Next Generation Space Vehicles | Flight and Landing Analysis of the Pad Abort Demonstrator

CASE STUDY

Images courtesy of Lockheed Martin

CUSTOMER:
Lockheed Martin Space Systems

INDUSTRY:
Aerospace

PROJECT NAME:
Pad Abort Demonstrator Loads Analysis

CUSTOMER LOCATION:
Littleton, Colorado

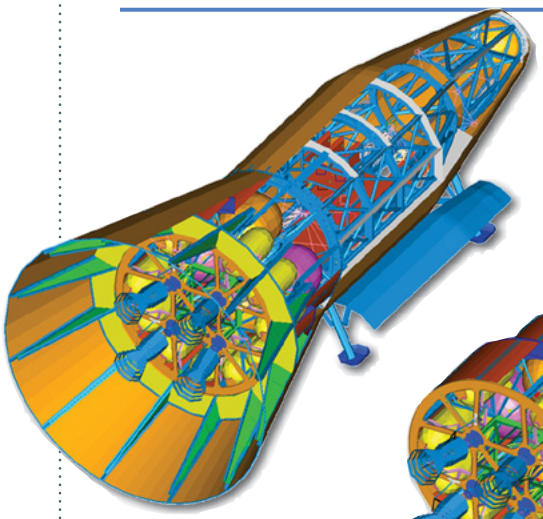
OVERVIEW

The Lockheed Martin launch Pad Abort Demonstrator (PAD) will be used as a test-bed to demonstrate crew escape technologies and to validate analytical models necessary for future crew escape systems. The launch Pad Abort Demonstrator test bed will use fully instrumented mannequins to provide data on crew environments during the test and checkout of crew escape propulsion systems, parachute deployment, vehicle orientation, landing techniques, and external aeroshell configurations.

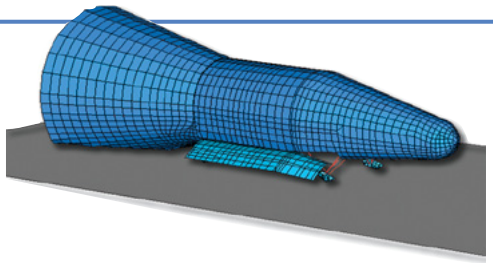
ATA Engineering, Inc., (ATA) was asked by Lockheed Martin to take on the responsibility for developing loads for flight and ground handling. This included structural, thermal, and vibroacoustic environments. One of the dominant load environments involved landing where the impact loads were attenuated through collapsible struts that would be replaced after each flight. Over a period of five months, ATA used a variety of advanced analysis tools including Abaqus, I-deas, NX Nastran, and MATLAB to demonstrate feasibility of the concept.

ATA SUPPORT INCLUDED:

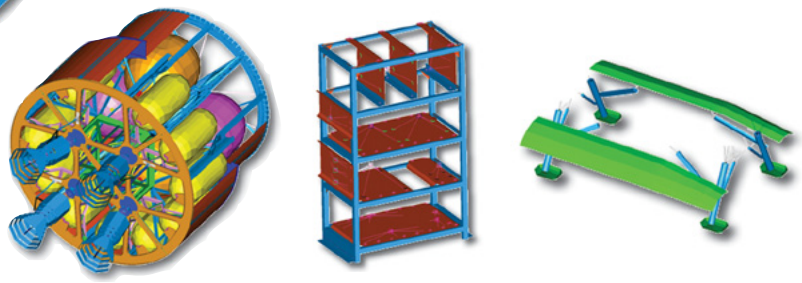
- Developed and maintained a system-level finite element model (FEM) through several design iterations.
- Determined accelerations and forces due to liftoff, ascent, recovery, and landing, as well as thermal and vibroacoustic environments.
- Performed transient analyses for a variety of flight conditions.
- Performed trade studies and investigative analyses to understand liftoff and landing events.
- Utilized Abaqus to perform nonlinear landing analyses, including studies to properly size the landing struts and verify that vehicle rollover did not occur.
- Supported preliminary design review (PDR), critical design review (CDR), and intermediate meetings and reviews.



▲ System-level finite element model



▲ Detailed impact landing simulation carried out using Abaqus/Explicit



▲ Inclusion of detailed component models in system-level FEM allowed recovery of responses at desired locations throughout vehicle

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