

# Structural Design, Analysis, and Test for the X-38

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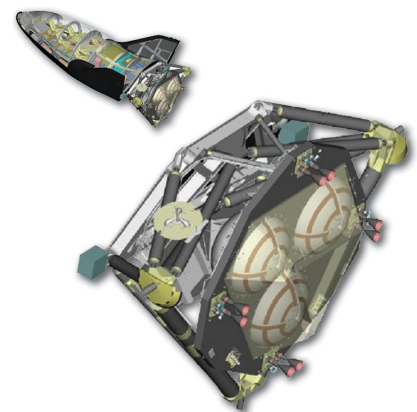
## Case Study

### OVERVIEW

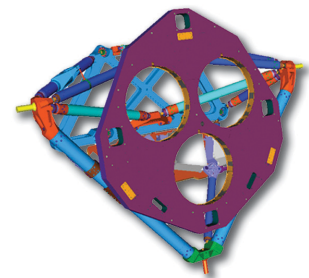
The X-38 vehicle was a NASA-funded project intended to be a precursor to the crew return vehicle for the International Space Station. The primary purpose of this vehicle was to serve as an emergency lifeboat for the astronauts. Orbital ATK (formerly Composite Optics, Inc.) was contracted to design, analyze, fabricate, and test the X-38 Deorbit Propulsion Stage (DPS) structure. The DPS did not only need to support the propellant tanks but also served as the vehicle chassis within the shuttle cargo bay. ATA supported Orbital ATK throughout the detailed design analysis of the X-38 DPS Forward Structural Adapter structure and provided engineering support for the static load test.

### TASKS PERFORMED & KEY OUTCOMES

- Updated the system finite element model (FEM) of the structure to reflect the latest vehicle and battery models provided by NASA.
- Performed quasi-static analyses of the final design limit loads and thermal analyses to assess the effect of the coefficient of thermal expansion mismatch between metallic and composite components.
- Assessed nominal beam and panel stresses, fitting detailed stresses, bonded interfaces, and bolted joints.
- Designed the static load test on the flight hardware, which required twenty load cases to fully test all critical components and bonded joints to 120% of the design limit loads.
- Verified that the test results correlated with analysis predictions to provide greater confidence in the modeling approach.



X-38 crew return vehicle and close-up of aft-end Deorbit Propulsion Stage



Deorbit Propulsion Stage structural assembly

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