SWAS

PROJECT HIGHLIGHTS

Announcement of Opportunity	
NASA Headquarters Office	Space Science & Applications
Enterprise	Space Science
Project	Submillimeter Wave Astronomy Satellite
Project Lead Center	GSFC
Management Approach	Augmented Hybrid
Mission Life (months)	24
Additional Data Analysis (months)	
Launch Date	06 Dec 1998

MISSION OBJECTIVES

SWAS is one of NASA's Small Explorer Program (SMEX) missions. The overall mission objective is to gain a greater understanding of star formation by determining the chemical composition of interstellar clouds, and establishing the means by which these clouds cool as they collapse to form stars and planets. SWAS will focus on the spectral lines at the frequencies indicated: (1) water at 556.936 GHz; (2) molecular oxygen at 487.249 GHz; (3) neutral carbon at 492.161 GHz; (4) isotopic carbon monoxide at 550.927 GHz; and (5) isotopic water at 548.676 GHz. SWAS will make detailed 1-degree x 1-degree maps of at least 20 giant molecular and dark cloud cores during the first two years of the mission.

FOREIGN PARTICIPATION

University of Cologne, Germany

Accosto-Optical Spectrometer (Hardware)

Science Team (Participants)

GROUND SYSTEM DESCRIPTION

SWAS is an non-TDRSS mission. The ground support for SWAS is provided through the Wallops Island Orbital Tracking Station (WPS) located at the Wallops Island, Virginia Flight Facility (WFF) and a Wallops-provided Transportable Orbital Tracking Station (TOTS) at Poker Flat, Alaska. Ground Network (GN) stations at Merritt Island, Florida, and at Santiago, Chile, will provide backup support. Deep Space Network (DSN) stations at Goldstone, California, at Canberra, Australia, and at Madrid, Spain, will provide emergency support. The Canberra DSN station will also provide southern hemisphere tracking support for orbit determination. SWAS flight operations will be supported by the Mission Operations Center (MOC), using the Integrated Test and Operation System (ITOS) at GSFC. The ITOS is an expandable, configurable hardware/software system used for operation of spacecraft and/or instrument payloads. Since the SAMPEX, FAST and SWAS missions are planned to be operational simultaneously, the POCC concept includes multi-mission support with the overlap period of support dependent on the mission life of each spacecraft. The Flight Dynamics Facility (FDF) at GSFC will provide standard orbit and attitude spacecraft support during prelaunch and mission phases - plus mission analysis/operations support and generation of planning aids. The GSFC Sensor Data Processing Facility (SDPF) Packet Processor II (PACOR II) will receive real-time telemetry data from the WPS and data from GN/DSN stations shortly after Line-of-Sight. PACOR II will perform data quality checks, levelzero processing and sequence ordering; and will provide instrument science data storage and data distribution to the Smithsonian Astrophysical Observatory Science Operations Center (SAOSOC) in Cambridge, Massachusetts. The SAOSOC will not perform realtime operations.

PAYLOAD DESCRIPTION

The SWAS payload is a single instrument for science data collection attached to the top of the spacecraft as a single module. The instrument consists of an off-axis Cassegrain telescope, a single detection subsystem comprised of two submillimeter heterodyne receivers, an acousto-optical spectrometer, instrument control electronics, the instrument structure and a thermal control subsystem.

INSTRUMENT DESCRIPTIONS AND SCIENCE LEADERS

Data Point Number 804: The SWAS Instrument [protoflight] (SWAS) is comprised of three major subsystems: An antenna telescope assembly, a submillimeter wave receiver, and an acousto-optical spectrometer (AOS). The antenna telescope includes a 55 x 71 cm diameter off-axis Cassegrain beryllium mirror which, along with an associated optics subsystem, focuses the radiation into the submillimeter wave receiver. The submillimeter wave receiver includes two cooled subharmonic Schottky diode receivers which produce intermediate frequencies that are fed into the broadband AOS. The AOS, in turn, permits observations of four spectral lines produced by H2O, 0 2, CI, and '3C0 simultaneously. An additional isotopic species of water, H Z'80, is observed by retuning one submillimeter wave receiver. Dr. Gary Melnick (Harvard-Smithsonian Center for Astrophysics (CFA) is the instrument PI.

SPACECRAFT DESCRIPTION

SWAS is a three-axis stabilized, stellar-pointed observatory. The spacecraft will maintain solar array sun pointing which points the instrument telescope at selected targets. The instrument is interfaced to the spacecraft as a fully-assembled module, and is designed to be thermally isolated from the spacecraft, which has five main subsystems: Mechanical, command and data handling (C&DH), attitude control system (ACS), power and thermal. The mechanical subsystem includes primary structure which consists of three machined octagonal rings of different diameters. C&DH provides a communications link between the spacecraft and the ground, and internally within the spacecraft computer. The ACS is comprised of an ACS processor, a control electronics box and a complement of sensors and actuators. The power subsystem solar array consists of four deployable, fixed solar panels and one body-mounted panel. Thermal control includes passive control elements, surface coatings and conduction paths and thermostatically-controlled heaters.

CONTRACT AND SUBCONTRACT HISTORY

Contractor/Subcontractor	Project Element
SAO	Instrument
Adcole	Coarse Sun Sensors
Adcole	Digital Sun Sensor
Ithaco	Electromagnetics
Motorola	Transponder
Spectrolab	Solar Array Panels

LAUNCH AND MISSION ORBIT DATA

Launch Vehicle/Upper Stage	Pegasus-XI-	Inclination (deg)	69.9
Launch Site	Western Test Range	Period (min)	97.6
Mission Orbit Type	Low Earth	Perigee (km)	638
		Apogee (km)	651