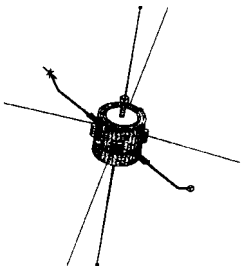
FAST

Fast Auroral Snapshot Explorer

Spacecraft Sketch	Mission Objective
	The Fast Auroral Snapshot Explorer (FAST) will investigate the plasma physics of auroral phenomena at extremely high time and spatial resolution. Data from the FAST experiments are expected to reveal the key physical processes responsible for accelerating electrons into the earth's upper atmosphere to produce the aurora. To achieve these scientific goals, FAST will 8y in a highly eccentric, near-polar orbit. The orbit will process nominally one degree per day throughout the one year planned mission duration. Scientific investigations will operate in a campaign mode (about 60 days long) as apogee transitions through the northern auroral zone and in a less intense survey mode during the rest of the orbit.

TYPE OF MISSION	PROGRAM OFFICE	PROJECT LEAD CENTER	MANAGEMENT APPROACH	S/C CONTRACTOR	I&T CONTRACTOR
ASTROPHYSICS	SPACE SCIENCE & APPLICATIONS	GSFC	IN-HOUSE	GSFC IN-HOUSE	GSFC IN-HOUSE

Payload Description

The FAST payload consists of seven experiments that include five particle instruments, one electric field instrument and a magnetometer. In order to capture the auroral phenomena over small time (microseconds) and spatial scales, FAST will utilize high speed data sampling, a large, fast-loading ("burst") memory and smart, on-board software to trigger on the appearance of various key phenomena. Using a 1-Gb solid-state memory and a data acquisition rate of 8 Mbs (almost two orders of magnitude faster than previous satellites), FAST will produce high-resolution snapshots of auroral arcs and other interesting auroral events. The FAST spacecraft is mission unique (e.g., non-SAMPEX derived), developed by the SMEX project. The lightweight spacecraft has body-mounted solar arrays, is spin-stabilized and rotates at 12 rpm with its spin axis normal to the orbit plane.

INSTRUMENT NAME	ACRONYM	PI AFFILIATION	PRINCIPAL INVESTIGATOR	I&T CONTRACTOR
ELECTRIC FIELD PLASMA EXPERIMENT	NONE	UCB	TBD	TBD
MAGNETOMETERS	MAG	UCLA	TBD	TBD
QUADRISPHERICAL ELECTROSTATIC ELECTRON ANALYZER	EESA	UCB	TBD	TBD
TIME-OF-FLIGHT ENERGY ANGLE MASS SPECTROGRAPH	TEAMS	UNIV NH/LPARL	TBD	TBD

Instrument Descriptions
The FAST Electric Field Plasma Experiment has ten electric field sensors, two on each of the four radial wire and one on each of the two rigid axial booms. All except the four outermost sensors can also operate as current collecting Langmuir probes. The instrument design is based on instruments flown on S3-3, IDEE-1, CRRES, Polar and Cluster. The instrument is designed to provide: 1) vector measurement of the electric field from DC to about 20 kHz; 2) AC electric field measurements up to 2 MHz; 3) monitoring of the dominant frequency and amplitude of high-frequency waves; 4) measurement of the thermal plasma density and temperature; 5) measurement of the density fluctuations; 6) measurements of time delays between different antennae; and 7) wavelength measurements up to 20 kHz.
The FAST Magnetometers (MAG) include both a DC fluxgate magnetometer and an AC search coil magnetometer. The fluxgate magnetometer is a three-axis instrument using highly stable low noise ring core sensors to provide magnetic field information from DC to 100 Hz. The search coil magnetometer uses a three axis sensor system that contains laminated permalloy cores, windings and preamplifiers. An AC magnetic field measurement is provided over the frequency range 10 Hz to 2.5 kHz. The design is based on the OGO-5 instrument combined with recent developments on classified projects.
The FAST Quadrispherical Electron Electrostatic Analyzer (EESA) sensor head is split into two half analyzers on opposite sides of the spacecraft. The EESA also includes a pair of deflectors located at the top-hat entrance, which allow the analyzer to tip the planar FOV into a slightly conical (+/- 10 degree) FOV. The deflectors on opposite half-analyzers flip their polarity at the end of the sweep in which the magnetic field bisects the two half-analyzers. This allows the instrument to monitor both upgoing and downgoing field-aligned fluxes. The anode pulses are amplified and read into the Burst Data Packets. The data are also averaged and placed into Survey Data Packets.
The FAST Time-of-flight Energy Angle Mass Spectrograph (TEAMS) is a high-sensitivity mass-resolving spectrometer which measures: 1) energy per charge using an electrostatic analyzer, 2) mass per charge using a time-of-flight (TOF) analyzer), 3) incidence azimuthal angle given by spacecraft spin and 4) the incidence polar angle given by the sectoring in the TOF unit. TEAMS operates in three data acquisition modes: 1) Survey Distribution mode which samples with high angle and energy resolution and with time resolution varying from 80 ms (slow) to 10 ms (fast); 2) High-Mass Distribution mode which uses a high mass resolution to identify minor species, with a low angle and energy resolution and with time resolution varying from 80 ms (slow) to 20 ms (fast); and 3) Burst mode which provides data with the highest time, angle, and energy resolution.

Launch
7/13/92(SPX) 6/15/95(SWS) 7/15/95(FST)