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Custom Carbon Cat Cloth

By [Dan Spurr](#), May 21, 2015

from "Rovings," *Professional BoatBuilder* No. 155

Compiled by Dan Spurr



Courtesy Gold Coast Yachts

The decision to infuse the all-carbon catamaran was made only after three months of panel testing that compared the process to wet-bagging. Prepreg was deemed too expensive.

Gold Coast Yachts (St. Croix, U.S. Virgin Islands), builder of sailing catamarans, started out in 1985 building wood/epoxy boats (see "Their Phone Is Ringing," PBB No. 124). Over the years the company's construction processes have evolved, sequencing through E-glass/foam core/epoxy composite employing wet-vacuum-bagging and resin-infusion processes. This past spring Gold Coast completed construction of a Paul Bieker-designed 53' (16.3m) performance catamaran for private clients in Seattle, Washington. Bieker is well known for designing C-class cats and other high-performance hulls and appendages, such as the foils for the AC72 Oracle Team USA that won the 2013 *America's Cup*.

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For the Gold Coast Yachts project, dubbed B53, carbon reinforcements were supplied by the U.K.-based firm Formax, whose newly appointed director of business development, one-time singlehanded ocean racer Philip Steggall, helped Bieker, Gold Coast, and the client determine the most appropriate construction process. According to Formax, to meet “weight and panel engineering requirements” it was determined that wet-bagging wouldn’t satisfy the specifications; so they turned to infused carbon, but worried that the process would prove tricky, owing to its smaller-diameter fiber that “can pack together more tightly, reducing the permeability of the fabric.” Prepreg carbon was deemed too expensive.

But that decision didn’t come easily. A three-month testing program compared Formax fabrics wet-bagged and infused in test panels. According to Steggall, there were worrisome voids with the wet-bagged panels and a big difference in the fiberglass-to-resin ratio. “The difference between wet-bagging, prepreg, and infusion,” he said, “is that with infusion you’re moving the resin across the surface and it’s very dynamic, and it’s very hard for air bubbles to stay in the laminate. The void content is much lower. Less than 1% for infusion, 3–5% for prepreg, and we’ve seen above 5% with wet-bagging.”

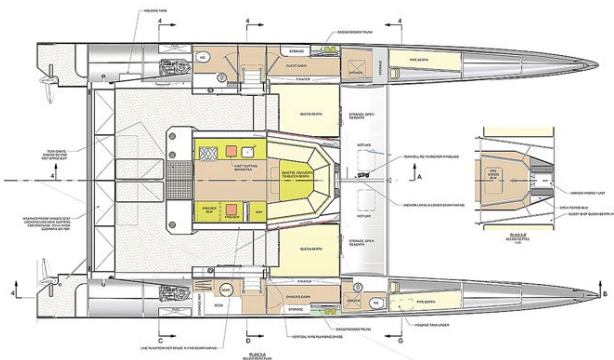
Steggall has become an expert in carbon infusion processes, learning a lot from building his own 48’ (14.6m) high-performance trimaran. “I made all the mistakes,” he said, now confident that he can train others to avoid them.

One key to success is



Courtesy Bieker Boats (both)

The 53.6’ (16.33m) Fūjin has spaceship-like bows, reverse sheer to increase space below, and a much lower profile cabin than many recreational catamarans today.



selecting the right fabric for the job. Steggall says he uses no woven reinforcements, only noncrimp stitched fabrics. He worked with Formax to modify its +45°/–45° biaxial carbon fiber fabrics of 400 g/m² and 300 g/m² (1.4 oz/sq ft and 1 oz/sq ft) and a 0°/90° biaxial of 300 g/m². A nylon microweb (at about 3 g/m² per 100 g/m² of carbon) was stitched between the plies to provide a path for air to escape. This web also increased flexural and compression strength without adding significant weight. In the end, the tests proved that infusion would best meet Bieker’s specifications.

But fabrics are only half the equation. The epoxy resin was supplied by Pro-Set (Bay City, Michigan), a formulation that Steggall says has high modulus and strength. Because epoxy has larger molecules than some other resins, such as vinylester, reducing viscosity was important, preferably with heat rather than additives, which was more easily managed in the warm ambient temperatures of the USVI.

Gold Coast Yachts’ Rich Difede said the Formax fabric allowed his team to “get air out ahead of the resin front, instead of entrapping it within the laminate, as is done with wet-bagging, and even with prepreg.” That custom fabric, he said, is how they met the weight and strength targets.

Partner Roger Hatfield says the boat will weigh “nearly half of anything in the same class. She is supposed to sail at about twice the wind speed, supposedly flying the windward hull. But the shape of the foils and T-rudder are such that the leeward hull will be mostly lifted and just skim the surface.”

Steggall is a hands-on composites consultant via his New England–based Bravolab, and though he now also works for Formax, Bravolab still operates independently as a specialist in carbon infusion. In addition to Gold Coast Yachts, clients include Gunboat USA, Saint-Gobain ADFORS, and Carbon Ocean Yachts.



Jake Welter

This rendering shows the catamaran sailing with the windward hull flying, which was designer Paul Bieker’s intention; her light displacement, low wetted surface, and generous sail plan will make her very fast.

Regarding the training he did on the Gold Coast project, Steggall says he begins “training people how to work on a specific task such as vacuum level monitoring, resin infusion flow,” emphasizing that they must “also be aware of what the total picture is.

Above all, learn how to recognize risk and manage it to prevent a catastrophic failure. The management of risk starts at the mold/tool construction and includes laminates design, material selection, controls, and instrumentation.”

The biggest problem with infusion, Steggall reiterated, is people, whom he compared to a symphony orchestra. The conductor, in the case of Gold Coast, is Difede, with others on the team attentive to their assigned job: checking temperatures, speed of resin advance, vacuum level, and flow front.

Principal specifications of the B53, soon to become *Fūjin*: LOA 53.6′ (16.33m), beam 26.3′ (8m), draft 1.3′–9.8′ (0.4m–3m), displacement 13,600 lbs (6,182 kg). Auxiliary power: (2) 29-hp Yanmar 3YM30 with SD20 saildrives.

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