NATIONAL AERONAUTICS AND
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PROJECT: MTS

PRESS KIT

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SPACECRAFT TO EXPLORE METEOROID HAZARD

A satellite designed to gather information on the hazards spacecraft encounter from minute particles in space, will be launched no earlier than August 13 from NASA's Wallops Station, Va.

The Meteoroid Technology Satellite is designed to gather engineering and scientific information on meteoroid penetration rates in a bumper-protected target and to obtain data on meteoroid speeds and quantities.

It will be launched by a Scout rocket in a south-easterly direction from Wallops Island. The intended orbit will have an apogee of 815 kilometers (506 statute miles) and a perigee of 491 kilometers (305 statute miles). The satellite will circle the Earth every 98 minutes on a path inclined 37.7 degrees to the Equator.

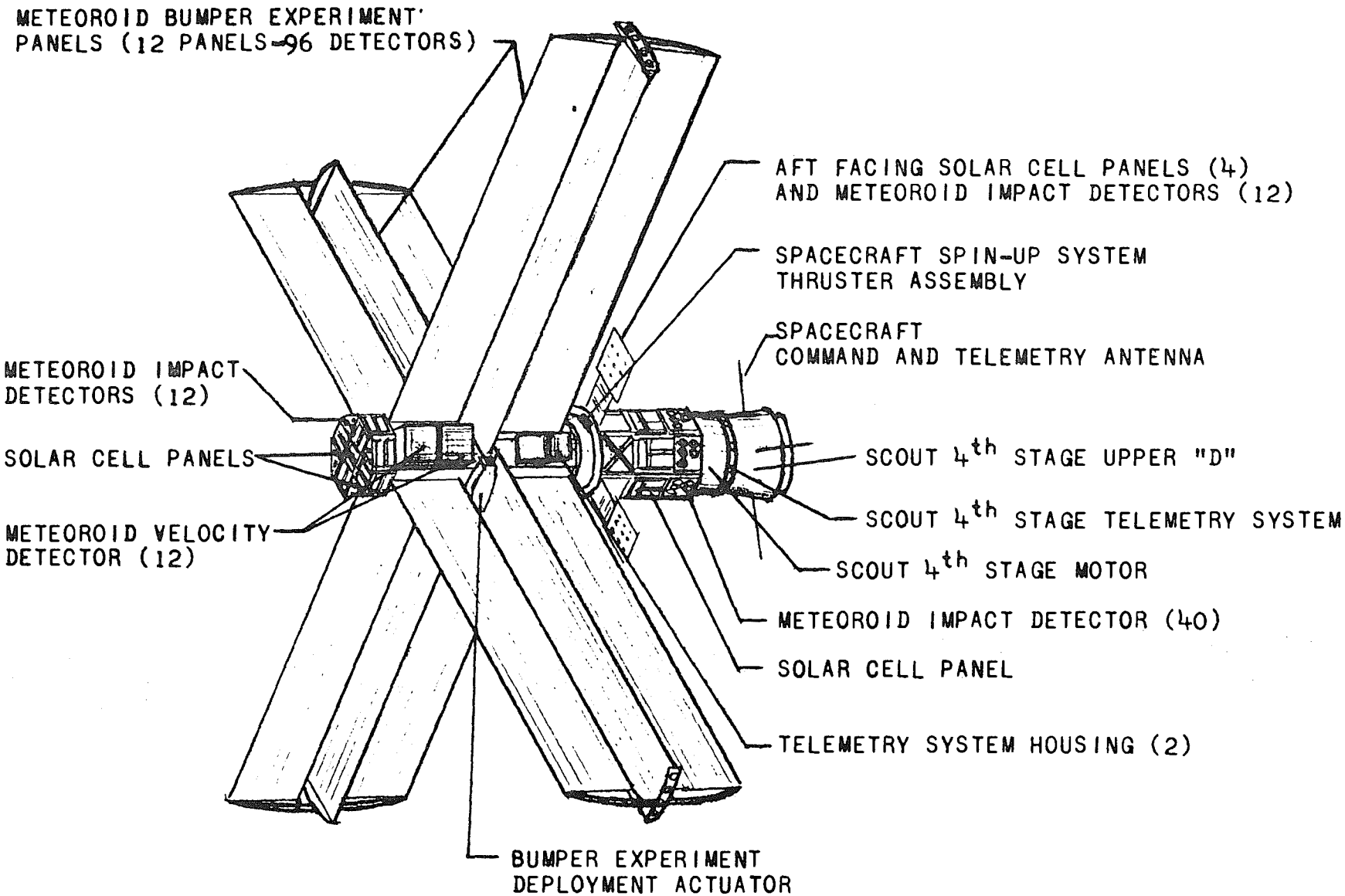
- more -

July 28, 1972

When successfully in orbit, the Meteoroid Technology Satellite (MTS) will be named Explorer 46 (XLVI).

Langley Research Center manages the Meteoroid Technology Satellite project under the overall guidance of NASA's Office of Aeronautics and Space Technology. Langley is also responsible for the spacecraft, the Scout launch vehicle, and for systems integration. Goddard Space Flight Center, Greenbelt, Md., is responsible for tracking and data acquisition for the satellite. Launch support and related functions are furnished by Wallops Station.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS)


METEOROID BUMPER EXPERIMENT PANELS (12 PANELS-96 DETECTORS)
AFT FACING SOLAR CELL PANELS (4) AND METEOROID IMPACT DETECTORS (12)
SPACECRAFT SPIN-UP SYSTEM THRUSTER ASSEMBLY
SPACECRAFT COMMAND AND TELEMETRY ANTENNA
METEOROID IMPACT DETECTORS (12)
SOLAR CELL PANELS
METEOROID VELOCITY DETECTOR (12)
SCOUT 4th STAGE UPPER "D"
SCOUT 4th STAGE TELEMETRY SYSTEM
SCOUT 4th STAGE MOTOR
METEOROID IMPACT DETECTOR (40)
SOLAR CELL PANEL
TELEMETRY SYSTEM HOUSING (2)
BUMPER EXPERIMENT DEPLOYMENT ACTUATOR

METEOROID TECHNOLOGY SATELLITE

Research Objectives

Primary objectives of the meteoroid satellite are: (1) to evaluate multi-sheet bumper configurations as meteoroid protection structures; and (2) to obtain a better understanding of the meteoroid environment in near-Earth space.

The MTS flight will be the first attempt to find out under actual space conditions how effectively a multi-sheet bumper can protect a spacecraft. The bumper concept consists of two thin sheets of metal separated by a space of 12.7 millimeters (one-half inch).

Laboratory experiments suggest that the two sheet bumper may provide better resistance to penetration than a single sheet of metal of greater total thickness. Flight measurements during the anticipated one-year lifetime of the MTS should provide confirmation of the laboratory results.

In addition to the primary bumper experiment, the MTS will carry 12 velocity detectors and 64 capacitance-type detectors to measure the impact flux distribution of small mass meteoroids.

Historical Background

NASA and the Langley Research Center have been active for many years in the effort to obtain a better understanding of the meteoroid environment near the Earth. Accurate knowledge of meteoroids is essential for the efficient design of spacecraft intended to remain in Earth orbit for extended periods.

Explorer XVI, a Langley satellite launched in December 1962, made the first statistically significant measurements of meteoroids in near-Earth space. It was followed by Explorer XXIII in November 1964. Both carried pressurized cell detectors of metal .0254 millimeters (.001 inch) and .0508 millimeters (.002 inch) thick. Explorer XXIII provided the first extended flight test of the capacitance-type detector.

They were followed by three satellites in the Pegasus series all launched in 1965. The Pegasus experiments carried very large areas of capacitance detectors as thick single sheet targets.

Extensive laboratory work has been carried on simultaneously to expand and interpret flight results and scientists and engineers now look to the MTS experiments to provide further insight and design information derived from actual flight in space.

Meteoroids

Meteoroids are small particles composed of iron, silicates and other substances which occur naturally in space. They vary greatly in size and occur sporadically and in showers traveling at extremely high speeds. Some are derived from the asteroids which revolve around the Sun between Mars and Jupiter; others are believed to come from the outermost regions of our solar system.

Meteoroids burn (become meteors) as they enter the atmosphere. Those which reach the Earth are called meteorites. Scientists have determined that several thousand tons of minute meteorites settle on the Earth in a single day.

These small particles may strike a satellite at velocities ranging from 11 to 73 kilometers (7 to 45 miles) per second, or even faster.

Meteoroid Detectors

The MTS satellite is intended to measure the numbers, mass and velocity of the particles it encounters during its working lifetime with three types of detectors.

1. Bumper Cell Detectors. The principal experiment on MTS will consist of more than 27.6 square meters (300 square feet) of bumper target. Meteoroid penetrations of the complete target (bumper plus main wall) will be registered by pressurized cell detectors. The target consists of an .0254 millimeter (.001 inch) stainless steel bumper mounted 12.7 millimeters (one-half inch) in front of an .0508 millimeter (.002 inch) thick stainless steel main wall.

The bumper target area is divided into 12 panels, each about .48 meters (19 inches) wide and 3.1 meters (10.5 feet) long. In flight, the bumper panels are deployed as four wings (see illustration on page 2a). Each panel contains eight pressurized cells providing a total of 96 detectors on the spacecraft.

If a meteoroid penetrates both bumper and main wall, there will be a loss of pressure in the cell which will be telemetered to the ground.

The stainless steel bumper sheets are mounted on each side of the pressurized cells with leaf springs which allow them to be collapsed flat against the detector wall. At launch, each of the 12 panels is rolled into a cylinder 114 millimeters (4.5 inches) in diameter and .48 meters (19 inches) long.

Panels will be deployed in orbit by a motorized boom system and gas will flow from 96 separate reservoirs to rigidize the pressure cells.

2. Meteoroid Velocity Detectors. Twelve box-shaped velocity detectors will be mounted at various locations on the central hub of the MTS. Each is 203 millimeters (8 inches) long; 203 millimeters (8 inches) wide; and 152 millimeters (6 inches) deep. The top and bottom surfaces of the box form two measuring stations a known distance apart. By timing the flight of a penetrating particle between the two stations, the velocity of the particle can be calculated.

The outer surface or front station, produced by the LTV Aerospace Corporation's Advanced Technology Center under a contract to NASA's Manned Spacecraft Center, is a thin film polysulfene capacitor 8,000 Angstroms (.0000315 inch) thick. The rear station consists of a .013 millimeter (.005 inch) stainless steel sheet backed by a second capacitor. When a particle pierces the front capacitor station, a timer is started. If the particle has sufficient energy to penetrate the thin sheet of stainless steel and the second capacitor, the timer stops. Thus the time of flight over a known distance can be determined for a meteoroid with sufficient energy to penetrate the steel sheet. Project scientists expect the detectors to record 15 to 30 time of flight measurements in a year.

3. Impact Flux Detectors. The MTS will carry 64 capacitor detectors to gather information on the population of very small particles in the regions the satellite traverses.

The capacitor sensor is an electrical device built as a thin sandwich of silicon dioxide between an inner layer of silicon substrate and an outer film of vapor deposited aluminum. The substrate and the aluminum conduct electricity, but the silicon dioxide does not. In flight, the capacitors will be charged electrically from 40 to 60 volts.

When a meteoroid penetrates the capacitor, a small amount of the material is vaporized and ionized in the area of penetration. As a result, a momentary short circuit occurs and the capacitor discharges. The current flow resulting from this discharge is monitored and recorded.

The ionization disappears in less than a millionth of a second and the capacitor quickly recharges. Thus it exhibits a "self healing" characteristic which makes it particularly attractive for long term use in space.

Two sizes of capacitor sensors will be carried aboard the MTS. Thirty-two sensors will have a detecting film 4000 Angstroms (.0000157 inch) thick and 32 will be 10,000 Angstroms (.0000394 inch) thick.

Telemetry

The MTS will carry two telemetry systems. One operates on ground command to transmit data from all spacecraft measurements and provide a tracking signal. It is powered by batteries recharged by solar cells.

The second system operates continuously in sunlight and transmits data only from the bumper experiment. It is powered only by solar cells.

Scout Launch Vehicle

Scout is NASA's only solid propellant launch vehicle with orbital capacity. The first development Scout was launched July 1, 1960. The MTS mission will be the 79th Scout launch. Since the Scout was recertified in 1963, the launch vehicle has attained a 94 percent success record.

Scout is a four-stage solid propellant rocket system. The launch vehicle and the MTS spacecraft will be set on an initial launch azimuth of 90 degrees.

The four Scout motors -- Algol III, Castor II, Antares II and Altair III -- are interlocked with transition sections that contain guidance, control, ignition, and instrumentation systems, separation mechanisms, and the spin motors needed to stabilize the fourth stage. Control is achieved by aerodynamic surfaces, jet vanes and hydrogen peroxide jets.

The MTS launch will mark the first use of the Algol III and concludes a three-year development program for that motor. The Algol III increases Scout's payload capacity from 146 kilograms (322 pounds) to 188 kilograms (415 pounds) in a 555-kilometer (345-statute-mile) easterly orbit.

It will be the largest vehicle ever launched from Wallops Station, Va.

The Algol III was designed and built by United Technology Corp., Sunnyvale, Calif. It is 1.14 meters (45 inches) in diameter compared with 1.02 meters (40 inches) for the Algol II.

The launch vehicle is approximately 22.25 meters (73 feet) long and weighs about 21,485 kilograms (47,365 pounds) at liftoff.

The Scout program is managed by NASA's Langley Research Center, Hampton, Va. The launch vehicle is built by LTV Aerospace Corp., Dallas, Texas.

SEQUENCE OF EVENTS

Event	Time (sec.)
Liftoff	0.00
First stage burnout	82.14
Second stage ignition	82.21
Second stage burnout	122.21
Third stage ignition	163.03
Third stage burnout	199.72
Spin-up	559.87
Third Stage separation	561.37
Fourth stage ignition	566.22
Fourth stage burnout	597.49

Tracking and Data Acquisition

The Goddard Space Flight Center Network will be used for orbit determination, satellite commanding and data acquisition. Telemetry data will be recorded on magnetic tapes, shipped to Goddard for review and then to Langley for data reduction. Reduced data will be analyzed and evaluated by the individual experimenters.

Personnel

The following scientists and engineers have had active roles in the development of the MTS and its experiments:

Langley Research Center

Spacecraft: Charles V. Koerner, Project Manager; William H. Kinard, Project Scientist; John E. Cooper, Mission Analysis Engineer; Hugh C. Halliday, Technical Project Engineer; Leon V. Taylor, Instrumentation Project Engineer; Erskine C. White, Spacecraft Integration Manager; Jose M. Alvarez, Experiments Engineer; Clyde J. May, Project Electrical Engineer; William L. Gaster, Project Pyrotechnic Engineer.

Launch Vehicle: R. D. English, Head, Scout Project Office; Clyde W. Winters, in charge of launch operations; W. Bruce Dunn, mechanical systems; Patrick H. Shea, ground support equipment; Willard L. Sullivan, fluid systems; Joseph F. Dixon, electrical systems, Franklin P. Keesee, Jr., guidance systems; John L. Allen, Jr., telemetry systems; Larry R. Tant, payload coordinator; Philip E. Everhart, in charge of quality assurance.

Wallops Station

William L. Lord, Test Director; William T. Burns, Project Engineer.

Goddard Space Flight Center

Tecwyn Roberts, Director, STDN; James M. Stevens, Director, MST Network; John Quill, Director, Network Support.

Manned Spacecraft Center

Paige B. Burbank, co-investigator, impact velocity experiment.

NASA Headquarters

Bernard G. Achhammer, Program Officer.

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