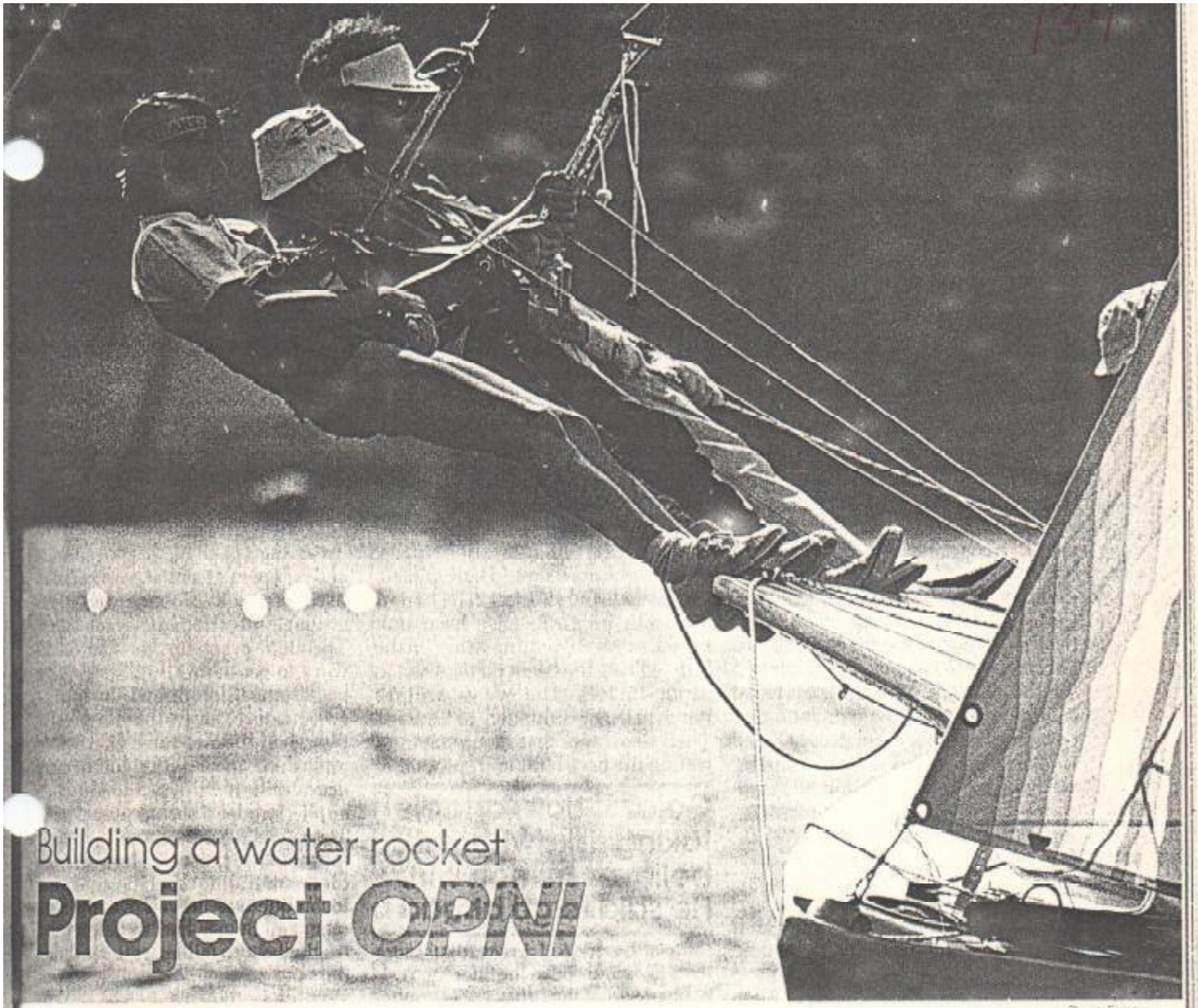


Daniel Forster

Three of the five trapeze wires are occupied on *OPNI*, the 38-foot dinghy racing the European lakes circuit

Building a water rocket

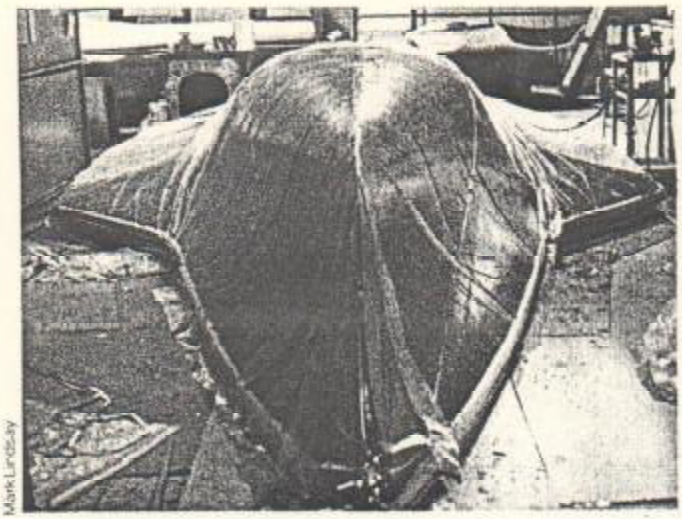
Project OPNI

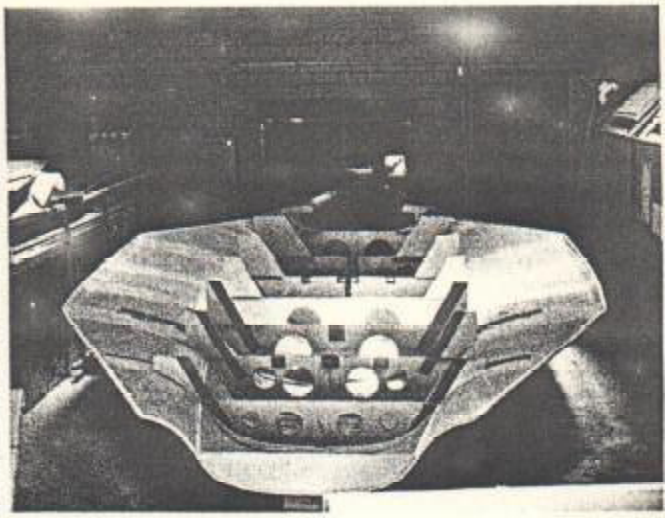
By Mark Lindsay

A new breeze was ghosting down from the snowclad Swiss Alps as we glided silently through the June heat waves over Lac Léman. The breeze reached us, and suddenly we were stretched full out on our trapezes, streaking soundlessly over perfect reflections at double the windspeed. Our portable radio crackled with the latest report on the forty-fifth running of the Geneva Yacht Club's Bol d'Or. "Leading the 479-boat fleet at the halfway point, 'la bête furieuse' [the furious beast], *OPNI*." On board *OPNI*, the Bruce Farr-designed European Lakes Cup racer, our crew of six broke out the wineskin and passed it around for a toast and for fortification against the next 50 miles.

Leading the race was cause enough for celebration; that we were here at all was truly remarkable, however. But then, *OPNI* (a French acronym for "unidentified planing object") is a remarkable boat. It is one of the most extreme racing boats on the water, a singleminded concept that required a lot of original thinking from the owner, the designer, and the builder. The owner wanted to win and knew how to organize and motivate people. The designer knew what shape, size, and weight the boat should be and how to outfit it. My boatbuilding company knew how to put it all together in a boat that would perform as designed. The owner and the designer really let their imaginations run wild in the original concept, and the designer was rarely conservative in making choices where more speed could be gained. This combination put me in the unusual position of being the most conservative. I was constantly looking for places that could break or bend. The designer generated numbers to substantiate his and the owner's ideas, and in the end they were right in almost every case.

The project had begun when a sportsman from Geneva named Alain Golaz asked Bruce Farr to design a boat to win the European Lakes Cup. This series is an outgrowth of a unique type of race held on several of the largest European Alpine lakes. Sailed the full length of





Mark Lindsay

each lake and back, these races can be 50 to 100 miles long and attract several hundred entries of almost every imaginable type, including daysailers, International Offshore Rule boats, and even trimarans. The European Lakes Cup itself takes in the three major races: the Bol d'Or on Lac Léman at Geneva, Switzerland, the Rund um den Bodensee on Lake Constance in West Germany, and the famous Centomiglia on Lake Garda in Italy. Restricted to monohulls, which must be self-righting, the Cup series is divided into three classes: A, for boats up to 14.2 meters (45 feet); B, for boats up to 11.5 meters (38 feet); and C, for boats up to 9.5 meters (31 feet). The winners in 1981 and 1982 were *Farmeticante* and *Grifo*, sister Class A boats built in Italy of wood to a Bruce Farr design. With experience gained from these two designs, Farr now suggested to Golaz that a Class B boat might be built light enough to overcome its shorter waterline and actually beat a Class A boat around the course. Its design and construction would have to be a radical departure from what had already been done. Golaz, a former downhill racer on the Swiss ski team, a driver of racing cars and motorcycles, and a pilot of hang gliders flying from the cliffs above Geneva, is a man comfortable with taking calculated risks when he believes he can win. He told Farr to go ahead.

Thus in February 1983, just four months before the Bol d'Or, Russell Bowler from Farr's office called me to see if we had recovered from the shock of the preliminary sketch he had sent. Farr wanted to take the rig design from his 45-foot *Grifo* and put it on a boat 10 feet shorter, with less than half the displacement, Bowler said. "We think one layer of Kevlar and epoxy on either side of a Nomex honeycomb core should be sufficient for strength and stiffness. The trapezing racks on *Grifo* have been outlawed, so we are putting wings on the hull to bring the beam on deck out to about 15 feet. The wings will be removable for shipping, of course." Then there was that requirement of getting the boat built and shipped to Geneva by June. I knew that more than one European builder had already decided the project was impossible. Yet I also knew that this was a chance to match an uncompromising design with the high-strength building techniques we had pioneered in our Tornado and Flying Dutchman hulls. I said yes.

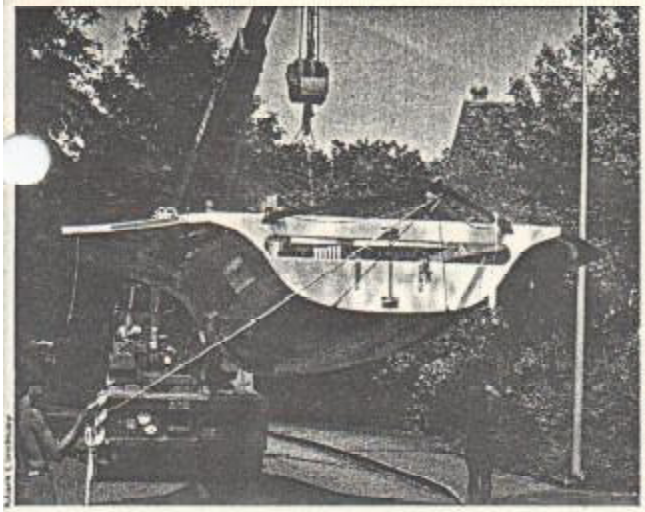
Golaz is comfortable taking risks when he believes he can win. He said to go ahead

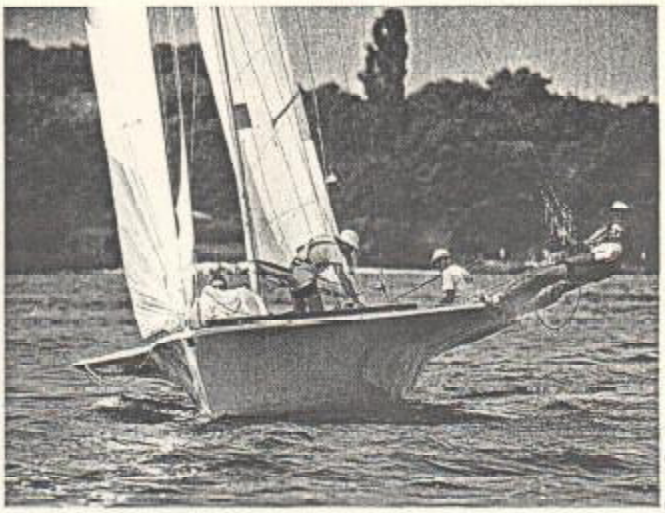
To do a one-off at a reasonable cost and in a short amount of time meant that the hull would have to be a wet lay-up, vacuum bagged, and cured at room temperature. Using Kevlar cloth preimpregnated with epoxy resin would have allowed a laminate with a better fiber-to-resin ratio and thus in theory less weight for a given strength. That plan would have required an oven large enough for the 35-foot-long hull, however, and a mold that could withstand the 250-degree oven temperatures and would have taken more money and time. Besides, with the skins as thin as they were to be, the total amount of resin we added using room-temperature epoxy was trivial.

Getting a good bond between skins and core was essential. We needed to use every bit of bonding surface available on the honeycomb edges. Through practice, we had found ways to get the resin to stick with a consistent fillet around the edge of every cell. Now we built a wooden plug, laid the wet inner skin over it, and then forced the honeycomb down onto it with vacuum pressure applied under a sealed plastic sheet. Then we laid on the outer skin and repeated the process. The soundness of the building specifications and technique was proven over the summer. The owner had to be prepared for the boat to fall apart the first time out, but to date we've heard of no structural problems. Maybe we overbuilt it.

The decks, cockpit sole, and bulkheads could be assembled from prepreg epoxy/Kevlar and honeycomb panels, custom fabricated complete with reinforcements and backups for the hardware, and baked in our 22-foot-long oven. Building in the reinforcement saves a considerable amount of weight but also means that the entire deck layout has to be designed exactly before construction can begin. Farr's staff met this unusual requirement of ours with their usual Kiwi skill and good humor, spiced with a few remarks about how their clever solutions would make us "bloody Yanks" rich.

Farr's structural plan evolved into something very similar to that on our Flying Dutchman, with a wide, shallow self-bailing cockpit sloping





From mold to gold: *OPNI*'s winged hull during vacuum-bag lay-up; as carbon-tipped frames are added; touring Geneva's streets; and afloat at last

gently down into an open transom. We used a layer of E-glass, one of Kevlar, the ¾-inch-thick Nomex honeycomb core, and another skin of Kevlar. The cockpit sole and deck were made integral with the hull through transverse honeycomb bulkheads reinforced with unidirectional carbon-fiber tows at critical points.

After many telephone discussions, Russell Bowler, the Farr project manager for *OPNI*, and Cliff Dekayne, DuPont's technical advisor on Kevlar and Nomex in marine applications, [illegible] to our plant in Gloucester, Massachusetts, where we decided on the final structure. Bowler's background as a Sydney Harbour 18-foot skiff sailor meant he knew about building boats right at the minimum. Dekayne was able to make the carefully calculated adjustments that, combined with our practical experience, produced a boat that was radically light but wouldn't break. The confrontation of these three different approaches to building the fastest boat was very exciting. One idea, countered with another, would trigger a third, and the solution would be greeted with laughter as we realized how far from the ordinary this boat would be.

Occasionally a high-flying idea would be brought down to earth as we faced development time constraints. The 7-foot-long foam keel with its 600-pound bulb became a cedar keel, as we thought about the problems of handling such a fragile creation on land, let alone the problems of running aground. The keel [illegible] to be easily removable for transporting between races. It was a dagger keel, technically, inasmuch as it had a trunk, but it was fitted to the boat from below and was nonadjustable. As if to justify the extra 15 pounds the cedar cost us, an hour into the first race we smacked dead into a very solid rock. There was no damage, except to the lead.

On the other hand, certain design gambles paid off handsomely. Usually, fore-and-aft rig placement is specified in the expectation that some fine tuning may be needed to balance the helm. With this boat, though, a simple and strong, but nonadjustable, Laser-style mast socket of aluminum, bonded to the hull, was specified. The designers located it perfectly, and the boat steered effortlessly.

Hoisting the sails in the light breeze was like releasing a caged hawk

The constant challenge was to keep everything as simple and light as possible. The curse that follows you if you are careless is that every time weight is added, the loads increase, requiring stronger and heavier construction and hardware, which weighs more and generates still higher loads. This escalation syndrome can be reversed, but not easily.

When the hull came off the mold, four men could pick it up, and as the featherlight bulkheads were glued in like parts in some giant model airplane, it became rigid. With the deck on, one person could still lift an end. Eventually, the fully rigged boat weighed in at 1,400 pounds.

As we neared the finishing stage, it was time to amputate the wings. These were Farr's substitute for the banned racks, and I believe they are an improvement. They are very light, probably weighing only about 70 pounds each. They also act as reserve buoyancy, so that the boat is much harder to capsize than the same design would be with racks. Being flat and solid, the wings are very easy to move around on, with or without hooking up to a trapeze wire. In crew work alone, I bet they more than compensate for any speed loss due to increased windage. Though cutting the wings from the hull and deck had been carefully planned from the start, there was little room for error, and making the first saber saw incision was a little horrifying. It was nothing, however, compared to the appearance of the boat with its wings chopped off; it was more like a huge sled than a sailing machine.

After several days and nights of sanding and Awlgripping, a crew of six men lifted the hull into a semi-trailer-sized shipping container. The wings were lashed to the top of the hull, with the sleeved two-piece mast and boom tied in the corners. Then the container doors were swung shut for the first leg of a 4,000-mile journey to the mountain-walled lakes of Europe.

My flight to Geneva coincided perfectly with the arrival of the container from the docks of Rotterdam. Golaz had persuaded the customs inspector to let the boat in on a Saturday afternoon. It was just short

Daniel Forster

OPNI's shallow cockpit and wide decks make for easy crew work

of a week to the Bol d'Or, and most of our competition was out sailing a tune-up race on Lac Léman as we muscled the boat out into Phillip Durr's boatyard in Geneva. The next five days saw a bare hull become a racing machine covered with self-tailing winches, blocks, rail-to-rail Harken traveler, self-tacking jib, and vang tracks. Half of the time the spectators outnumbered the workers, as friends, our competitors, and the simply curious came by to stare and ask, "What is it?"

The open-cockpit-side construction made the deck hardware easy to install, especially with the wings removed. To avoid having to put access ports in the cockpit sole, we had used a technique from our Tornado cats and embedded the fastening studs for all the padeyes in epoxy before fastening the sole to the hull. In fact, most of the fastenings were both screwed and epoxied in place to avoid loosening and leaks.

Launch day was a spectacle as *OPNI* was carried through the streets dangling from a crane like some space vehicle. The mast was stepped with full fanfare: flags, speeches, and a press conference. The rigged hull was then hoisted aloft and lowered gently onto the keel as several of us held it tethered. Finally, Durr punched the hoist buttons, and *OPNI* swung gracefully into the water. As Durr shook my hand, I realized my moment of truth had arrived.

With a 50-foot rig and a 5½-foot waterline beam, *OPNI* was much less stable at rest than any normal 38-footer, so we tied a wingtip to the dock. But hoisting the sails in the brisk evening breeze was like releasing a caged hawk. We screamed out of the harbor on a full plane. Once we settled down, the boat was as solid and flat as a table. Steering was by thumb and forefinger at the end of a 6-foot tiller extension, and the mainsheet man had complete control and a beautiful view of the sail from his position way out on the wire. The weight shift of one crewman coming in off the wire required very little compensating sail trim, making adjustments much easier than on a more normal-sized dinghy.

The last holes were being drilled and the bolts tightened on the tow to the start the next morning. The Bol d'Or start is like no other. Hundreds of boats were massed against the backdrop of the Geneva waterfront, a 200-foot-high water fountain, and the surrounding Alps. And the entire fleet would start together. We knew that several very fast boats with well-prepared crews were somewhere in that swarming crowd of 479 boats, but we were so busy keeping smaller boats from shutting off the wide path we needed to the line that we didn't see them until later. At the gun, a windshift put us at the wrong end of the 2-mile line. Somehow we dug out of there, and with the masthead genoa we sailed through a pack of boats flying their spinnakers. We were generating our own apparent wind and going several knots faster than they were. As the breeze built we left the last of the European Lakes Cup monster boats astern and worked on grinding down the few remaining ultralight trimarans ahead. Although we weren't racing against the multihulls technically, we nevertheless felt a dangerous sort of euphoria as we parlayed a few windshifts into a first overall at the halfway mark.

Returning into the onrushing fleet at sunset, we experimented with our spinnakers in the dying breeze but found that it was usually faster to head up and maintain boatspeed. As darkness fell, the wind stopped. Becalmed among hundreds of masthead lights, we watched the leading tris slip past on the opposite shore. Normally a 10- to 12-hour race for the leaders, this one became a 20-hour marathon relieved only by a few midnight squalls that sent us jumping to our trapeze wires while *OPNI* thundered through the blackness.

In the end, four tris crossed the line ahead of us, but when we finished the next European Lakes Cup racer was miles back. Triumphant but sleepy, we tied up at the Geneva Yacht Club and ordered double rounds of breakfast. Later in the day the wind came in with a bang, and unable to sleep through the temptation, we all climbed back into our trapeze harnesses. With the breeze on, the pole set just off the headstay, and everyone wired, we bore off on a little wave, and the unidentified planing object flew again!

Postscript: After winning in the Bol d'Or, *OPNI* went on to finish fourth in the Bodensee regatta, which put her into the lead for the European Lakes Cup going to Lake Garda. There, in a wide range of conditions, sailing against *Farmeticante*, *Grifa*, and the new monster boat *Avante Garde* with its 70-foot rig, *OPNI* took the Centomiglia by half an hour. In so doing, *OPNI* won both the Trophee Europeo regatta and the European Lakes Cup.

Mark Lindsay Boatbuilders in Gloucester, Massachusetts, is known for its innovative and fast one-design, especially Flying Dutchmans, Tornado cats, and Fireballs. Most recently, Lindsay has built a high-tech Star boat and is immersed in an offshore boat project.