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:
AF98-072

SBIR Title:
Isolation for Spacecraft with Multiple Payloads

Contract Number:
F29601-98-C-0218

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

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

Space Test Program STP-1 Launch on March 8, 2007

Adapter for Multiple Spacecraft on Atlas V and Delta IV

- Increased access to space for small satellites and space experiments
- Technology developed under Air Force SBIR funds leads to advancements in space-based technology
- Adapter crucial to DoD Space Test Program (STP) Mission on an Atlas V Launch Vehicle from Cape Canaveral
- STP is implementing a launch-on-schedule approach that will provide rideshare opportunities and reduce risk for launch

Commercialization Pilot Program Series

AFRL/VS07-0492

Air Force Requirement

The Air Force needs low-cost access to space for small satellites. The launch of secondary satellites (up to 180 kg) can greatly increase the number of missions flown, thereby increasing advancements in space-based technology for the Air Force.

Despite the benefits of small satellites for certain applications, infrequent launch opportunities and their associated high costs present the primary obstacle to the full utilization of small satellite technology. The Air Force identified large unused payload margins, on the majority of the DoD's Evolved Expendable Launch Vehicle (EELV) (Delta IV and Atlas V) manifests. By taking advantage of this existing unused payload margin the Air Force will increase access to space for small satellites and space experiments, and by sharing mission integration and launch expenses, the cost of space access will be dramatically reduced.

SBIR Technology

Using SBIR contracts under a program for the Air Force Research Laboratory's Space Vehicles Directorate, Kirtland Air Force Base, NM, CSA Engineering designed, built, and flight qualified EELV Secondary Payload Adapter (ESPA). ESPA is qualified to mount a 15,000-lb primary satellite and six 400-lb secondary satellites on a Delta IV or Atlas V EELV. This capability allows six additional spacecraft to be launched whenever there is excess capacity on an EELV Mission. ESPA is installed between the EELV upper stage and the primary payload (PPL). To provide minimal impact to the PPL, the ESPA duplicates the standard interface plane of the EELV upper stage and is designed to be very stiff in all directions. Since the ESPA ring is only 24 inches high, only a small amount of volume is taken away from the PPL. Vibration and shock isolation systems have also been designed for spacecraft on ESPA.

ESPA Ring

On March 8, 2007, the ESPA Ring enabled the launch of the STP-1 Mission on an Atlas V Launch Vehicle from Cape Canaveral. This Mission placed in orbit six unique spacecraft.

Transition Impact

Mission planners expect the ESPA technology to have a tremendous impact on future spacecraft programs by increasing the number of secondary payload launch opportunities available at a reasonable cost. Planners also anticipate that this AFRL development effort will help provide small satellite launch opportunities on a regular schedule, thus allowing for the full utilization of small satellite technology within the United States.

The small satellite community has adopted the ESPA secondary payload (SPL) interface as a standard. "ESPA spacecraft," weighing 400 lbs, with center-of-gravity at 20", and dimensions of 24"x28"x38", have become a standard small satellite configuration.

The DOD Space Test Program (STP) has focused near-term spacecraft development around ESPA-class spacecraft. The Standard Interface Vehicle (SIV) contract recently awarded to a team of Ball Aerospace and AeroAstro will build up to six ESPA spacecraft. STP is implementing a "launch on schedule" approach that will provide rideshare opportunities and reduce risk for launch by implementing existing technologies and standard interfaces to cut costs for multiple spacecraft buys.

Additionally, the AFRL's Demonstration and Science Experiments (DSX) Program has based its free-flyer spacecraft configuration on the ESPA Ring. DSX ESPA is a four-port Ring that will form the hub of a free-flyer spacecraft.

Company Impact

In addition to the flight program on which the original ESPA Ring technology was proven, this SBIR development has opened many doors for CSA for implementation of whole-spacecraft isolation as well as alternate ESPA configurations for current and future flight programs. In close succession to STP-1, CSA is providing an ESPA Ring for the next NASA lunar mission (LRO/LCROSS, October 2008), and ESPA will provide the hub of a free-flyer spacecraft for AFRL's DSX. LCROSS will consist of a lunar impactor and a "shepherding" spacecraft: the impactor will be the upper stage of an Atlas V, and the spacecraft is being built around an ESPA Ring. DSX will travel to the radiation environment of medium Earth orbit (MEO) to study wave-particle interaction and map the energetic particle and plasma environment.

ESPA was designed and built during the period when the EELVs were also being developed, and both EELV builders, Lockheed Martin and Boeing (now combined as the United Launch Alliance), were subcontractors to CSA during this period. Boeing and Lockheed advised CSA on launch environments for ESPA design, and both companies provided guidance for the development of the ESPA qualification program and test facility. CSA designed and built this facility and performed the ESPA qualification test. This general-purpose static test facility, located at Kirtland AFB, NM, expanded the test capability available to AFRL for qualification test programs.

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