

Areva Challenge

Designs America's Cup yacht with CATIA V5



Overview

■ Challenge

Due to a limited budget and a tight schedule, Areva Challenge had only one shot at designing its robust yet ultra-light America's Cup sailboat

■ Solution

They took advantage of CATIA V5's iterative process between geometry definition, composite design and FEA analysis in a virtual environment to optimize their design and get it right the first time

■ Benefits

The complete definition and simulation of this high tech carbon structure in CATIA V5 helped Areva Challenge design a boat that was reliable and ready to sail just a few weeks before the race



"For our first participation in this event, CATIA V5 helped us gain the best design practices that took other teams years and years of competing in the America's Cup to acquire."

Stephan Kandler, CEO of Areva Challenge

A team with a passion for excellence

Areva Challenge is the French team that participated in the 32nd America's Cup, the world's oldest sporting trophy. For the 2007 edition, eleven challengers competed in Valencia, Spain and was the first time in the Cup's history that all five continents were represented.

Areva Challenge, formerly named K-Challenge, was created in 2002 by two impassioned sailing entrepreneurs and a member of the 1992 America's Cup winning team. The Areva Challenge team is comprised of experienced people with the enthusiastic team spirit needed to compete in a race of America Cup's reputation. The design team, composed of architects and engineers, is responsible for designing and developing the sailboat that competes in this prestigious event.

Light seaworthy sailboats built to win

The America's Cup is a race where contestants are sailboats approximately 25 meters long that are considered to be the Formula 1 of the seas because they must

adhere to a set of precise design parameters and because they sail on a predefined circuit. Optimizing a design can only be done within the limits of these parameters.

Each sailboat is designed to sail faster than the competition and built using composite materials, to be as lightweight as possible on top and as heavy as possible at the bottom for reasons of stability. The boat must be structurally robust so that it remains intact throughout the race and weigh exactly 24 tons. For the Areva Challenge design department, designing a boat presents some important challenges: produce a shape that will float within one millimeter of its theoretical waterline; and build a carbon hull structure that is solid yet ultra light and that will sustain extremely high loads coming from the rig and the keel. The design team is responsible for producing the construction drawings needed by the shipyard to build the boat.

Producing the lightest structure possible

According to Stephan Kandler, CEO of Areva Challenge, the America's Cup is a race



between boats that sail at the same speed with one going a little bit faster than the other. So the difference between a “good” boat and a “bad” boat, in terms of performance, is about one to three percent. Although extremely small, it can make the difference between winning and coming in second place. As a result, if the structural design team can remove a few tens of kilos from a hull structure that weighs, in total, less than two tons compared to the bulb that weights about 20 tons, without compromising the stiffness they consider their mission a success. Thanks to CATIA V5 they were able to perform that weight transfer using an iterative process between composite design and FEA analysis that helped them explore many design alternatives and consequently produce the lightest and stiffest possible structure.

Designing and testing the boat without using physical prototypes

An America’s Cup Boat is extremely simple in terms of geometrical definition since there is nothing inside (no accommodations, no engine). However, it is very complex in terms of the carbon-honeycomb composite layout needed to support the considerable load of the tall mast and large sails as well as a very heavy and deep keel. 80 percent of the total weight is supported by the keel fin.

Areva Challenge chose CATIA V5 for the structural design of the sailboat thanks to its ability to handle the entire composite process from modeling to finite element analysis to manufacturing. For example, they use the CATIA Mechanical Design solution to create the parametric skeleton model of the

complete boat including the hull structure with bulkheads and reinforcements. For analysis they use CATIA Mesher and CATIA - Elfini Structural Analysis solver for associative meshing and automatic transfer of the composites properties to the mesh. They also use CATIA Composites Engineering, which allows them to try out, in a virtual environment, several structural designs in a minimum amount of time and to assign material properties to the mesh. By using the same application, user interface and data model, the Areva Challenge Design Group saves invaluable design and testing time with no need for data conversions. “Our first concern is to come up with the perfect hydrodynamic shape,” said Stephan Kandler. “We then need to position the bulkheads to reinforce the structure, perform analysis studies using CATIA’s finite element analysis tools and finally draw up the plans that the shipyard will use to actually build the boat,” said Stephan. “Thanks to CATIA V5, we never have to use physical prototypes. The boat is designed and analyzed in a virtual environment and has all the required characteristics,” he said.

CATIA V5 – captures years of experience

CATIA V5 also helped the young Areva Challenge Team design a high performance sailboat even though they did not have as many years of experience as other teams. “In general, most design groups gain their experience through years of building boats and seeing how they behave on the water,” said Stephan Kandler. “CATIA V5 helped us take a short cut thanks to its technology and ease of use,” he said. In addition, CATIA V5’s

iterative process helped Areva Challenge test their design in a virtual environment and integrate modifications early in the design stage. CATIA V5 has also helped the design group rapidly acquire the best design practices that led to the most optimum structure - practices that certain teams take years of competing in the America’s Cup to acquire.

Enlarging their perspectives in the near future

Four designers use CATIA V5 at the Areva Challenge Design Group. They plan to increase this number to ten in the near future and, at the same time, take advantage of Dassault Systèmes’ ENOVIA collaborative tools to promote real-time teamwork between their offices in Valencia Spain and the Brittany region in France where one of their naval architects, Guillaume Verdier is located.

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Stephan Kandler, CEO of Areva Challenge



Dassault Systèmes
9, quai Marcel Dassault, BP310
92156 Suresnes Cedex France
Tel: 33 (1) 40 99 40 99



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