

OPTIMIZED FOR ULTIMATE PERFORMANCE

OVERVIEW

■ Industry

Marine

60ft ultimate performance racing monohull

■ Target

Optimize the yacht structure for minimum weight while ensuring structural integrity

■ Solution

Close collaboration with designers to integrate structural considerations in their design process, in conjunction with advanced slamming analysis to ensure integrity and optimized support structure

■ Benefits

Minimum weight to increase the yachts ability to lift onto its foils and travel faster

Engineering the latest generation IMOCA 60 for VPLP and Charal Sailing Team



Gurit Composite Engineering isn't new to the racing scene and has worked on a number of IMOCA 60's before for world class teams. Since closure of the 2012 Vendée Globe, IMOCA 60's have evolved from straight daggerboards to using foils, all the way to what we now call native foilers. Boats that are designed around their foils.

The performance of VPLP's latest IMOCA 60, Charal, fully relies on its foils and this sets a new environment for structural engineering. With different boat behaviour at sea, more complex ergonomic challenges, and foil loads of unseen magnitude, IMOCA 60's are entering a new era.

VPLP and Gurit have put in place an open minded brainstorming approach at very early stages of the design process. Structural efficiency considerations were integrated at the heart of VPLP's design process, next to Charal Sailing Team's design choices and ergonomic considerations, and the collaborative approach paid off.

Charal's foils are designed to produce enough lift to sustain the entire mass of the boat, even at relatively low speed. As a result the magnitude of the loads entering the composite structure are in some area of the same order of magnitude as keel loads. Gurit engineers came up with structural concepts which are very much the

result of foil shape, bearing position relative to hull chine and Charal Sailing Team choices regarding the advanced actuations systems: they are by essence unique and tailored to this boat.

Keeping weight to the minimum

For any given foil size, a lighter boat will foil earlier and therefore travel quicker, which emphasises the need to optimise the structure and save weight.

The weight issue was exacerbated by the fact that the foils, their systems and the support structure around them have become larger and therefore heavier than on the previous generation of IMOCA 60's.

In minimising the weight, Gurit engineers focused their efforts on areas that contributed most to the overall weight. The deck and hull shells were the primary candidates for weight saving.

In optimising the deck shell, our engineers collaborated closely with VPLP design and Charal Sailing Team on deck shape. The aim was to reduce the developed area of composite material whilst maintaining a distribution of volume optimized for stability and without compromising structural behaviour or ergonomic considerations.

A global FEA model of the resulting boat shape was built and subjected to various global sailing load cases. FEA was also used to study structural efficiency of various deck camber configurations.

In minimising the weight of the hull shell, Gurit engineers had to account for the evolution of the boat's behaviour at sea brought by the new foil configuration. A faster boat increases slamming loads and the presence of foils applies the slamming loads to different locations on the hull. Engineers then undertook an advanced slamming analysis utilizing an in-house tool to predict transient slamming pressure distributions at different locations along the hull. This method takes into account the effect of the local hull curvature on the slamming loads, which produces a more accurate analysis to aid and improve the optimization of the support structure layout.

Different options were compared for structural layout and shell laminate, including a single skin shell with densely spaced stringers and sandwich shell with fewer and deeper support beams. In order to be weight competitive against sandwich panels, the single skin option required the single skin shell thickness to be reduced down to a level that Gurit engineers were not prepared to accept.

Moreover this option escalated the build complexity and meant that an imperfection could easily result in a significant structural issue.

On the other hand, the sandwich solution benefited from Gurit's in depth knowledge of the behaviour of Gurit® Corecell™ M foam when subject to high strain rate, typical of slamming response. This brought confidence in the ability of this solution to withstand the use and abuse that IMOCA 60 hull shell can be subject to.

Construction

Like all ultimate performance racing yachts, Charal was constructed using only the latest and most advanced materials and techniques. Gurit was proud to be not only the principal engineers on the project but also a key material supplier, with Charal being constructed by CDK Technologies using Gurit's Corecell™ M foam; Nomex honeycomb core; SE 84 prepreg with a combination of IMC and HEC unidirectional and multiaxial carbon fibre; and SA 80 adhesive films.

The results

Charal is the first native foiler IMOCA 60 to hit the water. The close collaboration between VPLP, Charal Sailing Team, CDK and Gurit has brought the innovation needed to tackle the challenges this new generation of Vendée Globe boats brings. Gurit engineer's work has resulted in a light, coherent structure with little compromises. The boat will be capable of boat speeds above 30 knots and has already shown an incredible potential on the water.



In the past Decade, VPLP Design and Gurit engineering have collaborated on projects from Ultim boats to IMOCA or cruising boats.

The CHARAL project was the first project where VPLP Design and Gurit engineering collaborated from the design brief stage enabling structural engineering improvements to be included in all of the design loops.

This collaboration has been a key factor of success in CHARAL's construction and design, enabling the team to compete in the Vendée Globe 2020 with a robust and lightweight yacht.

Charal Sailing Team

Charal Sailing Team was set with the ambition to win 2020 Vendée Globe. Skipper Jérémie Beyou has achieved a number of strong results over the years including: 3rd at the 2016 Vendée Globe, 3 time winner of Solitaire du Figaro and Winner of the 2017/2018 Volvo Ocean Race.

About Gurit

Gurit is specialized on the development and manufacture of advanced composite materials, related technologies and select finished parts and components. The comprehensive product range comprises fibre reinforced prepregs, structural core products, gel coats, adhesives, resins and consumables. Gurit supplies global growth markets with composite materials on the one hand and composite tooling equipment, core material wind turbine blade kits, structural engineering and select finished parts on the other. Gurit operates production sites and offices in Canada, China, Denmark, Ecuador, Germany, Hungary, Indonesia, India, Italy, New Zealand, Poland, Spain, Switzerland, Turkey, United Kingdom and the United States.

For more information, please visit: www.gurit.com

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