Air Force SBIR/STTR

Air Force SBIR/STTR Transition Story

Transition

An example of Air Force supported SBIR/STTR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.

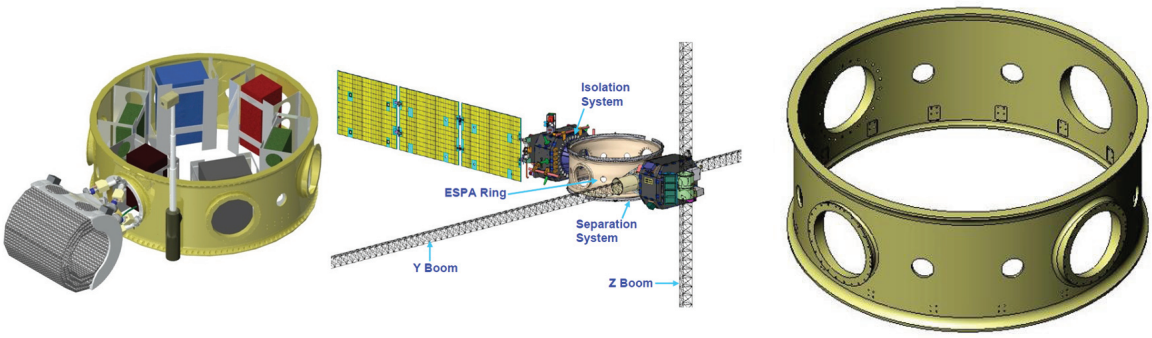
SBIR Topic Number:
AF01-044

SBIR Title:
Control and Pointing of Very Flexible Large Space Structures

Contract Number:
F29601-02-C-0005

SBIR Company Name:
CSA Engineering, Inc., Mountain View, CA

Technical Project Office:
AFRL Space Vehicles Directorate, Kirtland AFB, NM



Left: Demonstration and Science Experiment (DSX) using ESPA ring satellite bus. Right: DSX ESPA ring.

Affordable On-Orbit Demonstration of Very Large Flexible Space Structures Control and Pointing

- CSA Engineering developed tools to simulate the coupling between gossamer space structures and spacecraft attitude control systems, and a multiple secondary payload adapter was designed and fabricated for an Air Force flight experiment for use as a satellite bus
- The Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) ring used on the DSX experiment is a low-cost spacecraft bus alternative for multiple missions on a common launch vehicle
- The Air Force needs a system to provide increased spacecraft vibration isolation while achieving rocking modal dynamics above the minimal values determined by the launch vehicle guidance, navigation, and control systems
- Hybrid SoftRide systems will have vibration protection capabilities higher than flight-proven all-passive ones
- This SBIR program yielded roughly 1 million dollars in flight hardware and enhanced CSA's visibility within the space flight community

Commercialization Pilot Program Series

377ABW-2010-1254

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Air Force Requirement

Control of gossamer space structures will be critical in future Air Force missions to reduce deployment risk and assure minimal interaction with the attitude control systems. Multiple payload adapter technologies allow the Air Force to utilize excess launch mass margin to insert small payloads into orbit while minimizing cost. The use of a Hybrid SoftRide system would provide increased spacecraft vibration isolation while achieving rocking modal dynamics above the minimal values determined by the launch vehicle guidance, navigation, and control systems.

SBIR Technology

CSA Engineering developed tools to simulate the coupling between gossamer space structures and spacecraft attitude control systems. A multiple secondary payload adapter was designed and fabricated for an Air Force flight experiment for use as a satellite bus.

Hybrid SoftRide demonstration test bed

This provides the Air Force with an inexpensive alternative to traditional designs and offers modularity in the spacecraft integration. A magnetorheological-based augmentation to all-passive whole spacecraft vibration isolation systems was demonstrated to have the capacity to reduce launch load transmission to the spacecraft while minimizing interaction of rocking modes with the launch vehicle.

Transition Impact

Gossamer space structures will allow the Air Force to increase apertures and resolutions at the expense of program risks of deployment and structural control. Advanced control technologies will be required for such flight programs. Semi-active Hybrid SoftRide systems will have vibration protection capabilities greater than flight-proven all-passive ones. Future missions with delicate payloads may require this innovative technology.

Use of multiple payload adapters is an avenue to decrease the cost to get small-to-moderate sized spacecraft to orbit and increase the number of launch opportunities. The Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) ring is a low-cost alternative for the spacecraft bus for multiple missions on a common launch vehicle.

Demonstration and Science Experiment (DSX) ESPA ring during fabrication

The ESPA technology has flight heritage and is baselined by the Air Force for future EELV launches. The ESPA (and variants) could support future space flight missions requiring multiple payload capability or as a flight-proved, inexpensive spacecraft bus. On-board propulsion and avionics provide capability for orbit insertion of multiple payloads.

Company Impact

"This SBIR program yielded roughly 1 million dollars in flight hardware, which has increased our visibility and acceptance into the space flight community," states Dr. Conor D. Johnson, President of CSA Engineering.

CSA Engineering, located in Mountain View, California, is a world leader in structural dynamics, vibration suppression, and precision motion control technology. CSA became a wholly owned subsidiary of Moog Inc. in 2008.

U.S. AIR FORCE

SBIR/STTR

Air Force SBIR Program
AFRL/XP
1864 4th Street
Wright-Patterson AFB OH 45433

AF SBIR/STTR Program Manager: Augustine Vu
AF CPP Program Manager: Richard Flake
Website: www.sbirsttrmall.com
Comm: (800) 222-0336
Fax: (937) 255-2219
e-mail: afrl.xppn.dl.sbir.hq@wpafb.af.mil

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