DAN SPURR

Small Shop, Large Parts

After years in Florida, boatbuilder Jim Gardiner set up a new shop called Compmillennia in North Carolina, specializing in oversize advanced-composite structures.

by Dan Spurr

***Above**—Gardiner has no fear of large parts; consider this section of a 60' (18.2m) carbon boom that he made in 1992, in South Florida. The job was commissioned for the 151' (46m) sloop* Zeus*, a cold-molded yacht built in Brazil and finished in the U.S. He also built the 177' (54m) mast for* Zeus*. That spar, according to Gardiner, was probably the largest "single composite laminate anything" at the time.*

Eight years ago, Jim and his wife, Ginger, bought nine acres (3.6 hectares) of developed waterfront in Miami, Florida, where they managed a full-service yard. There's not much about boats that Jim Gardiner doesn't know, from wood/epoxy construction to advanced composites. Also in Florida, for example, a few years prior to the Miami yard purchase, he'd built what was then the biggest composite spar in the world, and conceived and produced the highly regarded Egret line of flats boats. Moorage and repair and refit work and custom yacht construction were steady at the new-old Miami yard.

The Gardiners eventually sold the Egret flats-boat business to an individual who wanted to build the boats in North Carolina, Ginger's home state, which she missed. So Jim and Ginger moved to Washington, North Carolina (established in 1776, and the first city named after George Washington), nicely positioned on the Pamlico River where it empties into the sound by the same name. They do there what they've always done: Ginger—who, when they met, was marketing manager for DuPont's Kevlar brand in composite applications—writes for *Composites World* and its sister magazines; and Jim builds boats. At present, make that *parts* of boats.

In *Professional BoatBuilder* No. 47 (June/July 1997), contributing editor/marine surveyor Jonathan Klopman wrote a lengthy profile of Gardiner and the company he then managed, Consolidated Yacht Corp. Below is a summary of Gardiner's early career, followed by a closer look at what he's doing now.

Background

Jim Gardiner was born in Columbus, Ohio, in 1952. His father was a graduate civil engineer; tools and instruction

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Outside Gardiner's Washington, North Carolina, fabrication shop (an industrial building he's recycled), a crane lifts a plywood shipping container with 110′-long (34m) carbon fiber sole beams that will be air-freighted to the United Arab Emirates for installation in a 462′ (141m) former military vessel being converted to a superyacht.

for their use, were freely available to his children. The family owned a summer cottage on Otsego Lake, Michigan, and, of course, there were lake boats—power and sail. As one might expect, the lad began building his own craft—mainly, plywood hydroplanes—and it was not long before he decided that boats would be his life's work. After high school Gardiner got a job with the Henry Boat Co., in Plain City, Ohio, an Amish boat factory that produced 18′ –26′ (5.5m–7.9m) lapstrake plywood powerboats—about 150 a year. There, Gardiner made parts from patterns: keels, frames, and planking. A motor-cycle accident, he admits quietly, brought about a change of plans; upon recovery he took a job building interior components for one of the first coach -conversion companies. Soon, however, he left for the East Coast, where he spent seven months as a volunteer at the Maine Maritime Museum's then-new Apprenticeship program, in Bath, one of only a very few boatbuilding training programs in the country at the time. At Bath he helped construct shop facilities and later a 14′ (4.3m) lapstrake peapod for exhibit at the New York Boat Show, which led to a full-time job with Erik Christensen at the Yacht Haven yard in Stamford Connectcut.

While at Yacht Haven, building a keel for *Accolade*, a Half Tonner designed by Bruce Kirby and built by the Gougeon Brothers' Bay City, Michigan, boatshop, Gardiner "became more aware" of the latter outfit, not only as boatbuilders but as makers of WEST SYSTEM epoxy resin and related supplies. (He says "more" aware because he'd actually been using the Gougeons' epoxy since 1969, while still in high school.)

Work slowed at Yacht Haven, so Gardiner moved again, this time to Bay City, where he spent the next four years with Gougeon Brothers working on projects like: the Two Tonner *Golden Dazy*, which won the Canada Cup in 1975; Olympic-class Tornado catamarans; the C-class catamaran. *Patient Lady III*; and *Rogue Wave*, the 60′ (18.3m) Dick Newick–designed trimaran successfully campaigned by Phil Weld in several offshore races.

Gardiner and Jan Gougeon also made a pact to build two 30′ (9.1m) trimarans and enter them in the 1980 edition of OSTAR, the singlehanded transatlantic race. A principal qualifying requirement for the event: sail 1,500 miles in salt water. So Gardiner moved to Florida in 1977. To pay the bills he took a carpenter's job at Bob Derecktor's yard in Dania and fin—ished the boat in Derecktor's back lot. *Cake Walk*'s wood/epoxy hull, and carbon fiber mast, boom, and rudder, weighed just 1,200 lbs (544 kg) all up.

"I'd never experienced the ocean before moving to Florida," Gardiner says. "I had no clue. But I got a real good lesson sailing my OSTAR quali–fier to Bermuda. Three-quarters of the way there I caught a big storm. A couple of other boats sank. A sea anchor I deployed kept me from flipping. I realized this crossing was a*bad* idea, so I pointed the boat back to the west, and headed for the beach."

Undaunted, Gardiner helped Tom Grossman finish work on *Kriter VII*, a 56′ (17m) Newick-designed trimaran,

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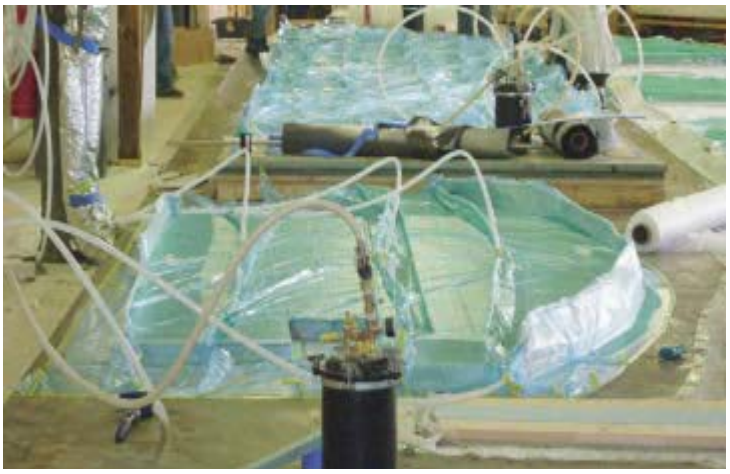
When curing pre-preg parts in a heated mold (shown on page 70), Gardiner monitors the cure cycle according to zone—via temperature data displayed on a PC running Techni-Systems software. Strategically placed thermisters (the sensor in the ***inset*** *photo) collect temperature information from six zones in the mold.*

JIM GARDINER (ALL)



Above left—*A curved structural bulkhead, positioned on its side, is being infused on a one-off plywood mold. The red area is a doorway.* ***Above right—****The crew can infuse one 18′ x 39′ (5.5m x 12m) flat Divinycell-cored panel per day. A Gurit/SP epoxy resin permits compliance with less-stringent fire codes (styrenated resins' flashpoints are too low).* ***Left—****The floor of the lamination room is actually a large (80′/24.4m) heated table for initiating the cure of infused parts. Many parts that Gardiner currently makes are of carbon pre-preg; the material is stored in a refrigerated outbuilding until needed on the shop floor.*

and then sailed with him double handed across the Atlantic to the United Kingdom, where Grossman entered the 1980 OSTAR. Grossman proved to be an excellent mentor for the fledgling ocean voyager, who would return to sail another day.

After a year at the Derecktor yard in Dania, Gardiner hired on with the innovative designer/builder Harry Schoell (originally in Hallandale, later in Fort Lauderdale), who had him build powerboat plugs, working alongside FRP pioneer Troy Wollard (see "First Glass," PBB No. 103). "Harry designed 'em," Gardiner says, "and Troy and I built the wooden plugs. I think the best composite builders—Eric Goetz, Walter Greene, Bob Derecktor—started out in wood because they understand that wood is stronger along the grain; in FRP construction, if you want strength in more than one direction, you have to orient your fibers in those directions."

With Schoell, Gardiner also began building fast motor yachts up to 85′ (26m), constructed of vacuum-bagged cored structures with unidirectional stitched fabrics in vinyl ester resin. "Flash stuff for 1980!" Gardiner says.

By 1985 he had amassed a range of technical knowledge and professsional experience and with that, confidence, and decided to go out on his own, building prototypes for other builders—in their shops.

In 1987 the Luhrs brothers, John and Warren, bought the old DESCO Marine shipyard in St. Augustine, which had specialized in commercial fishing vessels. Bob Hall designed sportfishing boats for the new com- pany called Luhrs, and Gardiner made its plugs and molds.

The OSTAR, however, remained unfinished business. Gardiner still had his trimaran, but decided instead to campaign a wood/epoxy 39′ (11.9m) Ben Lexcen–designed IOR-era monohull. He entered the 1988 event and completed the Plymouth-to-Newport crossing in a very respectable 23 days, 9 hours, 39 minutes. *Celox* finished fifth in class—the second wooden boat and third monohull without water ballast to cross the line.

Back in Florida, Warren Luhrs was in the process of building his second singlehanded ocean racer to compete in the BOC round-the-world event

. That boat, called *Hunter's Child*, would be built in England. When project manager Dick McBride, a Kiwi singlehander, decided to return to New Zealand, Gardiner replaced him to manage the build. (For a featurelength discussion of the design and construction of Luhrs's *Hunter's Child* series of oceangoing raceboats, see PBB No. 53.)

Once that job ended, Gardiner returned to Miami and, in effect, worked out of his truck again, building

plugs and molds. "There were two or three guys in Miami who did the majority of the plug work," he says. "We were a lot cheaper than the dedicated marine-tooling operations, because we didn't have any overhead. The customer would give us a corner in his shop, and away we'd go."

In 1991 Gardiner got a call from John Luhrs, whose friend Irwin Ziggleheim wanted a Tom Fexas designed 103′ (31.4m) motoryacht, in fiberglass. Gardiner leased space from

Derecktor, in Dania, and formed the Consolidated Yacht Corporation to build in the United States what would be called the Norship line of composite yachts. He made a 110′ (34m) plywood mold, with fitted bulkheads and interior panels. The American Bureau of Shipping certified it, and the project cranked up. Then the client died of lung cancer at 56, and the project was shut down. Consolidated Yacht Corporation carried on. In 1992 Gardiner made the 177′ (54m) mast for *Zeus*, a 151′ (46m) cold-molded yacht built in Brazil and finished in space rented from the Dennison yard in Dania. The finished spar was the largest ever made of composites to that time, and arguably the longest single composite laminate "anything."

Egret

Concurrently, Gardiner designed and began producing flats boats under the brand name Egret, some 400 units in all between 1993 and 2003.

Then, after completing more than 2,000 boat and yacht projects and jobs, he sold the assets of Consolidated Yacht Corp., including Egret, to Revenge Marine, along with a contract for the land to operate on. Revenge next bought the assets of Blackfin Yachts—a well-known production builder of sportfishing boats—and soon ran into cash-flow problems. Revenge was gone in a year. So Gardiner bought back Egret and took a purchase option on the property.

The Egret boats were of vinyl ester-with Corecell in the bottom, which Gardiner says required a high level of expertise fitting and laminating, but gave the boat a stiffer bottom and also absorbed "a lot of impact energy." He produced a glass version and a carbon/Kevlar version. A structural liner was bonded to the hull. "We used a Hobie Cat–type hull-to deck joint," he adds. "The hull rolled over and the deck bonded to that. There were no fastenings holding the boat together. Matched molds were made for small parts and the liner, so they were finished on both sides. Besides looking nicer, the smooth gelcoat on the interior surfaces prevented mildew from growing." The yard business started to take off. Gardiner says the company had $75,000 a month in dockage and storage alone. He had two elevators— one at 400 tons and the other at 280 tons, which enabled him to service the 70′ – 20′ (21m –37m) vessel niche-plus two Travelifts, at 70- and 30-ton capacities. The last boat Gardiner built at this yard was a four

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Left—*Gardiner checks one of several vacuum pumps installed on the other side of the lamination room wall. This big pump is kept running until the part gels.*
Right—*Resin pumps, made by Perfect Flow, perform "flawlessly," reports Gardiner.*

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In one of the outbuildings, rolls of fabric are slit to width on this machine.

engine, 50-knot, 85-footer (26m), made with vinyl ester resin and vacuum-bagged. As mentioned earlier, Gardiner sold the Egret boat assets to a person who wanted to relocate the business to Washington, North Carolina, on the condition that Jim help him set up the plant. So in 2006 Jim and Ginger Gardiner moved north.

Big Parts

Upon completing his commitment with Egret in North Carolina, Gardiner set up shop as Compmillennia in an older brick building whose previous tenant had been a Lowe's building supply franchise. As of this writing, Gardiner has a single client that keeps him and 25 employees buzzing every day on a narrow side street in an otherwise quiet Southern town of 10,000. The project: building composite parts for a 462′ (141m) superyacht under construction in Abu Dhabi, United Arab Emirates. Actually, the steel hull already existed and is being converted from a military vessel to a private yacht. Everything from the deck up is composite, however, and much of it originates in Gardiner's North Carolina shop; completed parts are shipped transatlantic out of Wilmington, Norfolk, and New York. The interior structure for this vessel is configured egg-crate style, with soles and partitions inside a composite shell that was made by Vectorworks Marine (Titusville, Florida) and, like all the other parts originating in the U.S., shipped to Abu Dhabi.

When Gardiner built *Zeus* 's mast in 1992, he employed computer software to monitor the cure cycle. "Back then," he says smiling, "the top-of-the line computer was a 386 PC with a 60-megabyte hard drive." For that project, Gardiner called upon a friend who was a retired scientist and programming whiz, to develop the-software. Now Gardiner is running custom software from Techni-Systems (Chelan, Washington) in making the 110′ (34m) carbon fiber sole beams with a low-temperature pre-preg system from Advanced Composite Group

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***Left**—Composite parts for the warship-to-superyacht conversion in Abu Dhabi include a helicopter deck vestibule. The lead carpenter, working on its plug, spent months in the Emirates on the project.*
***Right**—A cured carbon/Divinycell/epoxy section of the helipad is loaded into a semi-truck trailer destined for one of several port cities—Wilmington, Delaware; Norfolk, Virginia; or New York City—from which Gardiner is shipping completed parts overseas.*

(Derbyshire, United Kingdom). The heated mold is divided into six 20' (6m) zones, each with six thermistors (temperature sensors).

To provide manufacturing control, the computer program monitors mold temperature via the thermisters, and what Gardiner calls a "lagging thermister" on top of the part, which must go through the proper cycle. "This way we can control the temperature," Gardiner says. "You don't want 135°F [57°C] if you need 150°F [66°C]." The temperature is ramped up and ramped down over a 24-hour cure cycle; at the target temperature the carbon pre-preg liquefies and consolidates. Gardiner's 120′ multi-zone mold expands 1″ (25mm) during the cure cycle.

He says he could have the Techni-Systems computer automatically adjust temperatures, but he prefers it be done manually, because "then there is an element of discretion involved. Sometimes you want to flag one zone a little higher or lower so that the mold and the part are both in the same range. You don't want a heating element to run away."

During my visit, there were three major components being molded in Gardiner's shop. About a third of the building is walled off and elevated 3′ (0.9m); at one time it was the loading dock for a warehouse. Inside was a flurry of activity. In the front hall was an office with just enough space for Gardiner, his bookkeeper/finances/general-operations manager, Brad Dixon, and a part-time assistant, plus a few staff cutting plywood for the start of a new plug. In the inner chamber were multiple small crews focused on their respective tasks.

At one end of the room was an 80′ (24.4m) heated table, leveled by a trolley a few inches off the concrete shop floor. Underneath that is insulation. The crew was infusing a large flat panel measuring 18′ x 39′ (5.5m x 12m). All work here is with epoxy, chosen for its superior physical properties and long open times. The Gurit/SP (Zürich, Switzerland) Prime 20 epoxy has a flashpoint of 235°F (113°C), compared to polyester's flashpoint of just 80°F (27°C), and so exempts Gardiner's 80-year-old facility from stricter fire codes.

For these flat panels, the skins are infused along with a 30mm–60mm (1.2″–2.4″) Divinycell core. The crew can make one panel a day. While we watched, they crawled about the panel checking for air bubbles that are the telltale sign of any leak in the bag (by Airtech, Huntington Beach, California). On finding a leak, they'd tape it or apply a putty. Two men managed the barrel into which resin was pumped from the storage tank, and from which resin was drawn into the laminate. The pair's assigned task was to open feed lines and make sure the resin barrel didn't run dry. Resin is stored in a nearby 264-gal (1,000-l) tank kept at 85°F (29°C), and pumped via a Perfect Flow resin pump (Rook Metering/Michael Engineering, Mt. Pleasant, Michigan). Resin is tinted yellow; hardener, blue; and the cured product, green.

There are four vacuum pumps, so there's always a backup available in case of a problem. Gardener says his crew runs a 2-hp pump and a 7-hp (1.5-kW and 5-kW) pump on big parts, and keeps the big pump going until the part gels.

At day's end they throw insulation blankets over the laminate to retain heat; maximum temperature is 165°F (74°C). In the morning, when they return, the crew removes the blankets, disconnects the hoses, and transports the panel to a storage area outside. Then they'll start on another. The current non-structural sole Panel order is for 10,760 sq ft (1,000m2), complementing the 10,760 sq ft already delivered. Gardiner says he's achieved savings by handling 100″-wide (2.5m) rolls of material; each weighs 380 lbs to 450 lbs (172 kg to 204 kg). They'removed by grabbing the pipe rollers with tobacco hooks (this is North Carolina, remember!), and lifted by a chain hoist and deposited onto the dispensing carts. A one-man job. Several other crew members were detailing an insert in a large, curved part—15′ (4.6m) long and curving at a right angle upward to roughly 10′ (3m) tall— that incorporates a section of side deck and cabin side. The laminate is multiaxial E-glass with Diab's H-100 core, and Prime 20 epoxy resin dispensed by Pefect Flow pumps, which Gardiner says "have worked flawlessly pumping the 60,000 kg [132,000 lbs] of resin used thus far." Still in the tool-making stage was a third major part: the big vessel's helicopter deck vestibule, a must-have feature, of course aboard any self-respecting superyacht.

What comes after the client in Abu Dhabi? Maybe another project from the same source, but that's over the horizon. Gardiner knows as well as anyone the risks of having all your eggs in one basket. He talks about wind energy and infrastructure. Making composite turbine blades, he says, is quite competitive now, with high risks and low margins. Then again, he muses, maybe he'll take on small-parts manufacturing and repair. More certain is the decision to restart his refit business, reaching out to former clients. "We have the resources and capacity," he says. "We are very versatile." In fact, he presently has a crew in Miami refurbishing Zeus.

Indeed he is versatile. But for right now, one basket is better than none. And fortunately, that basket is…big.