ASSP

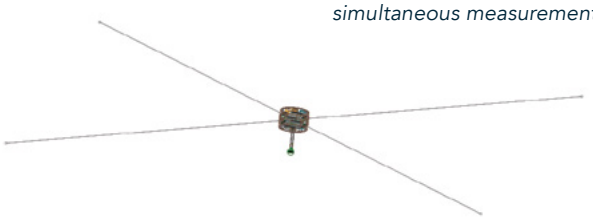
Auroral Spatial Structures Probe

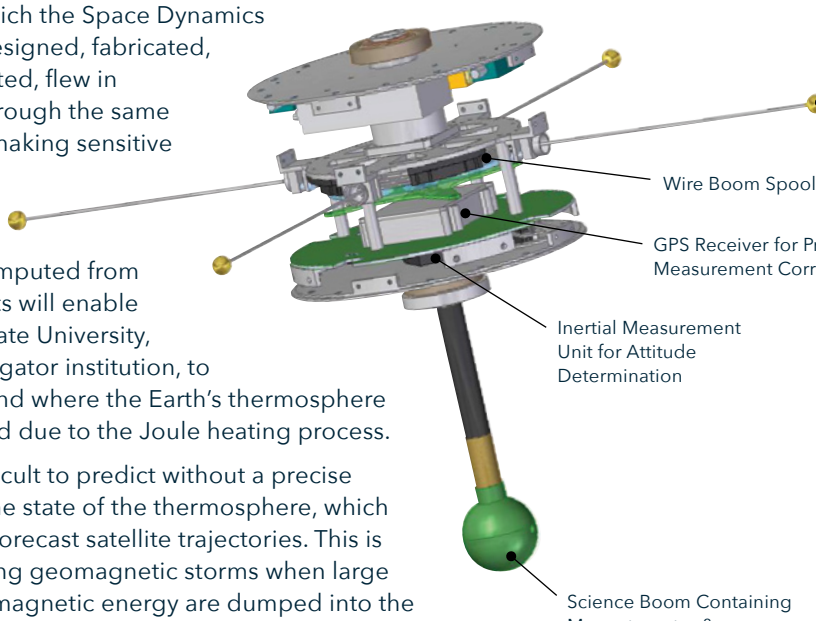
The NASA Auroral Spatial Structures Probe (ASSP) mission measured the spatial and temporal variation of the energy flow into the upper atmosphere in and around the aurora. Electromagnetic energy is generated when solar wind interacts with Earth's magnetosphere and flows into Earth's upper atmosphere. ASSP is the first NASA sounding rocket mission to make use of a constellation of mini-payloads to observe both the spatial pattern and temporal variations associated with this energy.

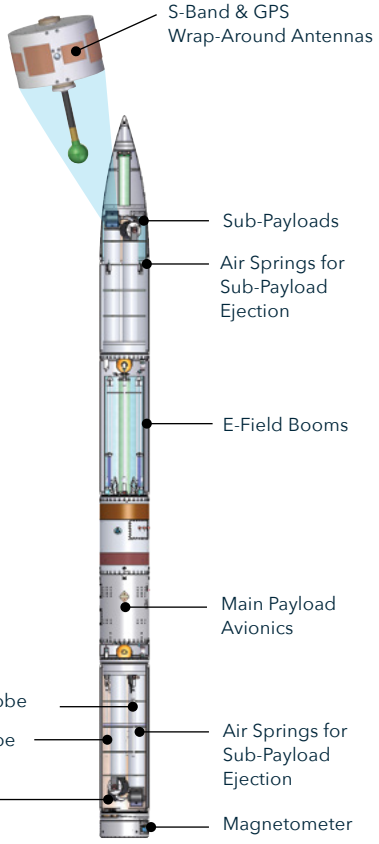
Seven payloads, which the Space Dynamics Laboratory (SDL) designed, fabricated, assembled, and tested, flew in rapid succession through the same volumes of space, making sensitive observations of electric and magnetic fields. The energy flow computed from these measurements will enable scientists at Utah State University, the principal investigator institution, to understand when and where the Earth's thermosphere will heat and expand due to the Joule heating process.

Satellite drag is difficult to predict without a precise understanding of the state of the thermosphere, which limits the ability to forecast satellite trajectories. This is especially true during geomagnetic storms when large amounts of electromagnetic energy are dumped into the thermosphere and dissipated through the Joule heating process. The data from ASSP will be combined with ground-based observations of winds, large-scale electric field patterns, and auroral images. This research is focused on understanding the importance of small spatial scale and rapid temporal fluctuations of electromagnetic fields relative to slow and larger-scale electrodynamic processes. The end result will be an increased understanding of Joule heating and ultimately the processes that lead to global temperature changes in the thermosphere.

This is an external view of one of the six sub-payloads that ejected from the main payload. All six sub-payloads and the main payload flew in a constellation and took simultaneous measurements.







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SDL/12-576 Rev. D

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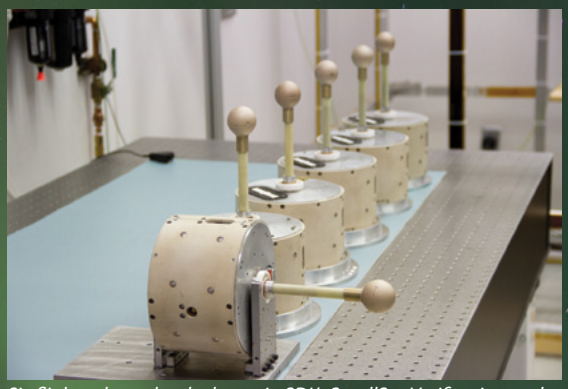
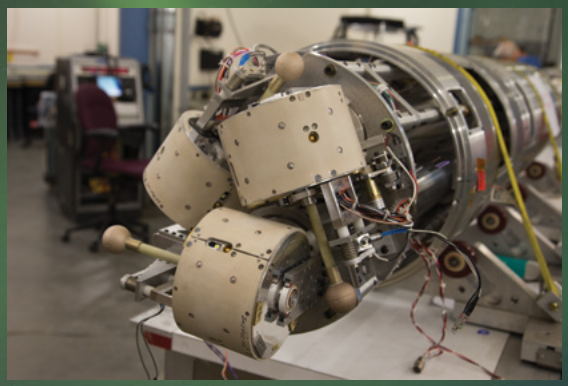
ASSP was launched on January 28, 2015, from Poker Flat, Alaska, into active aurora during geomagnetically active conditions. To capture the data, a constellation of six small sub-payloads were ejected from the rocket mid-flight and continued to separate relative to each other throughout a sounding rocket flight. Each of the six sub-payloads, plus the main payload, carried a crossed pair of double-probe sensors to measure in-situ electric fields, a three-axis magnetometer, a Langmuir probe, and a GPS receiver. The data obtained at the different spatial locations and baselines will be used to develop models for the spatial and temporal distribution of E-fields and their correlations in space and time. Complementing the rocket data, a network of imaging Fabry-Perot spectrometers monitored both the E- and F-region neutral winds along the entire flight path of the payloads. The PFISR radar provided both F-region electric field maps and E-region densities for a portion of the trajectory.



Six flight sub-payloads shown in SDL's SmallSat Verification and Validation Laboratory after static balance testing. The payload consists of three science instruments, with GPS and communications hardware tightly integrated in a 6" diameter cylinder.



Three aft sub-payloads being integrated into the rocket body. The sub-payloads are spun to 2 Hz in their cradles and ejected using pneumatic pistons at high velocity. Each sub-payload was ejected from the rocket at 50 m/s in different directions to create a network of measurement points.

Background image courtesy of NASA. Long exposure of the ASSP launch showing all four stages of the rocket motors igniting. The rocket apogee reached approximately 550 km into space.

UtahStateUniversity

The material contained in this document is based upon work supported by the National Aeronautics and Space Administration (NASA) under award No. NNX11AE23G. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of NASA.