Altair HyperWorks Success Story

Sea Ray

HyperWorks at Sea Ray: Engineering High-Performance Pleasure Boats

For Sea Ray Boats, the leading, U.S.-based manufacturer of high-end pleasure boats, CAE simulations are an integral part of the design process to achieve shorter time to market. HyperWorks is deployed for the entire analysis process of the vessel, from modeling and simulation, to visualization and reporting. By using HyperWorks, Sea Ray's engineers can quickly model their advanced composite structures, as well as run complex inertia relief and durability load cases.

Altair Engineering

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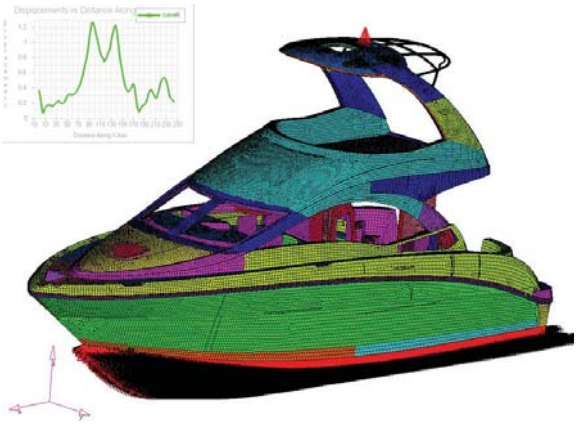
Altair® HyperWorks®

The Engineering Framework for Product Design™

Merritt Island, near Cocoa Beach and Cape Canaveral on Florida's Space Coast, is home to the product development and engineering organization for Sea Ray Boats, the leading manufacturer of high-end pleasure craft and part of the Brunswick Boat Group — the world's largest maker of pleasure boats. A Sea Ray engineering team at Merritt Island painstakingly creates and analyzes engineering designs for the handsome, high-performance boats for which Sea Ray is famous. They use Altair HyperWorks CAE tools exclusively.



"One of our sister companies also uses Altair software" said Sea Ray's Giovanni Greco, director of the 75-employee Engineering Department of which the CAE team is a part. "Sea Ray started using HyperWorks to model subsystems, and has now expanded to full vessel models."

Since Greco joined the company two years ago, the use of HyperWorks has expanded to seven engineers. The team now has a much broader understanding of HyperWorks and is using it more comprehensively, creating full-system CAE models of entire vessels and looking at designs under a variety of load conditions.

The constant design challenges: space and performance

The pleasure boat market, like many luxury goods markets, demands change and innovation. Sea Ray satisfies this demand with a steady output of new models, introducing eight to 12 new or refreshed designs every year. At any given time, the engineering team is working on six or seven designs from its styling department, which is one of the largest in the marine industry. At the beginning of a project, the design office collaborates closely with the structural engineers and naval architects in the engineering group. As the model takes shape, other engineering groups — electrical, mechanical, propulsion — become increasingly involved.

"The key design elements for Sea Ray boats are a very good-looking profile, lots of reconfigurable space and performance," said Greco. "Sea Ray is known for high-performance sport boats, cruisers and yachts, and making them perform well is a challenge, particularly because many of our customers want their boats well optioned-out with TV, entertainment systems and high-tech gadgets, including real-time GPS displays at the helm. Many of these things are heavy and difficult to package, and they challenge us to provide speed and acceleration. That's why the key advantage of structural analysis is that it enables us to reduce mass and improve performance."

"We're very happy with the level of support that we get and with the level of HyperWorks technology that we're able to purchase through Altair's token system."

Giovanni Greco
Director of Engineering
Sea Ray Boats

The constant challenge in designing boats is creating usable space, which is always in short supply. Much of the design effort focuses on configurable space — space that can change function to fill more than one need. Beds, couches and tables pull out, flip out or disappear, depending on the activity or time of day. The design cycle varies with the boat: the team

typically averages eight to 10 months for a sport boat, 10 to 12 months for a sport cruiser, and 12 to 18 months for a yacht, depending on size. Sizes range from an 18-foot sport boat, which can go 50 MPH, to 60-foot yachts that top out at 40 MPH.

Full-system models in HyperMesh and HyperView

The engineering team depends primarily on HyperMesh and HyperView to create and assess its full-system structural models. They also use HyperGraph in the Structural Group and the Naval Engineering Group to plot speed, performance and G-loading from instrumented on-water testing. The Mechanical Engineering section recently began using MotionView to simulate the function of a number of mechanisms. Greco, who knows HyperWorks well from his work in the automotive industry, finds HyperMesh particularly useful because of the way it handles materials.

"That's one of the big benefits I see from using Altair," said Greco. "The key material we work with here is fiberglass composite. Altair provides a very good user interface for modeling composites, which is one of the features I've always looked for in pre- and post-processors. I've made suggestions to Altair for refinements in this area, and HyperMesh has become a key enabler to modeling our materials and structures."

Sea Ray relies solely on OptiStruct for structural analysis. The standard Sea Ray model analysis includes inertia relief and vibration simulations on an untrimmed vessel. Later on, point masses that represent the engine, batteries, generators and other non-structural components are added to the simulation model.

"We map out the differences between a bare model and a trimmed vessel with HyperWorks, just the way we did back in automotive," said Greco. "The next step for us would be frequency response analysis with vibration inputs — a running engine or generator, for example. Then, we would look at responses at key locations like the helm, the arches or the seatbases at the helm.

We've done this on two boats, and we're now mapping out a procedure that will enable everybody in the group to do it routinely.

"We're just starting to find out that the most important thing is not strength — the traditional way of designing a boat — but designing for the correct stiffness. That can only be done with an analysis package that lets you model the entire vessel at once."

"We map out the differences between a weight model and a trimmed vessel with HyperWorks, just the way we did back in automotive."

Giovanni Greco

Expanding the use of HyperWorks tools

Sea Ray has been using HyperWorks long enough to build a library of full-system models, which helps shorten the design cycle. The library now includes every boat size that Sea Ray builds. It enables the engineering team to do studies earlier in the design of a new model by making changes to an existing FEA model — moving bulkheads, changing room layouts, shifting weight and mass, as well as running analyses to see the effects on the boat's structure.

Greco's group is continually expanding its modeling and analysis capability using HyperWorks tools.

"I've had a working relationship with Altair for about 13 years," said Greco. "We're very happy with the level of support that we get, as well as with the level of HyperWorks technology that we're able to purchase through the token system that Altair offers. It makes it easy for us to explore technologies like MotionView, for multi-body dynamics, or HyperGraph, for result-curve plotting."

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