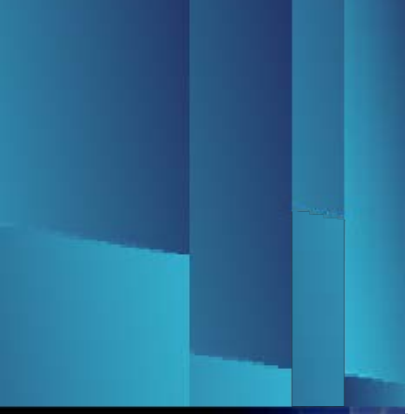

Space Vehicles Directorate

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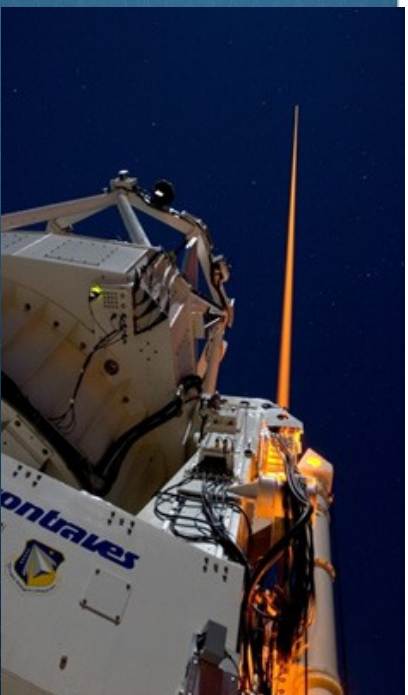
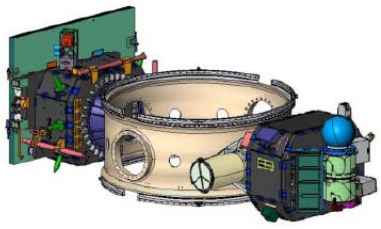


AFRL
THE AIR FORCE RESEARCH LABORATORY

Air Force Research Laboratory Space Vehicles Directorate Demonstration and Science Experiments (DSX) Satellite

Description of Technology:
When launched in Fall 2017, the Air Force Research Laboratory Space Vehicle Directorate's Demonstration and Science Experiments (DSX) spacecraft will conduct basic research designed to significantly advance the Department of Defense's (DoD) capability to operate in the harsh radiation environment of medium-Earth orbit (MEO). The ability to operate effectively in MEO significantly increases the DoD's capability to field resilient space systems.

DSX is manifested on the Space Test Program-2 (STP-2) mission, utilizing the SpaceX Falcon Heavy launch vehicle. DSX will be flown in an elliptical orbit in MEO for one year of projected experimental operations.



Launch Configuration

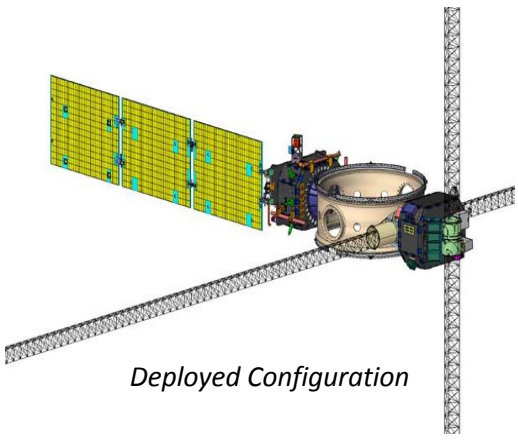
DSX Design:
The DSX design uses an Evolved Expendable Launch Vehicle (EELV) Secondary Payload Adapter (ESPA) ring as an integral structural component.

Experiments DSX Will Perform:
1. The Wave Particle Interaction Experiment (WPIx) will investigate the influence of very-low frequency (VLF) radio waves on particle dynamics.

2. Space Weather Experiments (SWx) will measure and map the distributions of energetic protons, electrons, and low-energy plasma in the inner magnetosphere to improve environment models for spacecraft design and operations.

3. Space Environment Effects (SFx) will determine the MEO environmental effects on electrical components to launch as a secondary payload with primary missions requiring an EELV.

The spacecraft functions are contained within an avionics module on an ESPA ring port. The experiment payloads are located in a payload module attached to the ring opposite the avionics module.

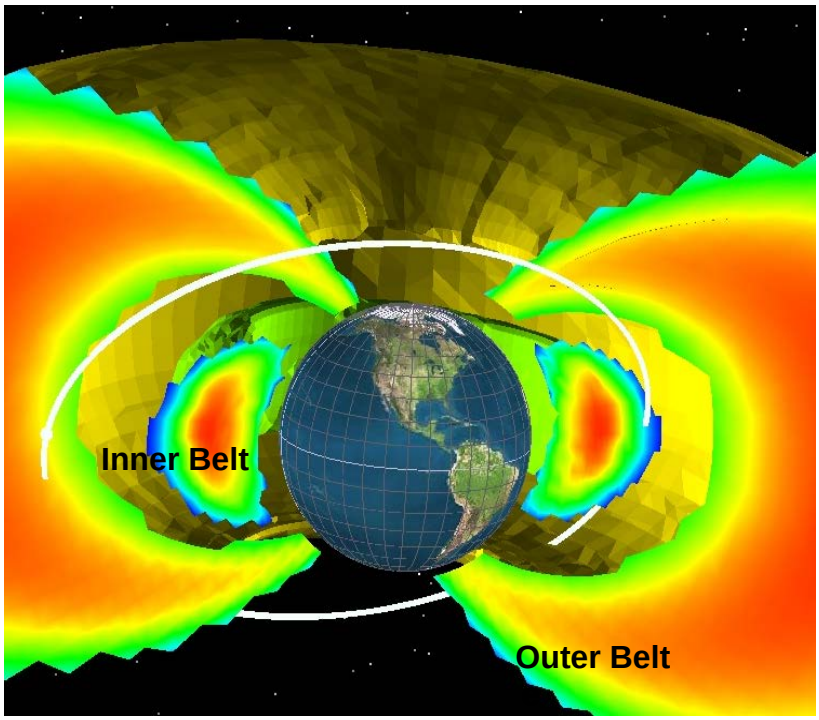


Deployed Configuration

Primary Experiment Payloads: The **WPIx** will transmit and receive VLF waves in the 100 Hz to 750 kHz range in order to investigate their interactions with trapped electrons in the magnetosphere. DSX will also study the behavior of an in-situ VLF antenna and characterize its far-field radiated patterns, as well as natural wave-particle interactions at MEO.

The suite of **SWx** instruments will characterize the high and low energy electron and proton fluxes and pitch angle distributions along the DSX orbit. In addition to providing observational support to the natural component of the WPIx experiment, it will provide the most comprehensive survey of the radiation environment at MEO. In addition, this suite will enable observation of the "slot region" between the inner and outer radiation belt, leading to better understanding of radiation belt dynamics.

The **SFx** consists of NASA's Space Environment Testbed (SET) and four AFRL-developed photometers and radiometers. SET features four smaller experiments designed to investigate radiation effects on electronics such as field programmable gate arrays. The AFRL instruments will directly measure the radiation-induced degradation of the optical and thermal properties for several spacecraft materials of interest.



Van Allen Radiation Belts

DSX Secondary Experiment:

DSX has one secondary experiment, the Adaptive Controls Experiment (ACE). ACE software will perform automated on-orbit system analysis to produce frequency response functions for the DSX spacecraft structures and then demonstrate the ability to produce on-orbit adaptive, multi-input, multi-output control law designs to meet performance objectives. ACE will interact with the spacecraft attitude determination and control system.

DSX Benefit to the Nation:

DSX will benefit the warfighter by significantly enhancing understanding of the MEO environment with particular emphasis on the "slot region." In addition, DSX will advance our understanding of the interplay between waves and particles that underlies radiation belt dynamics, enabling better specification, forecasting, and mitigation.

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