

EXHIBIT 1020

Thirty Knots, With the Wind at Your Wings



THE CHAMP The America's Cup defender Alinghi 5, a catamaran with a mast almost 200 feet tall, practicing last month in Valencia, Spain.
Alberto Saiz/Associated Press

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VALENCIA, Spain USA-17, the challenger for the America's Cup, and Alinghi 5, the defender, may be stripped-down, lean racing machines, built purely for speed. But both are fully loaded.

Loaded, that is, with compressive and tensile stresses in an exquisitely choreographed dance of struts, spars and cables. Made almost entirely of carbon fiber, the enormous multihulls USA-17 has three hulls, Alinghi 5 two are about as delicate as a house of cards. If a big enough element were to break, the whole thing could fall apart.

That could be disastrous, considering that the boats, with masts that tower a couple of hundred feet above the water, are capable of speeds of 30 knots, about 35 miles per hour, or more.

On Monday, however, the boats hardly moved at all, as inconsistent winds forced the postponement of the first race in the best-of-three series on the Mediterranean. The two teams will try again on Wednesday.

If the boats make it through the races relatively intact, it will be a testament to the skill of the sailors and of the designers and engineers who spent several years building them, more or less on the fly as the two sides quarreled in court over the terms of the race.

“If we break it,” said Brad Butterworth, skipper of the Alinghi team, which is owned by the Swiss biotech mogul Ernesto Bertarelli, “it’ll be because of some failure of a fitting or a user mistake something that we’ve done that’s put the boat in a compromising position where it couldn’t handle the loads.”

The America’s Cup has always been a showcase for innovation: the 1895 victor, Defender, for example, used aluminum, steel and bronze in the hull, an unheard-of combination at the time. And sailing in general, and high-level racing in particular, are no strangers to technology. But it has not been used at such an extreme scale before.



LEAN MACHINE The America's Cup challenger USA-17, above in Valencia, Spain, and the defender, Alinghi 5, are made of carbon fiber and have towering masts and huge multihulls. Guilain Grenier

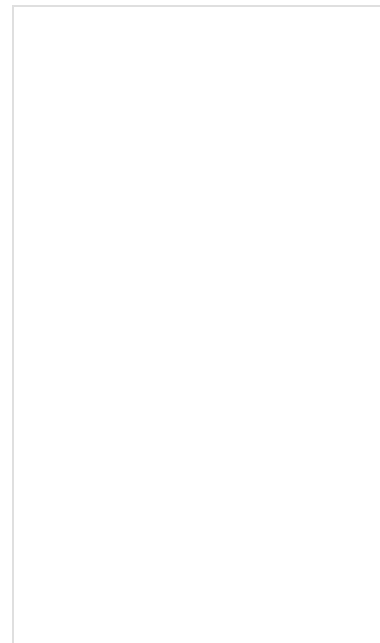
The most obvious advance can be seen rising above USA-17, which is owned by Lawrence J. Ellison, president of the software company Oracle. It looks as if someone wrenched a wing off a large jetliner and perched it, tip up, atop a trailer hitch on the boat’s middle hull.

Wing sails, as they are called, have been around for years, and one was even used to great advantage in the 1988 America's Cup. But at 223 feet, this one is much bigger than others (and bigger, in fact, than any airplane wing) and more controllable, with nine adjustable flaps.

Like an airplane wing, it provides lift, although largely in a horizontal direction. And like an airplane wing, the slots between the main elements and the flaps add to the lifting power.

But the wing also solves a basic problem of sailing: how to take full advantage of the wind without overturning. The flaps can be adjusted to maximize lift on the wing's lower end, generating a lot of power, and to reduce it up top, generating less heeling, or tipping, force.

"You can shift the center of the force up and down the wing very quickly," said Russell Coutts, chief executive of BMW Oracle. "So when you've got too much power, then you can unload the top of the wing."



The wing designers use the same principles, and much the same software, as airplane designers, said Mike Drummond, the team's design director. (One member of the team also does work for Boeing, though not on wings.)

"You have to understand the aerodynamic principles well and how to apply them," Mr. Drummond said. "If you have the skills to design an airplane, you have the skills to design a yacht. Now we could have a good crack at a windmill."

Load-shifting can be done with more traditional sails, too, by changing their shape, which is accomplished in part by having a flexible mast. But even with technology one system uses image-recognition equipment to "read" lines on the sails to see if they match prescribed curvatures shape-changing is difficult. It is easier with a solid wing.

Alinghi 5 uses traditional sails, but that is not to say it is any less innovative than BMW Oracle's boat. It has a flexible mast, one that is nearly 200 feet tall, and some of the biggest sails anywhere. Like most advanced racing sails, they are a sandwich of polyester film sheets with a filling of carbon fibers providing strength. The fibers are laid out in radial lines calculated to match the loads, and where the fibers come together in areas of maximum stress the sail has a distinct look, as if it has been dusted with ashes.

Alinghi is lighter than USA-17, and might be described as being a bit more tightly wound. On both boats, the rigging creates huge forces that tend to push the middle of the vessel upward. On USA-17, the middle hull serves as a beam to counteract those forces. On Alinghi 5, said Dirk Kramers, the team's chief engineer, a delicate truss of struts and cables does the job.

Alinghi 5, like other racing boats, including BMW Oracle's, has a system of sensors to monitor the stresses in real time. Each of the sensors 150 on Alinghi 5, in critical locations in all parts of the structure including the cables consists of a single glass fiber that is laminated with the carbon as the boat is built. The fiber is internally reflective at specific points, so that when light is sent along the fiber, some of it

bounces back to a detector. Differences in travel time mean the fiber, and thus the structural element, is being stretched or compressed. The data are displayed on screens in the boat's cockpits and can be transmitted to engineers on shore.

Mr. Kramers said the data was initially useful in determining the actual stresses as the design became a reality. "With this boat, we were in such uncharted territory," he said. "We felt we needed a very accurate way of finding out what the loads are."

Now that the boat is in the water, Mr. Kramers said, the sensors are more of an offensive tool because they tell the sailors just how far they can go. And if the data from one or more sensors exceed an established threshold, an alarm sounds.

Sailors being sailors, they like to push the boat as much as they can. Alinghi's principal designer, Rolf Volijk, said there was one day when the alarm did not work, and the crew was very happy. "They said it was a perfect sailing day," he said. The design team looked at the data back at the office, he said, "and we found all the alarm points where probably they felt very comfortable."

Alarms or no, Mr. Butterworth, Alinghi's skipper, said the crew had become accustomed to what it could and could not do. "When we first put it in the water, we were worried about the size of the job and the scope of the job," he said. "Now it's just another boat, really."

The crew has also become accustomed to Alinghi's speed. Mr. Butterworth described a recent day when a sailor who had never been on the boat came along.

"He's sitting on the back and we're doing 36 knots," he recalled. The man uttered a curse, Mr. Butterworth added, "and he says, 'Is this right?'"

"We said yeah, this is normal now."

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