

## Pretest Acoustic Analysis of Orion E-STA



## Case Study

### OVERVIEW

The Orion Multi-Purpose Crew Vehicle is NASA's first spacecraft designed for long-duration, human-rated deep-space exploration. Orion is being designed to eventually transport humans beyond low Earth orbit to destinations such as the Moon and Mars and return them safely to Earth. Glenn Research Center (GRC) supported the Orion Multi-Purpose Crew Vehicle program with vibroacoustic testing of the Orion Service Module European Structural Test Article (E-STA) developed by the European Space Agency. This testing occurred at the Space Power Facility at Plum Brook Station.

ATA supported GRC by building vibroacoustic models of E-STA. Prior to the test, these models were used to design the acoustic tests by predicting expected responses. After the test, test-measured responses were compared to pretest predictions so that validation/correlation of the model could be performed. Software packages used include Nastran, MATLAB, VA One, and WaveSix.

### TASKS PERFORMED & KEY OUTCOMES

- Construction of low-frequency boundary element method (BEM) models
- Construction of high-frequency statistical energy analysis (SEA) models, which included derivation of equivalent SEA properties from finite element models (FEMs)
- Implementation of "hybrid" vibroacoustic modeling techniques to improve predictions in the mid-frequency regime
- Development and delivery of methods and custom scripts to improve efficiency of model construction and analysis processes
- Documentation of all model changes
- Model predictions compared favorably with test results