

## **INTEGRATED VIBRATION AND ACCELERATION TESTING TO REDUCE PAYLOAD MASS, COST AND MISSION RISK**

### **Summary**

It was demonstrated, through both simulation and test, that exposing a spacecraft to simultaneous acceleration and vibration loads can cause nonlinear structural responses, including shifts in natural frequencies, changes in mode shapes, and changes in the components that are excited. However, current space launch qualification standards call for a series of discrete tests that apply individual load components separately. Therefore, combined environments testing is the only known method of evaluating the otherwise “hidden risks” of nonlinear structural responses.

Phase 1 developed and demonstrated the capability to deliver simultaneous acceleration and vibration loads to space launch hardware utilizing a state-of-the-art centrifuge. The second objective was to understand the significance of any effects identified. A 1U CubeSat (the Drexel University DragonSat-1) was selected as the Device under Test (DUT).

The Phase 2 proposal will extend the Phase 1 modeling efforts to actual acceleration testing in the ATFS-400.

### **Objectives**

Test two fixtures for combined environment testing in the ATFS-400. One test fixture was designed for vibration loads aligned with the acceleration vector. The second fixture delivered vibration loads in a transverse direction.

Compare results with modeling and simulation effort completed in Phase 1

### **Customer/Partner**

American Aerospace Advisors, Inc. & Drexel University

### **Status**

In the process of developing SBIR Phase 2 Proposal (January 2013)

### **Future Publications**

SBIR Report

Aviation Space and Environmental Medicine