Hawkes Ocean Technologies

Streamlining the Development Process with ANSYS Workbench

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Shortcomings in current research equipment hamper today's undersea exploration: Scuba limits divers to the ocean's surface, while conventional submersibles and remote vehicles have limited speed, range, and maneuverability. Additionally, these submersibles are extremely heavy and need costly dedicated mother ships to transport and maintain them.

With more than 40 years experience designing and building submersibles, Hawkes Ocean Technologies (HOT) has moved beyond these constraints to engineer a new class of small, light-weight, positively buoyant winged craft that can "fly" through the water at depths of up to 36,000 ft. for exploration, adventure, recreation, film/television, science and industry.

TECHNOLOGY USED

ANSYS® Workbench™, ANSYS® Mechanical™, ANSYS® CFX®

CHALLENGES

The challenges of designing a craft that can withstand pressures of nearly 16,000 psi while easily maneuvering through the water included:

- Determining stresses within complex anisotropic composite material used in pressure-resistant housings
- Optimizing tradeoffs between power, weight and mass
- Minimizing underwater drag of the external fairing to achieve maximum speed with minimal power consumption, thus extending the range of the craft and maintaining sufficient sustained speed needed to overcome positive buoyancy

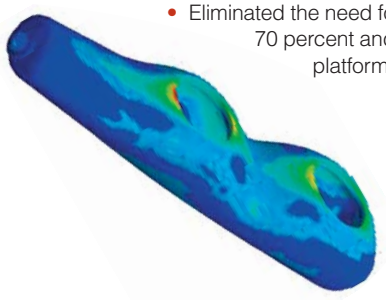
SOLUTIONS

To account for the multiple disciplines and physical phenomena present in operating conditions, Hawkes engineers turned to simulation tools within the ANSYS Workbench environment:

- ANSYS CFX software was used in developing the overall streamlined shape of the external fairing to minimize drag; fluid analysis defined the flow around the fairing and enabled researchers to readily pinpoint any areas of excessive turbulence
- ANSYS Mechanical technology was used extensively for stress analysis of part assemblies in helping to ensure that components, made with as little material as possible, could withstand underwater pressure. The program readily accounted for the anisotropic material properties of the composite parts and clearly showed directional stresses, aiding engineers in determining proper carbon-fiber orientation and thickness. In generating complex assembly models, surface-to-surface contact element features automatically detected contact points and allowed for different material properties and adjusted mesh densities

BENEFITS

- CAD associativity, contact elements and assembly features saved considerable time for design/simulation iterations, which allowed numerous alternative configurations to be studied and guided engineers toward an optimal hull shape
- Quickly arrived at an optimal design for a craft that could withstand prescribed pressure limits with minimal weight and fit within tight space constraints
- Reduced the weight of the craft by 50 percent by designing components of composites instead of aluminum or other metals
- Eliminated the need for a costly dedicated mother ship, reducing operational costs by 70 percent and allowing the craft to operate freely from a variety of launch platforms



ANSYS Mechanical was used for stress analysis of the pressurized pilot compartment hull

COMPANY INFORMATION

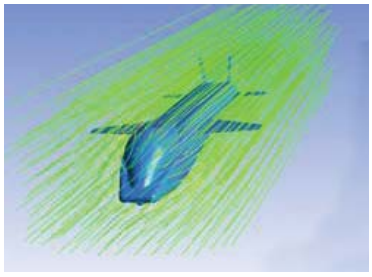
Country: U.S.A.

Industry: Oceanography

DEEPFLIGHT HAWKES OCEAN TECHNOLOGIES

www.deepflight.com

> "The ANSYS Workbench platform lets us streamline the development process by eliminating the need to manually transfer simulation files and translate analysis results from one program to another. ANSYS Workbench associativity with the CAD system was a big time saver, and the ability to perform so many fast iterations guided us toward an optimal hull shape that was not intuitively obvious. When you dive to these depths, there is no room for error. That's why we rely confidently on simulation technology from ANSYS in the development of these next-generation winged submersibles."
>
> Adam Wright
> Senior Mechanical Engineer
> Hawkes Ocean Technologies



ANSYS CFX helped develop the overall streamlined shape of the external fairing

CASE STUDY