix.

That's a lot to keep in mind while trying to review and revise more than 200 questions about pumps, batteries, through-hulls, fuel tanks, and all the other important boat systems components the ABYC Marine Systems Certification exam aims to cover.

By the end of the week, we had overhauled a significant portion of the exam, weeding out almost all of the too-long and NOT/EXCEPT and ALL THE ABOVE questions, replacing them with questions to better reflect current requirements for boats regarding new battery technologies, widespread use of electronic steering, carbon-monoxide and smoke detection, and more.

Next, the test will be sent out for an initial pilot run, then reviewed and updated based on those results. Then, the study guide and other teaching materials will be updated to ensure they adequately cover everything in the exam. Finally, after about a year, the new certification course will be ready.

Test building is a long, painstaking process that goes to the heart of what really matters: credibility and trust. It's something all ABYC-certified technicians and advisors should feel good about—and that goes doubly so for anyone who hires them.

***About the Author**: Mike Telleria is the engineering manager for Pacific Asian Enterprises, builder of Nordhavn Yachts.* PBB

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