OSO-7

NEWS NASA

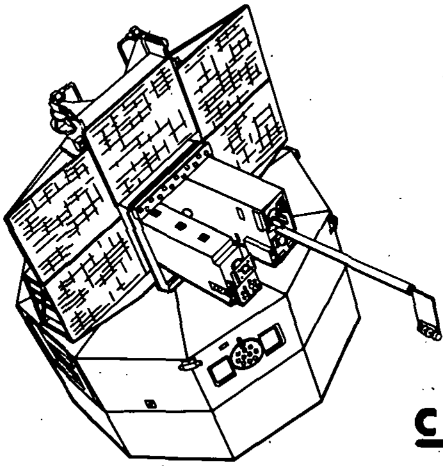
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

TELS. WO 2-4155
WO 3-6925

RELEASE NO: 71-163

FOR RELEASE: September 16, 1971
3 PM

PRESS KIT



PROJECT: OSO-H

contents

- more -

September 9, 1971

(NASA-News-Release-71-163) OSO TO CONTINUE STUDY OF THE SUN (NASA) 28 p

N76-71924

Unclas
00/98 14002

NEWS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546
TELS: (202) 962-4155
(202) 963-6925

FOR RELEASE: September 16, 1971
3 PM

Joseph J. McRoberts
(Phone: 202/962-1176)

RELEASE NO: 71-163

OSO TO CONTINUE STUDY OF THE SUN

The most advanced and largest spacecraft in the Orbiting Solar Observatory (OSO) series is scheduled for launch by the National Aeronautics and Space Administration aboard a Delta launch vehicle from Cape Kennedy, Fla., no earlier than Sept. 23.

Designated OSO-H (OSO-7 in orbit) the Observatory will collect valuable data for scientists who study the Sun.

The primary objective of OSO-H is to study the solar corona. Pictures of the white light corona, the faint outermost layer of the solar atmosphere that is normally seen only during total solar eclipses, will be photographed. A circular occulting disk on a boom extending in front of the observatory will produce an artificial, man-made eclipse for the imaging camera.

- more -

August 31, 1971

Bright streamers in the corona will be recorded up to distances of five million miles from the surface of the Sun, and their evolution and rotation with the Sun will be studied. Active regions and their extent into the corona will be observed by the X-ray experiment with the goal of understanding their role in heating up the corona to millions of degrees, and their relation to the streamers seen in white light.

During active periods the OSO-H will obtain measurements of X-ray and ultraviolet radiation from high temperature plasma explosions on the Sun, called solar flares; the cause of these explosions and the method by which the plasma reaches temperatures as high as 50 million degrees centigrade are still unknown. Radiation and atomic particles from the flares strike the upper atmosphere of Earth with disruptive effects on communications. Scientists are still searching for an accurate way to forecast these disturbances.

The OSO-H studies will be coordinated with ground-based observatories in New Mexico, Maryland and Australia to maximize the scientific usefulness of the flare measurements.

- more -

The 1,400-pound Observatory, twice the weight of any previous OSO, will be launched aboard NASA's two-stage Delta N launch vehicle into a circular Earth orbit. The Delta will also carry a 45-pound secondary payload satellite -- NASA's Test and Training Satellite-D (TETR-D). This satellite carries instrumentation to simulate the Apollo signals. Launching it with OSO is an economical way to provide for the evaluation and development of ground systems as well as to train personnel in NASA's Manned Space Flight Network.

The planned orbit for both spacecraft is circular, 345 statute miles (550 kilometers) above Earth, with an inclination of 33 degrees to the equator and an orbital period of 96 minutes. Since the TETR-D will be separated from the launch vehicle about 18 minutes after OSO-H, the two satellites will be separated in orbit initially by about one-half mile with a subsequent separation rate of five feet a second.

OSOs 1, 2, 3, 4, 5, and 6 were launched on Mar. 7, 1962, Feb. 3, 1965, Mar. 8, 1967, Oct. 18, 1967, Jan. 22, 1969, and Aug. 9, 1969, respectively. OSO-C was launched Aug. 25, 1965, but the launch vehicle failed to place it into orbit.

The Sun is the source of most energy for life on Earth. Only by viewing the Sun from above Earth's energy absorbing atmosphere, can scientists get a truly sharp view of this "nearby" star and learn more about its influence on Earth. In fact, knowledge gained from OSO satellites might aid physicists searching for an unlimited and pollution-free power source on Earth.

The extremely hot plasma in solar atmospheric phenomena is also suspected as the site of nuclear fusion energy generation. The primary problem encountered in laboratory studies of controlled nuclear fusion, in research to develop a virtually pollution-free power source, is that of producing and controlling an extremely hot plasma. The Sun seems to know how to do this and scientists hope to learn about and from the Sun.

Ultraviolet and X-ray energy from the Sun, absorbed by Earth's upper atmosphere, produce the zone of ions and elec-tions around Earth called the ionosphere. It is the ionosphere that makes possible worldwide radio communications. Such radio signals travel great distances by essentially bouncing back and forth between Earth's surface and the ionosphere.

- more -

Variations in the Sun's output of energy can drastically change the ionosphere and cause geomagnetic storms. These upper atmospheric changes can wipe out shortwave radio communications on Earth for periods up to several hours.

Solar energy impinging upon Earth's lower atmosphere and surface, cause the wind pressure circulation patterns which move weather systems around the globe.

In addition to its importance to and influence on Earth and human life, the Sun provides man with his only opportunity to study a star at close range. It is 30 trillion miles closer to Earth than the next nearest star.

Scientists are able to observe the solar disk and study single features such as solar flares and sunspots. Detailed observations across the disk can give directly the temperature and density in the solar atmosphere.

Scientists consider the understanding of solar physics to be indispensable to the understanding of the physics of Earth and the other planets.

- more -

Solar flare observations thus far have, in fact, taught scientists more about plasma physics that can be applied, in general, than about the mysteries of what constitutes a solar flare. The OSO-H's solar flare studies may well add to this basic storehouse of knowledge.

The OSO-H is similar in appearance to the six previous OSO's launched into Earth orbit. However, advanced solar scanning control and attitude sensing instruments have been added to the spacecraft in support of the more sensitive experiments assigned to this mission. The Observatory consists of two connected sections: an upper sail-like structure which carries the two prime experiments to be pointed at the Sun, and a nine-sided base section called the "wheel" which carries scanning experiments and the basic Observatory support equipment.

The OSO-H is stabilized in orbit by its wheel section which spins like a gyroscope at about 30 rpm. When the Observatory is in the "day" part of its orbit, the sail section points toward the Sun permitting detailed observations. The pointing accuracy of OSO-H is better than one minute of arc. This is roughly equivalent to sighting a sphere 18 inches in diameter from a distance of one mile.

A new gyroscope, added to the sail section on OSO-H, retains a memory of the Sun's position so that the instruments can lock on the Sun much more rapidly after the satellite emerges from the Earth's shadow.

On previous OSO's, the sail section would stop pointing in the direction of the Sun and start spinning with the wheel section on entering Earth's shadow.

The six experiments carried by OSO'H weigh a total of 497 pounds. They are provided by the Goddard Space Flight Center, the Naval Research Laboratory, the Massachusetts Institute of Technology, the University of New Hampshire, and the University of California.

The OSO Program is directed by Physics and Astronomy Programs, Office of Space Science and Applications, NASA Headquarters, Washington, D.C. Project management is provided by the Goddard Space Flight Center, Greenbelt, Md., which is also responsible for the tracking and data acquisition and the Delta launch vehicle. Launch of the Delta is supported by Kennedy Space Center's Unmanned Launch Operations (ULO).

This and the preceding OSO's were designed, built, and tested by Ball Brothers Research Corp., Boulder, Colo. The Delta launch vehicle is built by McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

The TETR program is directed by NASA's Network Development of Engineering Support Implementation Division, Office of Tracking and Data Acquisition. Project management is under the Goddars Space Flight Center, Greenbelt, Md. The TETR spacecraft are designed and built by TRW's Space Vehicles Division, Redondo Beach, Calif.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS)

THE STUDY OF THE SUN

The source of almost all energy in the solar system, the Sun, is a hot ball of gases 864,000 miles in diameter powered by nuclear reactions in its deep interior. Solar flares often erupt in the chromosphere (a thin zone above the visible surface) and can produce X-rays, ultraviolet radiation, and high energy particles that can strike the Earth. The outermost portion of the Sun, its corona, constantly sheds material known as the "solar wind" which streams out into space.

As solar energy impinges upon the Earth, its lethal ultraviolet and X-rays are absorbed in portions of the atmosphere, while the visible "white light" strikes and warms the lower atmosphere, land and the seas.

Although our atmosphere thus protects us from much of the lethal energy, it also restricts the terrestrial observation of our mother star located some 93 million miles distance. Even the visible light that reaches the surface is scattered by the atmosphere and its pollutants such that the images are smeared. Thus, we rarely get a truly sharp view of the Sun from the ground.

Orbiting Earth above our atmosphere, the National Aeronautics and Space Administration's Orbiting Solar Observatories are providing scientist with stable platforms which produce new and significant data about the Sun. By viewing all of its varied radiation we hope to gain better understanding of how it functions, and put such knowledge to use for the betterment of man.

One of two principal tasks of the upcoming OSO-H, seventh in the OSO series, is to study the Sun's corona out to considerable distances from the Sun's visible surface or photosphere, by using a disk on a rod extended in front of the Observatory to artificially blot out the photosphere, as the Moon does in a total solar eclipse. The OSO scientists will be able to use this man-made permanent solar eclipse to study the active regions of the corona and to derive the physical properties of the long coronal streamers as they grow, change in shape, and rotate along with the Sun.

- more -

The other principal task of the OSO-H is to study the X-rays and extreme ultraviolet radiation from solar flares and "active regions" in the solar corona. Such studies will help the OSO scientists better understand the cause of flares, what happens in a flare, and how it affects us on Earth.

Along with making solar measurements, the OSO-H also will measure the position, intensity, and energy range of X-ray sources in the Milky Way Galaxy and possibly beyond.

As is the case most often with all basic research, the biggest "payoffs" in the study of the Sun have been unsuspected. Studies of solar flares, for example, have so far taught us much about plasma physics that can be applied in general, although we have yet to solve the mystery of what causes a flare.

Helium, which has many important industrial uses, was discovered on the Sun by earlier solar scientists before it was found on Earth. The unique conditions of temperature and density in the Sun, which are extremely difficult to simulate on Earth, make it a unique astrophysical laboratory which can be used to complement our Earth-bound scientific research activities.

Geology and biology relate also because the evidence from the record of rocks and fossils found on Earth verify the astronomers' conclusion that the Sun has been shining at about the same rate for at least the last three billion years. However, variations in the Sun's output might have caused the ice ages many thousands of years ago when nearly the entire U.S. was covered with ice. Russian astronomers have also suggested strong effects of the solar cycle on Earth's climate in recent years.

SOLAR GLOSSARY

Age:	Estimated 5 billion years
Diameter:	About 864,000 miles (109 times that of Earth)
Volume:	1,300,000 times that of Earth
Mass:	333,000 times that of Earth
Surface Temperature:	$10,000^{o}F$ (Earth, average of $32^{o}F$)
Interior Temperature:	22 to 27 million degrees F. (Earth, 5000^{o})
Rotation (as seen from Earth):	Varies, more rapid near the equator where the period is 27 days; in higher latitudes the period is around 32 days
Distance from Earth:	93 million miles or 1 Astronomical Unit
Surface Gravity	28 times that of Earth
Chromosphere:	The rosy red (light pinkish) layer which extends out several thousand miles from the Sun's surface. Visible without special instrumentation only during solar eclipse because it is overwhelmed by brilliance of the photosphere.
Corona:	The Sun's outermost layer, seen briefly during a total solar eclipse when it appears as a varying white halo against the dark silhouette of the Moon. When there are relatively few sunspots, the corona has an almost smooth outline. At times, however, its streamers can be seen to extend outward for millions of miles.

Cosmic Ray Particles: Mostly protons with energies ranging from less than 10 MeV (million electron volts) to 50 BeV (billion electron volts).

Gamma Ray: A quantum of electromagnetic radiation emitted by a nucleus as a result of of a transition between two energy levels of the nucleus. Energies range from 100,000 to 1,000,000 electron volts, perhaps greater.

Granulations: Irregular in shape, they appear over the entire surface of the Sun except in sunspots. Constantly in motion, they have a turbulent life of only a few minutes.

Limb: The edge of the Sun's disk, as seen from Earth.

Penumbra: The grayish,filament-like structures surrounding the umbra of a sunspot.

Photosphere: The visible surface of the Sun.

Prominences: Clouds of dense material that extend up from the surface, or photosphere. Flame-like in appearance they sometimes shoot outward a million miles. The more spectacular prominence erruptions seem to be associated with flares.

Spectrometer: An instrument which measures intensity in various wavelengths. A dispersing element, such as a diffraction-grating, is employed to separate the various wavelengths.

Sunspots: The dark areas in the photosphere having extremely strong magnetic fields. Some of the larger ones have a total area of several million square miles. The temperature within a sunspot is believed to be several thousand degrees less than that at the photosphere. The number of sunspots varies over a solar cycle of 11.3 years between maxima sunspot activity. Seen in the light of calcium atoms, the sunspots are surrounded by larger bright regions called plages.

Umbra: The dark central portion of a sunspot. The same term is used to describe the dark central part of the Moon's shadow during an eclipse of the Sun.

Flares: Short-lived brightenings in a plage region. From the ground, most clearly seen in the light of hydrogen atoms. They may last a few minutes or hours, and can sometimes cause violent ejections of enormous streams of energetic particles.

Plages: Extensive bright areas seen in the monochromatic light of strong spectral lines. They are usually associated with sunspots and have lifetimes up to several months. They mark the locations of "active regions" in the solar atmosphere.

OSO-H SPACECRAFT AND ITS OPERATION

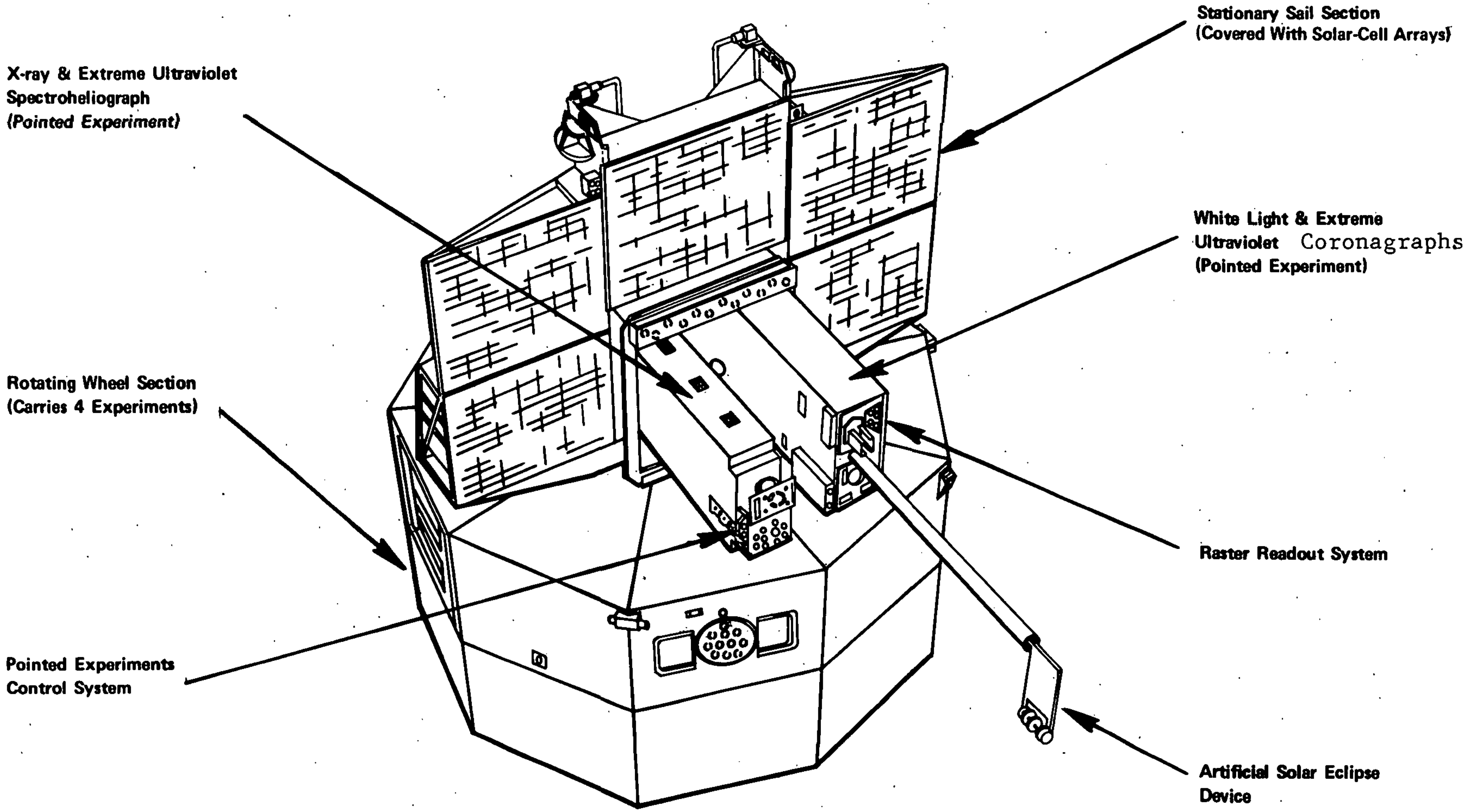
The OSO-H is an improved version of the original Orbiting Solar Observatory concept. At 1,400 pounds, it weighs more than twice as much as any previous OSO. The additional weight is required by the necessary advanced support systems for the highly sensitive experiments assigned to the mission.

Structural design concept of the OSO-H is basically like the six OSO's already launched into Earth orbit for a continuing study of the Sun. It consists of two connected sections: an upper sail-like structure which carries the two primary experiments to be pointed at the Sun; and a lower rotating wheel section which carries the basic Observatory support instrumentation and four experiments. The three momentum arms on previous OSO's have been eliminated by putting more balance weights into the wheel structure.

Rotation of the wheel section at about 30 rpm stabilizes the Observatory, relative to the Sun, like a gyroscope. An orientation control system utilizing gas jets and a magnetic torquing coil keep the Observatory's spin axis perpendicular to the Sun. A star scanner added to the wheel section permits the attitude of the Observatory to be determined to within 1/10th of a degree.

When the Observatory is in sunlight, its sail section continuously points the primary experiments at the solar disk.

The pointed experiments can be commanded from the ground to "look" at specific points or to scan an area of 60 by 60 arc minutes or smaller areas measuring 5 by 5 arc minutes to study subjects of interest such as a sunspot or a solar flare. Overall pointing accuracy of the OSO-H is better than one minute of arc.



ORBITING SOLAR OBSERVATORY-H

THE OSO-H EXPERIMENTS

Pointed Experiments

Dr. W. M. Neupert, NASA Goddard Space Flight Center -- X-RAY AND EXTREME ULTRAVIOLET SPECTROHELIOGRAPH

This 74-pound experiment is designed to deduce the distribution of matter and temperature in the Sun's corona above active regions and determine how these quantities change in the corona during solar flares. Further, it will generate spectroheliograms of the Sun in selected spectral lines between 1.75 Angstroms and 400 Angstroms wavelength, and obtain spectra of selected areas of the solar disk.

As a secondary objective, this experiment will attempt to detect polarization of the X-rays from active regions. Polarization is a property of light which carries information about the conditions under which it was produced.

Dr. R. Tousey, Naval Research Laboratory -- WHITE LIGHT AND EXTREME ULTRAVIOLET CORONAGRAPHS

This 117-pound experiment is designed to monitor the white light corona, studying the evolution of streamers as they rotate with the Sun at great distance from its visible disk. In the extreme ultraviolet, it will map the structure of active regions in the lower corona.

Wheel Experiments

Dr. G. W. Clark, Massachusetts Institute of Technology -- LOW ENERGY COSMIC X-RAY EXPERIMENT

This 59-pound experiment is designed to survey the entire sky for sources of cosmic X-rays in the energy range from one to 60 keV (thousands of electron volts) with an angular resolution of about one degree. Possible variation in the X-ray sources will be studied. Spectral analysis also will be performed in five broad energy bands.

Dr. E. L. Chupp, University of New Hampshire -- SOLAR GAMMA RAY MONITOR

The purpose of this 74-pound experiment is to detect and measure the gamma ray fluxes in the energy range from 0.3 to 9.1 MeV (millions of electron volts) during solar flares. Provision for detecting bursts of high energy solar neutrons is also included. It can thus detect nuclear reactions in flares and elsewhere on the Sun.

Dr. L. E. Peterson, University of California -- HIGH ENERGY COSMIC X-RAY EXPERIMENT

This 98-pound experiment is intended to observe the intensity, position, and spectrum of cosmic X-ray sources in the 10 to 550 keV range.

Dr. L. E. Peterson, University of California -- HARD SOLAR X-RAY MONITOR

This 39-pound experiment is designed to detect hard solar X-ray bursts in the energy range of about one to 300 keV. Data will be provided over a wide, dynamic range of intensity with better spectral, time and spatial resolution than that which has been obtained on previous experiments. As a flare detector and monitor, it supports the solar experiments on the sail.

TEST AND TRAINING SATELLITE-D

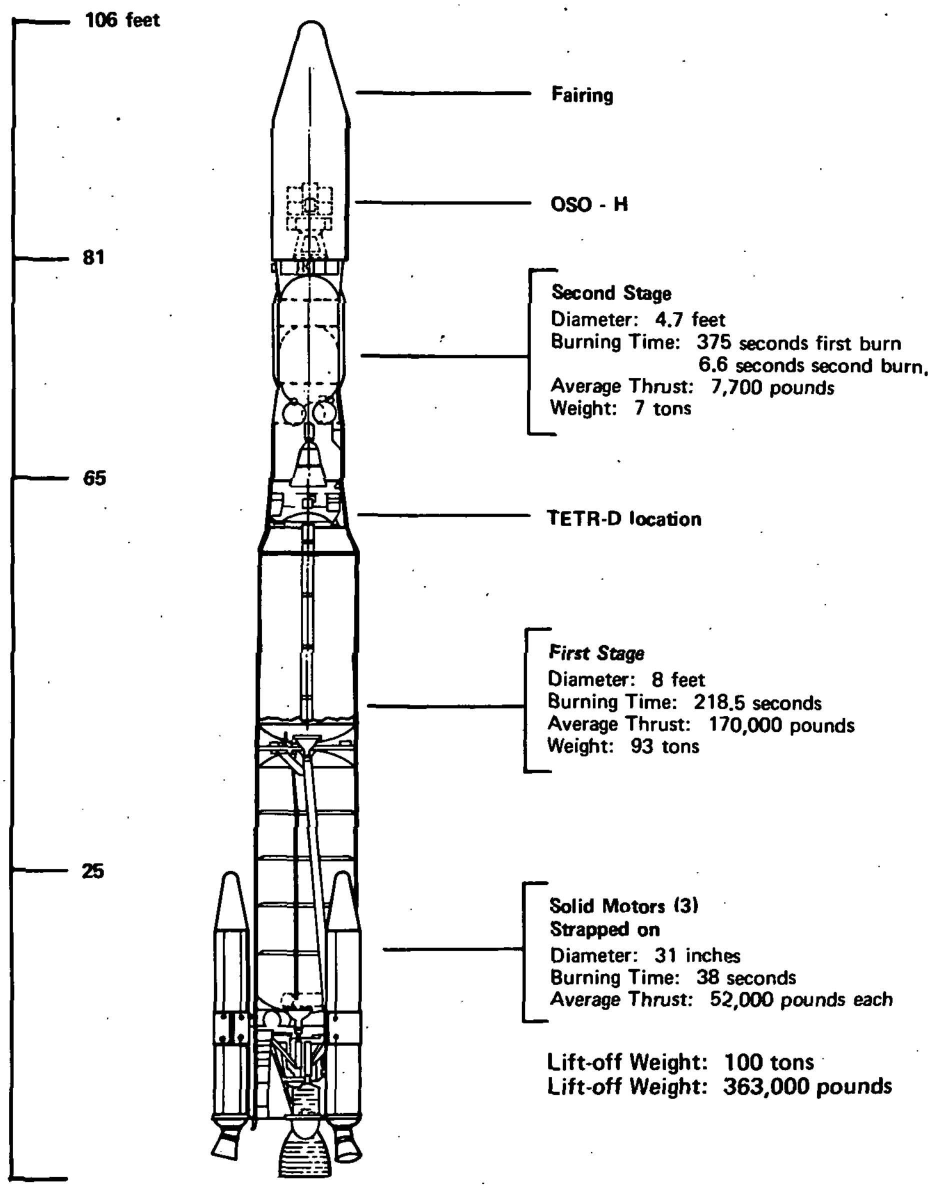
The objectives of the Test and Training Satellite (TETR) project are to develop, launch and operate a series of spacecraft for evaluation and development of ground systems as well as train personnel in NASA's Manned Space Flight Network (MSFN).

The TETR-D, fourth spacecraft in this series, carries an S-Band transponder which receives and transmits signals simulating those of the Apollo spacecraft.

Designated TETR-4 in orbit, the 45-pound spacecraft is mounted in the rear section of the Delta Launch Vehicle second stage. It will be ejected rearward at two feet per second about 18 minutes after the OSO-H is separated from the launch vehicle.

The launch plan calls for placing the TETR-D into a circular orbit about 345 statute miles above Earth. Inclination of the orbit to the equator is 33 degrees, and the orbital period is about 96 minutes. Estimated useful lifetime of the magnetically-stabilized satellite is three years.

With the use of this satellite, MSFN personnel will be able to receive realistic training in the checkout of the Unified S-Band Systems used on Apollo. Further, they will be able to conduct mission simulations, and develop and verify new procedures.



DELTA LAUNCH VEHICLE

The Delta is a multi-stage launch vehicle capable of placing unmanned satellites of varying sizes and weights into earth orbits ranging from the near-earth (200 miles) to the geosynchronous (22,300 miles). This versatile launch vehicle can also place satellites into lunar orbit and send them into space beyond.

In addition to being the workhorse for NASA's automated satellite programs, the Delta orbits unmanned satellites of other U.S. Federal and commercial agencies as well as those of many foreign countries.

The OSO-H/TETR-D mission will utilize a two-stage version of the Delta, called the Delta N. In addition to carrying three solid motors strapped on the first stage for added liftoff boost. this Delta will employ a restartable second stage. This will be the 85th mission for the Delta.

The Delta program is managed for NASA by its Goddard Space Flight Center.

LAUNCH AND ORBIT SEQUENCE OF EVENTS

The sequence of events from liftoff until the spacecraft is fully operational is as follows:

Launch Sequence

Event	Time (Seconds)
Liftoff	0.00
Solid Motors Burnout	38
Jettison Solid Motor Casings	75
Stage I Burnout	218
Stage II Ignition/Stage I Separation	223
Jettison Fairing/Start OSO Sail Spinup	231
Stage II Cutoff	597
Coast Pitch Maneuver	636-837
Restart Stage II	1701
Stage II Final Cutoff	1708
Coast Yaw Maneuver	1724-1753
OSO-H Separated From Stage II	1996
OSO-H Acquires Sun	2176
TETR-D Spacecraft Separated From Stage II	3096

Orbit Sequence

While in orbit, the Observatory spin axis is maintained normal to the Sun vector within ± 4 degrees. This is accomplished by an automatic pitch control system using gas jets and a manual control system using a magnetic pitch coil. When activated, the gas jets precess the spacecraft, thus providing a coarse control about the pitch axis. This automatic pitch control system can also be operated manually by command control.

No experiment high voltage will be turned on for approximately three days. This period will permit sufficient time for outgassing from the Observatory. It will also provide time to evaluate the basic operational subsystems and low voltage circuits of the Observatory prior to initial experimentation.

About 72 hours after launch the GSFC OSO control center through the Fort Myers, Fla.; Johannesburg, Republic of South Africa; and Orroral, Australia, Tracking and Command Stations will initiate commands to turn on then turn off the first wheel experiment. This first turn-on will be for a 30-second interval. On the next orbital pass the experiment will be turned on for a longer duration. This procedure will be continued several times and the telemetry data take will be examined for any anomolous conditions. If none are noted the experiment will then be commanded on and left on for an hour. The second wheel experiment will then go through the turn on procedures, etc., until all wheel experiments are on and acquiring scientific data.

The sail experiments will be turned on in the same manner such that after about six days the entire Observatory should be completely checked out and initiating the operational observing program.

OPERATIONS CONTROL, TRACKING AND DATA ACQUISITION

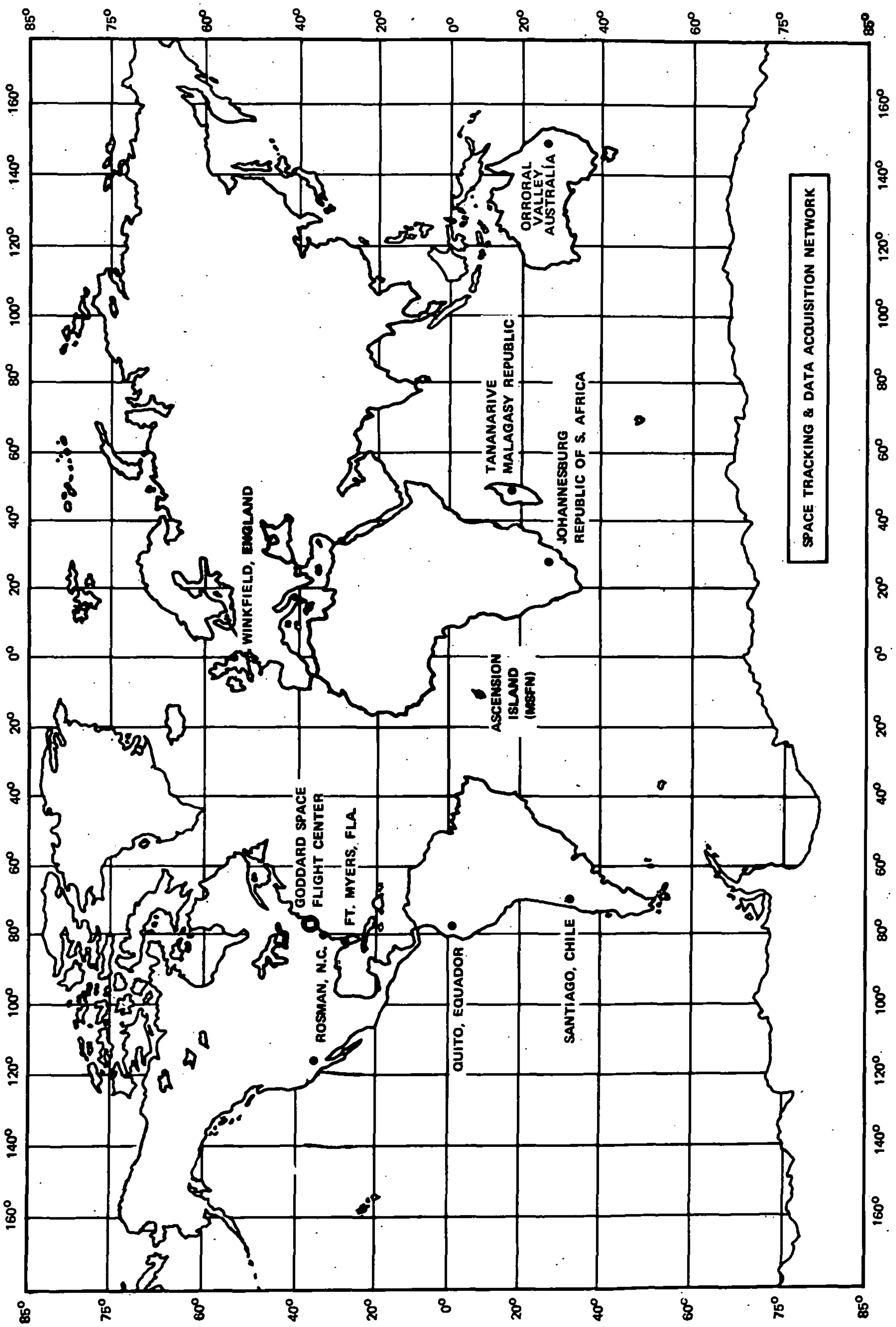
The OSO-H mission will be controlled from the OSO Control Center at the Goddard Space Flight Center.

Tracking, acquiring data, and generating commands to the Observatory will be accomplished by NASA's Space Tracking and Data Acquisition Network (STADAN). Communications between the OSO Control Center and the STADAN stations flow two-way over the NASA Communications System -- NASCOM. Both STADAN and NASCOM are managed by Goddard.

As the OSO-H orbits the globe once about every 96 minutes, it continuously transmits spacecraft and experiment data back to Earth, and simultaneously records the data on one of two onboard tape recorders. Since the OSO is not always in sight of a ground station, this data may be played back later, upon ground command, at 18 times recorded speed.

The primary STADAN station for generating commands to the OSO-H and acquiring data from it is located at Fort Myers, Fla. Other stations with a command capability located in Johannesburg, Republic of South Africa; Orroral, Australia; Quito, Equador; and Santiago, Chile, will also be required to perform these functions, however, since the Observatory does not always pass over the Fort Myers station.

Spacecraft and experiment data collected by the STADAN stations will be transmitted over the NASCOM to the OSO Control Center. Goddard, in turn, will relay experiment data to experimenter laboratory locations to provide for near realtime experiment control. These include the Naval Research Laboratory, the University of California, San Diego, and the University of New Hampshire.


SPACE TRACKING & DATA ACQUISITION NETWORK
ORRORAL VALLEY, AUSTRALIA
TANANARIVE MALAGASY REPUBLIC
JOHANNESBURG REPUBLIC OF S. AFRICA
WINKFIELD, ENGLAND
ASCENSION ISLAND (MSFN)
GODDARD SPACE FLIGHT CENTER
FT. MYERS, FLA.
ROSMAN, N.C.
QUITO, EQUADOR
SANTIAGO, CHILE

THE PROJECT, EXPERIMENT AND LAUNCH TEAM

NASA Headquarters, Washington, D.C.

(Program Direction)

Dr. John E. Naugle	Associate Administrator for Space Science & Applications
Jesse L. Mitchell	Director of Physics and Astronomy Programs
C. Dixon Ashworth	OSO Program Manager
Dr. Goetz K. Oertel	OSO Program Scientist
Michael E. McDonald	OSO Program Engineer
Joseph B. Mahon	Director, Launch Vehicles and Propulsion Programs
I. T. Gillam, IV	Delta Program Manager
Gerald M. Truszynski	Associate Administrator for Tracking & Data Acquisition

Goddard Space Flight Center, Greenbelt, Md.

(Project Management)

Dr. John F. Clark	Director
Robert E. Bourdeau	Director of Projects
John M. Thole	OSO Project Manager
Dr. Stephen P. Maran	OSO Project Scientist
William B. Poland, Jr.	OSO Tracking Scientist
William R. Schindler	Delta Project Manager
Harold L. Hoff	Chief of STADAN Operations Division
Charles H. Underwood	TETR Project Manager

- more -

Kennedy Space Center, Cape Kennedy, Fla.

(Launch Operations)

Dr. Kurt Debus	Director
John Neilon	Director, Unmanned Launch Operations
Hugh A. Weston	Manager, Delta Operations

Ball Brothers Research Corporation, Boulder, Colo.

(Spacecraft Development)

O. E. Bartoe	President
John O. Simpson	OSO Program Director

McDonnell-Douglas Astronautics Company, Huntington Beach, Calif.

(Launch Vehicle Production)

Marcus F. Cooper	Director, Florida Test Center, Cape Kennedy
E. W. Bonnett	Delta Program Manager

- end -

CONTRACTOR NAME	STATE	ROLE OF CONTRACTOR	AMOUNT (IN K$)
Spacecraft:			
Ball Brothers Research Corporation (Peak employment of 165 people in October, 1970)	Colorado	Prime Spacecraft Contractor	11,787
Major Subcontractors:			
Parsons	California	Supplier of Structural Honeycomb	288
Spectrolab	California	Supplier of Solar Panels	93
Bendix	New Jersey	Supplier of Flight Gyro	286
EMR	Florida	Supplier of PCM System	97
AVCO	Ohio	Supplier of Command System	608
Experiments:			
Ultra Violet Experiment - NRL	Wash. D.C.	Experimenter	1,893
Major Subcontractors:			
Bendix	New Jersey	Supplier of XUV Instrument	757
EMR	Florida	Supplier of Coronograph	1,178
EUV Spectroheligraph Experiment - GSFC	Maryland	Experimenter	314
Major Contractor:			
General Electric	Pennsylvania	Designed & Fabricated Instrument	4,019
Cosmic Ray Experiment - MIT	Massachusetts	Experimenter - Designed & Fabricated Instrument	1,584
Gamma Ray Experiment - U. of New Hampshire	N. Hampshire	Experimenter	569
Major Subcontractor:			
Time Zero, Inc.	California	Fabricated Gamma Ray Monitor	1,655

NOTE: Data are through launch -- does not include post-launch data analysis.

- more -

CONTRACTOR NAME	STATE	ROLE OF CONTRACTOR	AMOUNT (IN K$)
Cosmic Ray Experiment - U. of Calif.	California	Experimenter	876
Major Subcontractor: Ball Brothers Research Corporation	Colorado	Fabricate Electronics	663
Solar X-Ray Monitor - U. of Calif.	California	Experimenter	400
Major Subcontractor: Analog Technology Corporation	California	Design & Fabricate Monitor	1,332

NOTE: Data are through launch -- does not include post-launch data analysis.

- more -