

CUSTOMER:  
**ATK Composite Optics, Inc. (COI)**

INDUSTRY:  
**Aerospace**

PROJECT NAME:  
**MESSENGER Structural Analysis and Static Load Testing**

CUSTOMER LOCATION:  
**San Diego, California**

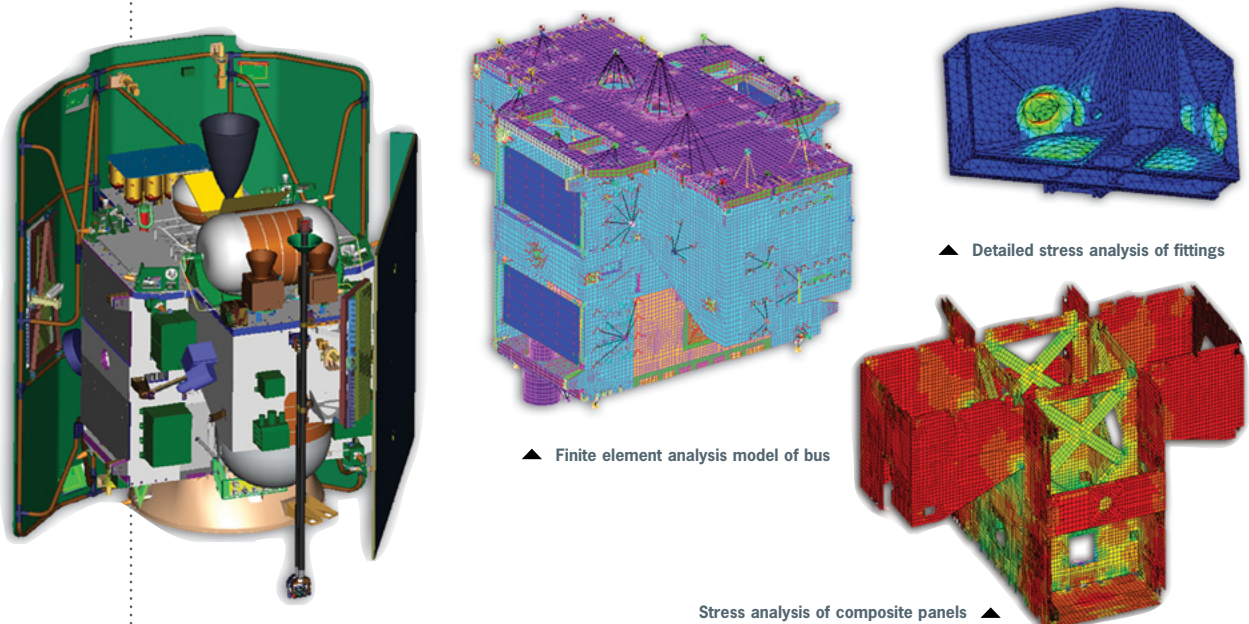
**OVERVIEW**

Launched in August of 2004, MESSENGER is the MErcury Surface, Space ENvironment, GEochemistry, and Ranging mission designed to investigate six key scientific questions about Mercury's characteristics and environment. The MESSENGER mission will orbit Mercury after making two flybys of the planet, using data collected during the flybys as an initial guide to perform a more focused scientific investigation of the planet. The spacecraft will be inserted into Mercury orbit in March 2011 and will carry out comprehensive measurements for one full Earth year.

ATK Composite Optics, Inc., (COI) was responsible for the design, analysis, fabrication, and testing of the composite bus structure of the spacecraft. ATA supported COI by providing comprehensive analysis of the MESSENGER bus structure with regards to the design limit loads.

**ATA SUPPORT INCLUDED:**

- ▷ Developed a detailed FEM of the structure in combination with the nonstructural components that the bus is designed to support.
- ▷ Iteratively performed quasi-static analyses of design limit loads and the anticipated thermal environment, calculated margins of safety, and made design recommendations until all-positive margins were achieved.
- ▷ Assessed overall panel stresses, fitting detailed stresses, bonded interfaces, and bolted joints.
- ▷ Reduced spacecraft weight by optimizing fitting designs.
- ▷ Verified the analysis predictions by designing and directing the static load test to qualify the flight hardware.



▲ Finite element analysis model of bus

▲ Detailed stress analysis of fittings

Stress analysis of composite panels ▲