HyperSizer Analysis Software and Composite Crew Module Both Pass Critical NASA Tests

Positive results pave the way for greater use of composites in space vehicles

Hampton, VA, December 8, 2009—In a series of critical, full-scale, physical tests just completed by NASA, HyperSizer®—the structural sizing and composite analysis software from Collier Research Corporation—accurately predicted the Composite Crew Module (CCM)'s successful performance under simulated flight conditions.

The CCM is an all-composite alternative for the flight crew module Orion, which is part of NASA's Constellation program to return man to the Moon and/or Mars. The successful outcome of the recent tests is seen by all involved as a major milestone in the design of human-rated spacecraft that points towards increased use of lightweight composites in space vehicles.

HyperSizer software was used throughout the almost three-year project to optimize the design, weight and manufacturability of the CCM, which is constructed of honeycomb sandwich and solid laminate composites. HyperSizer was the first NASA software to be licensed and commercialized as part of the agency's effort to transfer technology to U.S. business and industry.

The tests were conducted by the NASA Engineering and Safety Center (NESC) at Langley Research Center, which is using the CCM project to study materials tradeoffs between metals and composites in space structures.

"The CCM is an alternative for the metallic crew module, but it has also represented an opportunity for the NASA family to get up the curve on experience with composites," said CCM Project Manager Mike Kirsch. "Our analytical models predicted the response very well and now we're much better informed to make good material tradeoffs for future spacecraft."

HyperSizer is a structural sizing and design optimization tool that works in a feedback loop with finite element analysis (FEA) to automatically search for solutions that minimize weight and maximize manufacturability. Although it can also be used on metallic structures, HyperSizer is particularly applicable to complex composite materials, providing the capability to optimize the architecture of large structures—like space vehicles, aircraft, railcars, ships, or even wind turbine blades—ply-by-ply and element-by-element.

In the case of the CCM, HyperSizer guided design and manufacturing decisions throughout the product development process. "HyperSizer gave us a view into what the physics were doing," said Kirsch. "We could zoom in on the architecture, refine the design, trade solutions and evaluate mass and manufacturability very quickly." The software was also the primary communications tool used to display analytical results during five different technical reviews with industry and agency experts.

"I've been working with composites for 25 years and the CCM is the most complicated structure I've ever dealt with," said Jim Jeans, chief architect for NASA on the project. "The fact that it passed these tests with flying colors is a credit to HyperSizer, which we used in every phase of the project. The sizing and strain predictions all held up as the software predicted."

Load testing of the CCM involved blanketing the vehicle with 280 linear strain gages—fiber optic cables generating about 3000 channels of data—and 80 acoustic sensors that listened for fiber breaks in the composite lay-ups. The structure successfully withstood tests of loads applied to the structure to simulate launch abort and parachute deployment.

Then came the most critical test of internal pressure, which required the CCM to withstand twice standard atmosphere pressure (31 psi) in order to meet the required NASA safety factor of two. Although additional testing involving intentional damage of the CCM will continue into early 2010, passing the internal pressure test was essential for keeping the module development program on track.

"This project clearly demonstrates HyperSizer's ability to accurately predict the behavior of large composite structures, with exacting design and manufacturing requirements," said Craig Collier, president of Collier Research Corporation and the original programmer of the software. "The use of composites continues to expand across new industries as manufacturers look for ways to safely and cost-effectively replace heavier materials. HyperSizer can be an important tool for ensuring the integrity and optimal performance of the design engineering team's work."

About Collier Research Corporation
Collier Research Corporation is a leading engineering software provider to the aerospace industry and NASA, providing structural tools, methods research, and software solutions with its flagship product, HyperSizer. As a trusted industry leader, HyperSizer provides aerospace stress analysis and sizing optimization, reducing the weight of aircraft and space vehicles, whether designed with composites or traditional metallic materials. HyperSizer is developed by engineers, for engineers, and is currently being used by NASA on the Crew Exploration Vehicle, the Ares I and Ares V launch vehicles, and by aerospace industry leaders such as Boeing, Lockheed Martin, Bombardier, and Gulfstream for commercial transport planes and business jets. For more information, visit www.hypersizer.com .

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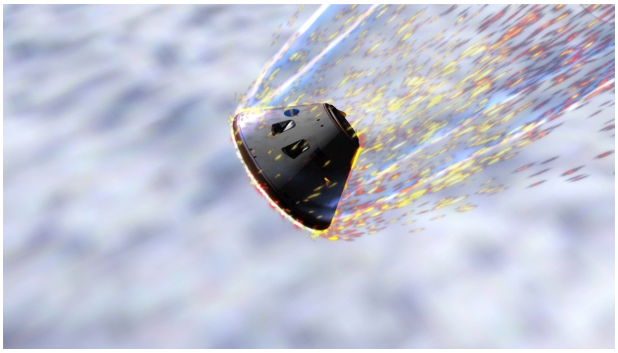

Image 1. Artist's rendition of NASA's Orion flight crew module during re-entry into the earth's atmosphere. A composite alternative, being tested to withstand the mechanical loads encountered during such an event, has successfully passed critical flight condition simulation tests. Image courtesy of NASA

Image 2. The design and construction of the NASA Composite Crew Module (CCM) was optimized with the help of HyperSizer structural sizing and design analysis software. The module is pictured here with sensors attached in preparation for pressure testing. Photo courtesy of NASA

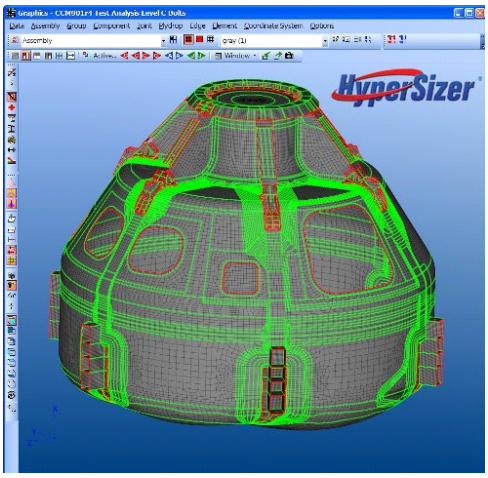

Image 3. HyperSizer software's structural sizing and design analysis of NASA's Composite Crew Module (CCM) enable the prediction of the structure's successful response to simulated flight condition load testing. This finite element model of the CCM displayed in HyperSizer shows the composite ply drops identified in green.

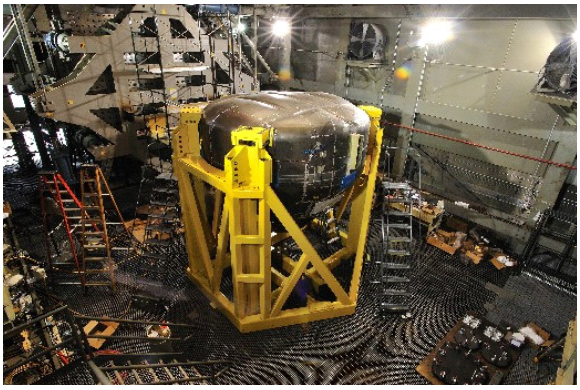

Image 4. NASA's Composite Crew Module (CCM) in the test rig (upside down) at NASA's Engineering and Safety Center (NESC) at Langley Research Center. The CCM project is being carried out to study materials tradeoffs between metals and composites in large space structures. Photo courtesy of NASA [EDITORS NOTE: A similar photo is also available in a vertical format] **# # #**