



CUSTOMER:  
**Vivace-Spacetron**

INDUSTRY:  
**Aerospace**

PROJECT NAME:  
**Vivace-Spacetron Cygnus Vertical Container**

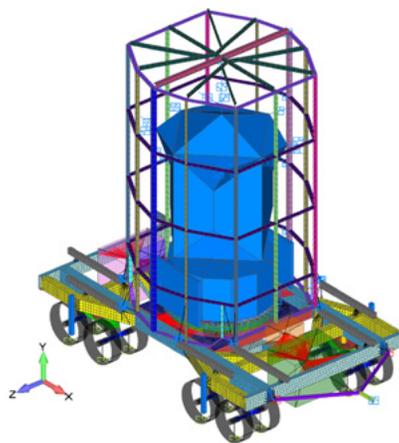
CUSTOMER LOCATION:  
**Valencia, CA**

**OVERVIEW**

The Cygnus spacecraft is an unmanned resupply spacecraft being developed by Orbital Sciences Corporation as part of NASA's Commercial Orbital Transportation Services program. Vivace-Spacetron (Vivace) was contracted to design and build a unique vertical ground transporter for the Cygnus cargo resupply spacecraft. In support of the transporter design, ATA Engineering, Inc., (ATA) derived ground transportation environments and performed a comprehensive collection of modal, random vibration, nonlinear transient, and linear transient analyses in order to verify that the acceleration and displacement responses of Cygnus during transport to the launch vehicle integration facility did not exceed specified requirements. These analyses were critical in designing a suspension system that prevents the transmission of high acceleration levels to the spacecraft. In addition, these analyses demonstrated that proper clearance between the spacecraft and protective transporter doors could be achieved during the most severe operational conditions. This support aided Vivace in successful design, construction, and operational demonstration under a very aggressive schedule while meeting stringent budget constraints.

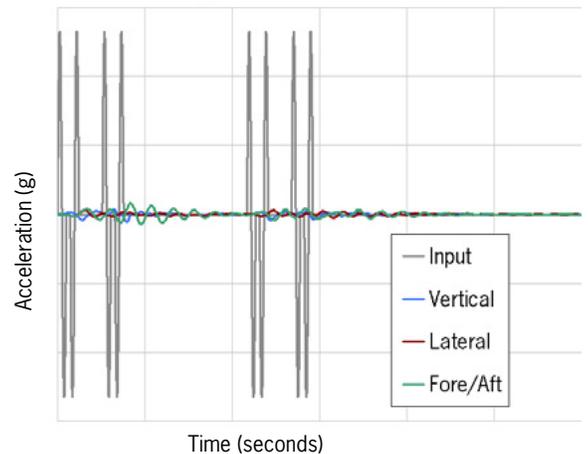
**ATA SUPPORT INCLUDED:**

- ▷ Derivation of the bounding dynamic environment design requirements for transient and random ground transportation conditions.
- ▷ Performance of preliminary analytical design studies to define the suspension and towbar isolation system requirements necessary to mitigate large accelerations of the Cygnus spacecraft.
- ▷ Generation of PSD acceleration responses of the spacecraft for road surface random excitations. Relative deflections between the spacecraft and protective doors were also evaluated.
- ▷ Linear and nonlinear transient analyses to predict acceleration and displacement time histories due to bump excitation (transporter rolling over an object in the road) and tractor braking events.
- ▷ Evaluation of the stability of the transporter with the fully fueled Cygnus.



▲ Finite element model of the Cygnus Vertical Container

Cygnus Net CG Acceleration



▲ Isolated time history response of Cygnus spacecraft during transport

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