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NASA

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

TELS. WO 2-4155
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FOR RELEASE: SUNDAY
August 15, 1965

RELEASE NO: 65-261

PROJECT: OSO-C

CONTENTS

(To be launched no earlier than August 24.)

NEWS NASA

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NASA TO LAUNCH
THIRD ORBITING
SOLAR OBSERVATORY

The National Aeronautics and Space Administration will launch a 620-pound Orbiting Solar Observatory (OSO) no earlier than August 24 from Cape Kennedy, Fla.

OSO-C will carry nine separate scientific experiments to study the Sun and its influence on the Earth's atmosphere. The launch site will be Cape Kennedy, Fla.

The OSO program is one of NASA's major efforts in solar physics and OSO-C's launch will maintain the continuity of observations during the 11-year solar activity cycle. Solar activity currently is in a minimum phase.

A better understanding of the Sun's mechanics and behavior is expected to enhance mankind's knowledge of the solar influence on Earth and to help in predicting solar flares whose swiftly-generated X-rays could menace manned space flights.

This will be the third OSO in a series of eight solar observatories planned by NASA. The first two OSO satellites were launched from Cape Kennedy Mar. 7, 1962, and Feb. 3, 1965. OSO I, which carried 13 experiments, provided more than 2,000 hours of scientific information during its lifetime. OSO II, with eight experiments, is still operating.

As were earlier OSOs, the new solar observatory will be launched by a three-stage Delta rocket into a planned circular orbit about 350 miles above the Earth. The orbit will have an inclination of 33 degrees to the equator and a period of about 95 minutes. If successfully placed into orbit it will be officially designated Orbiting Solar Observatory III. Its useful scientific lifetime is expected to be about six months.

OSO-C is physically similar to earlier observatories in the program. It has two main sections: (1) A spinning base portion, called the wheel, which provides gyroscopic stability and carries the telemetry, command system, batteries, control electronics, gas spin-control arms and seven experiments, and (2) A top section, called the sail, which is a fan-shaped device carrying two experiments that point continuously toward the Sun. The sail also has solar cells affixed to it to convert energy from the Sun into electrical power.

Although the observatory physically resembles the earlier OSO spacecraft, and its basic operating principle is the same, it features three significant improvements which are expected to greatly enhance its ability to perform solar investigations.

Innovations on OSO-C include:

(1) An improved ground command system which will permit the spacecraft to receive up to 94 different commands from ground stations. The command capabilities of OSO I and OSO II were 10 and 70, respectively.

(2) A torque coil to augment the nitrogen gas jet system. The coil generates a magnetic field thus creating a torque on the spacecraft by reacting with the Earth's magnetic field. Previously, OSO depended exclusively on the controlled release of the compressed nitrogen for its pitch control. The new coil, operated by ground commands, provides the torque to assist in orienting the spacecraft in pitch attitude after it has achieved orbit. This will reduce gas consumption and increase the life expectancy of the observatory.

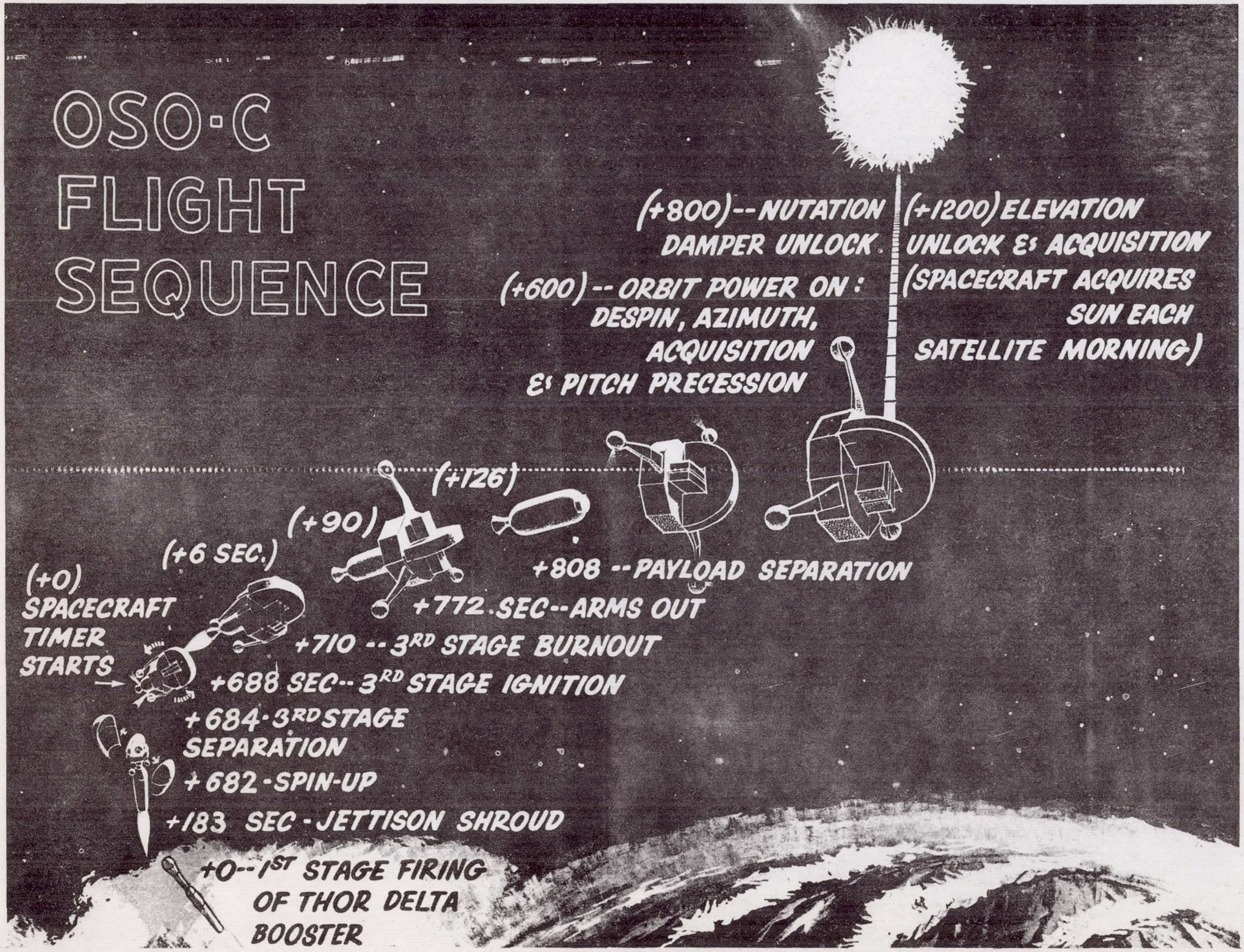
(3) An improved roll aspect measuring device designed to determine the roll attitude of the spacecraft by sensing its position in relation to the Earth's magnetic field and the direction of the Sun.

The nine experiments carried by OSO-C are designed to continue and extend the work of the two previous spacecraft in the series. They will study solar X-rays, gamma rays, ultraviolet radiation and other phases of solar activity. They represent a joint government-university-industry effort.

The OSO program is directed by the Physics and Astronomy Programs Division of the Office of Space Science and Applications at NASA Headquarters. Project management is under the Goddard Space Flight Center, Greenbelt, Md., which is also responsible for tracking and data acquisition and the Delta launch rocket.

The OSO spacecraft are designed and built under contract by Ball Brothers Research Corp., Boulder, Colo. The three-stage Delta rocket used to launch OSO is produced by Douglas Aircraft Co., Santa Monica, Calif.

(TECHNICAL INFORMATION FOLLOWS)


OSO-C FLIGHT SEQUENCE
(+800)--NUTATION DAMPER UNLOCK
(+1200) ELEVATION UNLOCK & ACQUISITION (SPACECRAFT ACQUIRES SUN EACH SATELLITE MORNING)
(+600)--ORBIT POWER ON: DESPIN, AZIMUTH, ACQUISITION & PITCH PRECESSION
(+126)
(+90)
(+6 SEC.)
(+0) SPACECRAFT TIMER STARTS
+808 --PAYLOAD SEPARATION
+772 SEC--ARMS OUT
+710 --3RD STAGE BURNOUT
+688 SEC--3RD STAGE IGNITION
+684-3RD STAGE SEPARATION
+682-SPIN-UP
+183 SEC-JETTISON SHROUD
+0--1ST STAGE FIRING OF THOR DELTA BOOSTER

OSO-C SATELLITE

The OSO is a space platform for direct observation of the Sun. In operation it uses the gyroscopic properties of a spinning body to maintain stability. Unlike other satellites, however, OSO has an unusual biaxial attitude control system to point instruments at the Sun.

Physically, the observatory consists of two main sections. These are the wheel section and a sail-like platform on which the solar cells are mounted. The wheel section spins to provide stability for the satellite, while the spin axis is maintained approximately perpendicular to the direction of the sunlight with cold gas precession jets, augmented by the torque coil described earlier.

Driving against the spinning wheel section, electronic control systems hold the sail platform facing toward the Sun.

Wheel and Sail Structure

The 44-inch diameter, nine-inch-high wheel structure is made of aluminum alloy and consists of nine pie-shaped compartments each with 1,000 cubic inches of space. Five compartments contain experiments. Four house the electronic controls, batteries, telemetry and radio-command equipment.

Three 30-inch arms extend at 120-degree intervals when orbit is achieved. Each arm has a six-inch diameter sphere mounted at the end containing nitrogen gas under a pressure of 3,000 pounds per square inch. The wheel spin rate is automatically controlled at 30 revolutions per minute by release of the gas through tiny jets.

The sail structure is nearly semicircular with a radius of 22 inches. It is covered with 1,860 solar cells, except for the portion occupied by the Sun-pointing experiments. Behind the solar cell panel are electronic and mechanical components to operate the sail.

When the satellite is injected into orbit, it will be spinning at about 120 revolutions per minute. Before it separates from the Delta third stage (which also goes into orbit), the three arms containing the gas vessels are extended. This action reduces the wheel spin rate to about 90 rpm. The gas jets are used to further decrease the spin rate to 30 rpm.

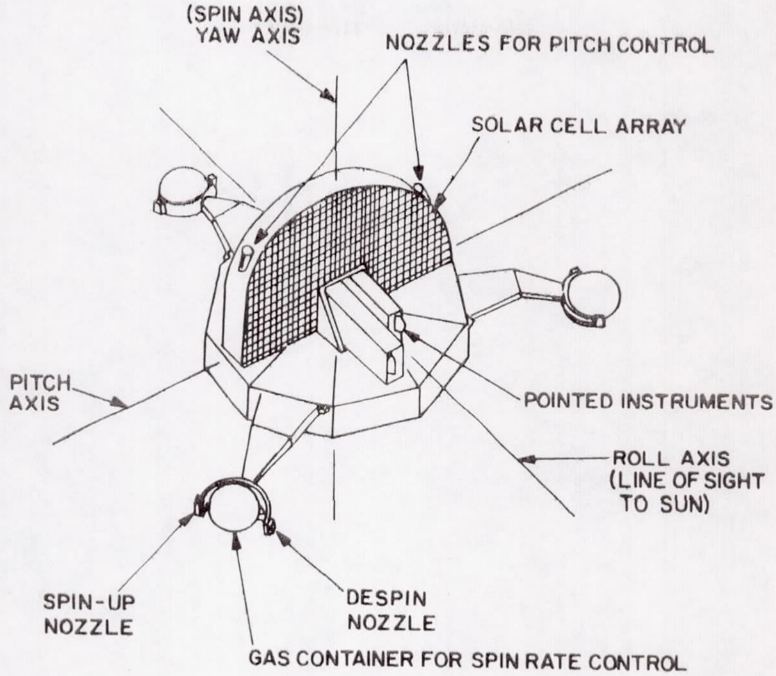
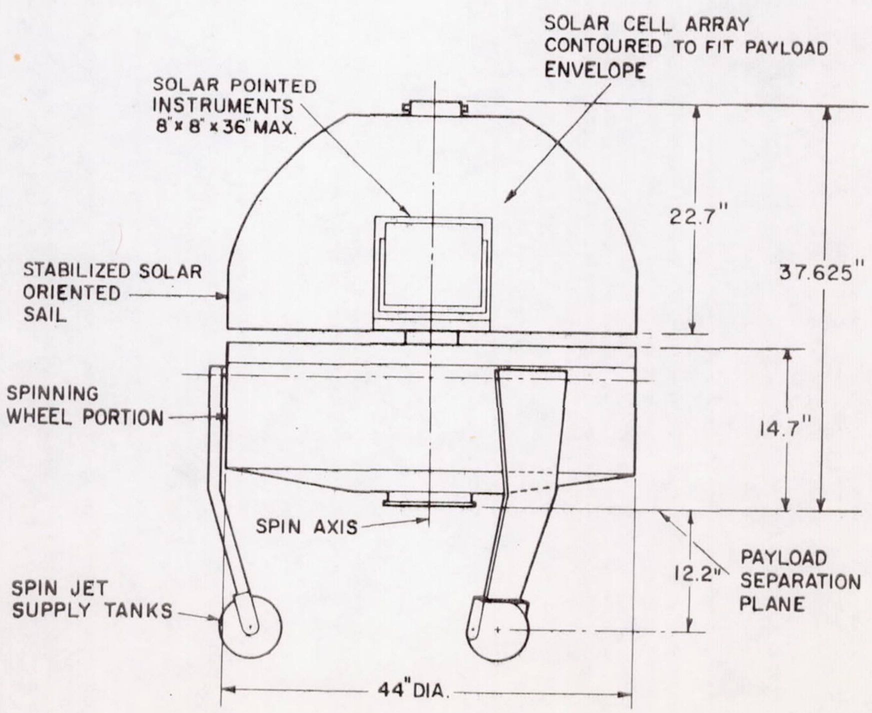
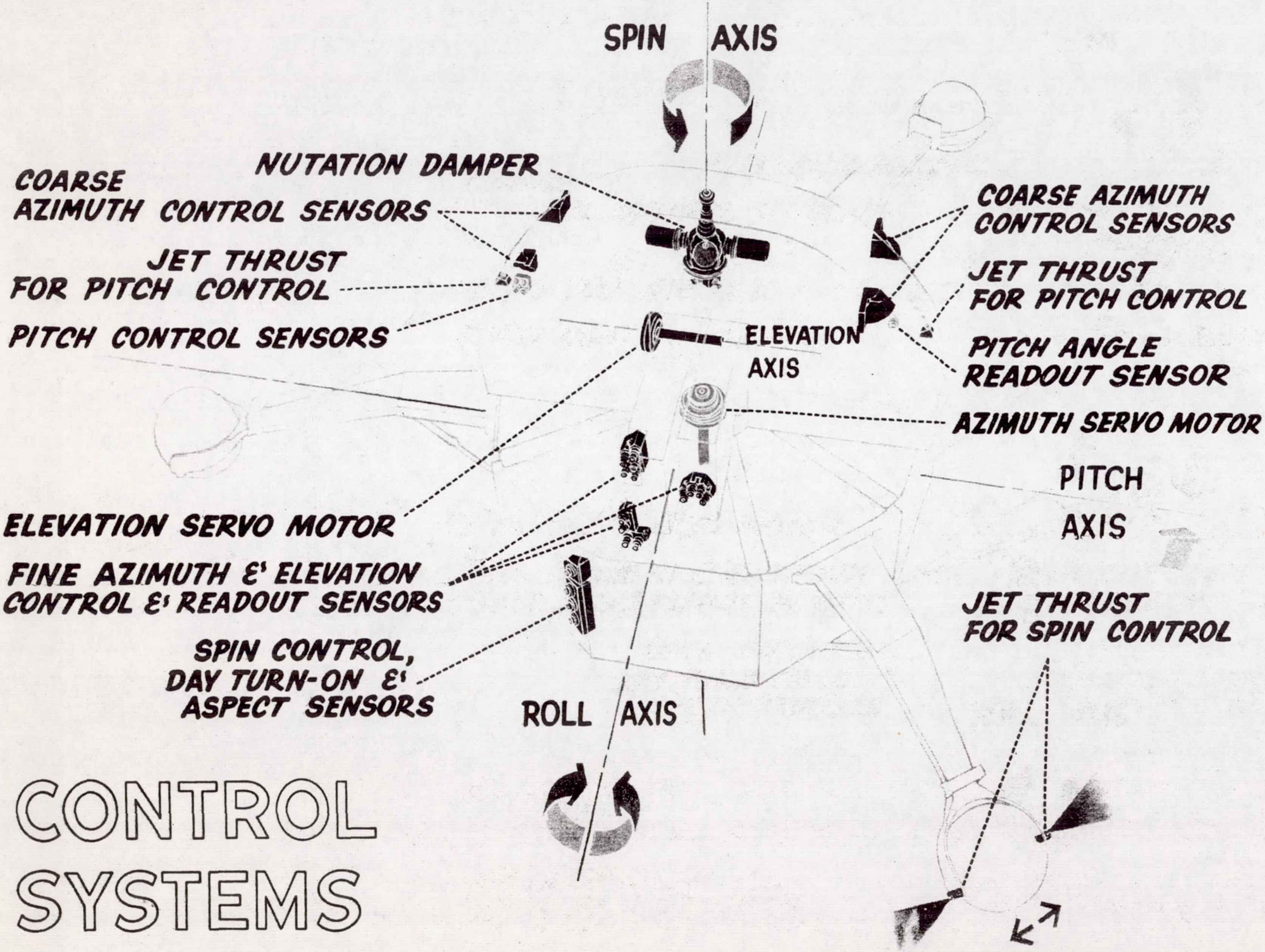
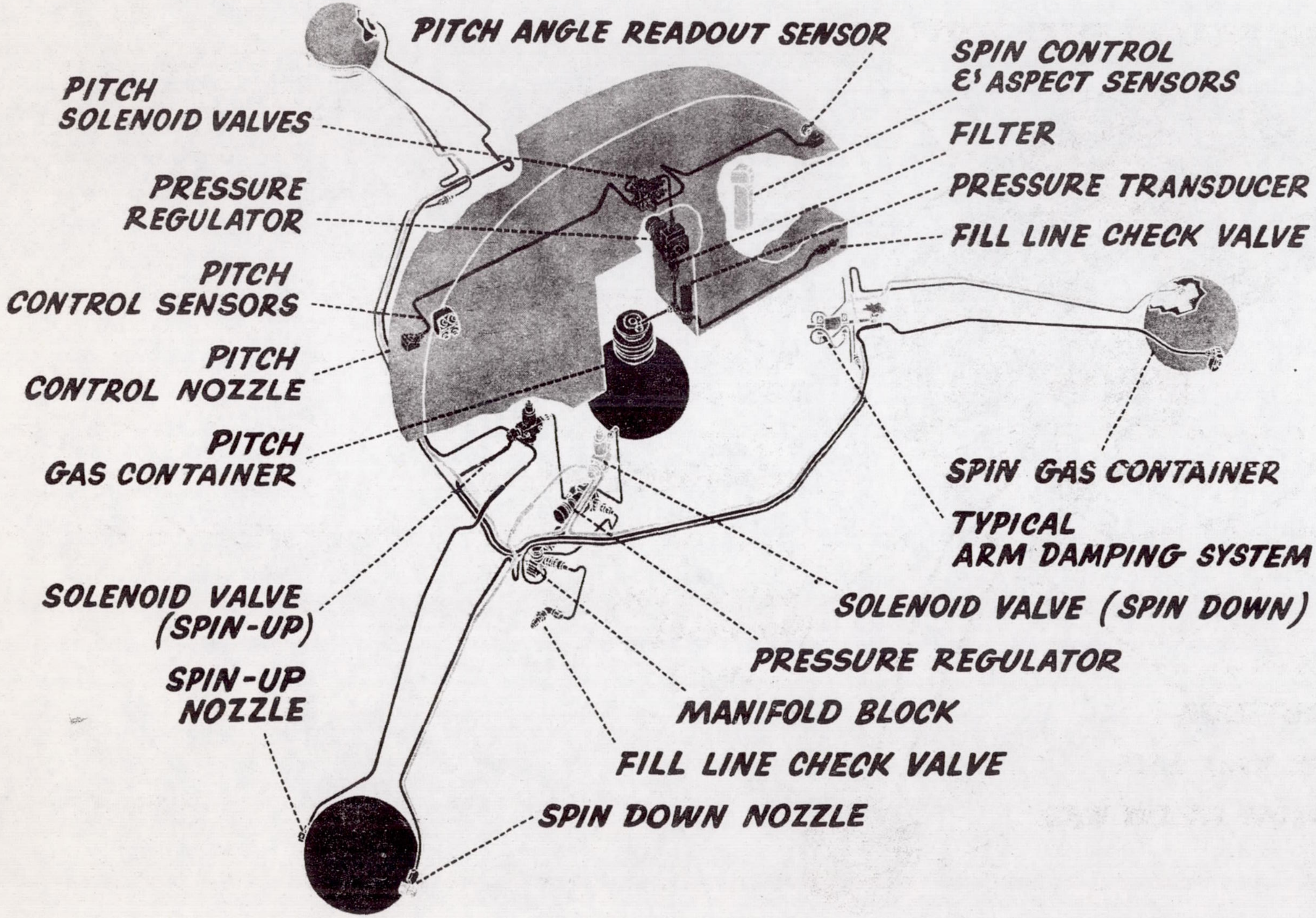


Figure III-1 – Spacecraft Configuration



CONTROL SYSTEMS





GAS CONTROL SYSTEMS

Meanwhile, the sail section spins in the opposite direction to the wheel. A complex system of pointing control devices insures that the sail points toward the Sun when the OSO is in daylight. Photodetectors seek the Sun. Four coarse detectors, each with a 90-degree field of view, provide signals which despin the upper section until the detectors point the sail to within two or three degrees of the Sun. Then two fine detectors supply signals for making more precise adjustments in azimuth and for pointing in elevation.

The pointing accuracy (one minute of arc) is comparable to sighting an object 18 inches in diameter from a distance of a mile.

OSO SCIENTIFIC OBJECTIVES

Objectives of the Orbiting Solar Observatory program are to advance our understanding of the Sun's structure and behavior and to determine the physical processes by which the Sun influences the Earth.

The Sun is the nearest star to Earth and offers opportunities to acquire new knowledge of astrophysical phenomena and to test theories. It is the only star in which man can observe directly structural features such as sunspots or prominences and the only one near enough to permit detailed study of its X-rays, gamma rays and radio emissions.

The Sun emits electromagnetic radiations of various wavelengths and energetic particles. This radiated energy striking the Earth produces circulation in both the upper and lower atmospheres. In the lower atmosphere, this circulation produces long-range climatic effects which result in the day-by day movement of weather systems.

Part of the solar radiation, however, is absorbed or reflected by the upper atmosphere, and this radiation -- X-ray and ultraviolet -- produces the region of great electron concentration called the ionosphere. Rapid changes in the intensity of solar radiation in these wavelengths have been noted by OSO I and OSO II. These changes always follow a period of activity on the Sun's surface. Solar-particle emission also undergoes large variations following solar flares.

Thus, a study of solar activity and its effect on Earth, aside from basic scientific interest, is necessary for a fuller understanding of the space environment prior to manned flights to the Moon and beyond.

Of the total radiation spectrum emitted by the Sun, the Earth's atmosphere absorbs most of the ultraviolet and X-rays below the energy level of 3,000 Angstroms. The OSO satellite, operating above the atmosphere, is able to observe radiation in these wavelengths. It is, therefore, an ideal research tool for solar investigation.

EXPERIMENTS

The experiments selected for the OSO-C were chosen for their potential to provide answers to some of the more pressing questions on the nature of solar emissions. In basic terms, these experiments are intended to map the occurence and energy of solar radiation.

Of the nine experiments carried by the new observatory, two will be pointed at the Sun from the sail portion of the spacecraft. The remaining seven experiments need not be oriented toward the Sun continuously and accurately and are located in the nine-sided rotating wheel section.

POINTED EXPERIMENTS

Ultraviolet Scanning Monochromator

This experiment, provided by the Air Force Cambridge Research Laboratory, Cambridge, Mass., is designed to investigate the effect of solar ultraviolet radiation on the Earth's ionosphere. It is an advanced version of similar devices flown earlier on sounding rockets. Its range of coverage will be from 250 to 1,300 Angstroms. The device weighs 39 pounds and operates on 3.2 watts of power.

Solar Spectrometer

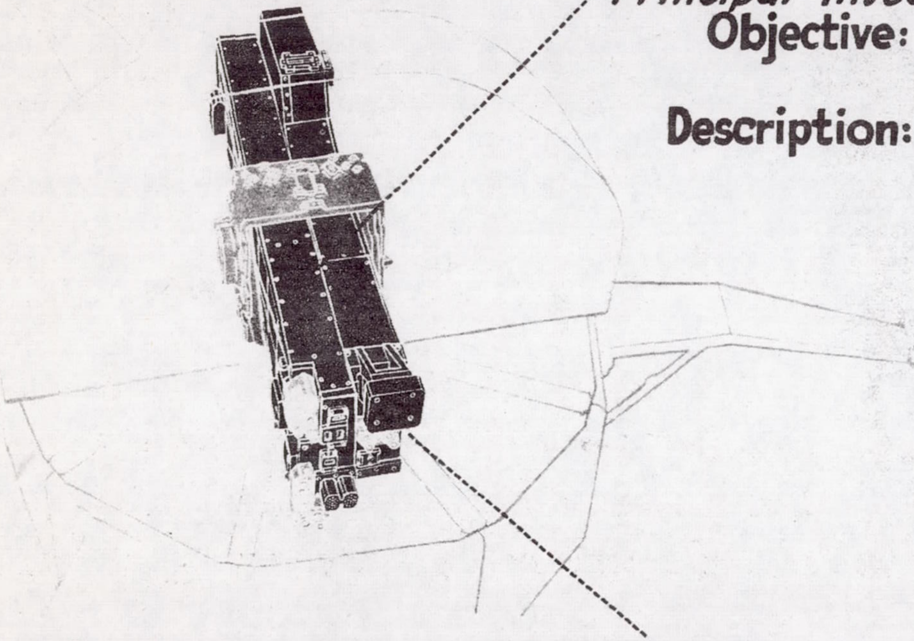
Provided by the NASA Goddard Space Flight Center, this spectrometer is a combination of five instruments, four of which are designed to measure solar X-ray radiation in various wavelengths from one to 400 Angstroms. Each of the four instruments will scan the Sun at various pre-established speeds. Then, when the fifth instrument observes an excess of X-ray flux caused by a solar event, it will override operation of the other four instruments and cause them to operate at their highest scanning speeds. This will permit the instruments to obtain higher time resolution of changes of solar flux caused by the solar event. Like the other pointed experiment, the Goddard spectrometer is controlled by

Goddard Space Flight Center - X-Ray Spectrometer

Principal Investigator: Dr. W. Neupert

Objective: *Measure Solar X-Ray Radiation in the Wavelength Range of 1Å to 400Å*

Description: *Grazing-incidence Grating Spectrometer with Magnetic Focusing Photomultiplier Scans the Spectral Range of 25Å to 400Å in 6,144 Steps. Two Crystal Goniometers Scan the Spectral Ranges of 1Å-2.5Å & 2.5Å-6.4Å in 256 Steps. A Third Goniometer Scans the Range of 6.4Å-25Å in 512 Steps. Two Parallel Ion Chambers are Sensitive to Flare Activity in the 2Å-8Å Range.*



Air Force Cambridge Research Laboratory Ultraviolet Spectrometer

Principal Investigator: Dr. H.E. Hinteregger

Objective: *Measure Solar Radiation in the Wavelength Range of 250Å - 1300Å.*

Description: *Grazing-incidence Grating Spectrometer with Magnetic Focusing Photomultiplier Scans the Spectral Range in 2040 Discrete Steps at Several Stepping Rates.*

ORIENTED EXPERIMENTS

ground command making it one of the most complicated scientific satellite devices ever to be controlled in this manner. The experiment weighs 38 pounds and operates on an average power of 2.75 watts.

WHEEL EXPERIMENTS

Thermal Radiation Emissivity Detector

This experiment from the NASA Ames Research Center, Mountain View, Calif., is designed to support the Apollo manned Moon landing program. It is a relatively simple experiment involving 12 special coatings to measure the long-term effects of the space environment on spacecraft surfaces. This is the same type of experiment flown by Ames on OSO II. It weighs two pounds and uses two watts of power.

Earth Albedo Telescopes

This instrument package, weighing almost 21 pounds, was provided by the NASA Ames Research Center. It consists of six telescopes. Its purpose is to measure the light energy reflected from the Earth's surface -- the Earth's albedo. Operating in an Angstrom range from 3,200 to 7,800, the telescopes are expected to give scientists a better insight into the various differences of Earth-reflected energy since this energy varies greatly over water and cloud cover areas. It uses 0.5 watt of power.

Direction Radiometer Telescopes

The third NASA Ames Research Center experiment consists of directionally sensitive radiometer telescopes, designed to extend the Albedo experiment measurements into the far infrared range of from one to 30 microns. It consists of two parabolic mirrors with associated detectros. The device weighs slightly more than five pounds and uses 0.5 watt of power.

Celestial Gamma-Ray Detector

Provided by the Massachusetts Institute of Technology, this 90-pound device is the heaviest experiment carried on board OSO-C. It occupies two complete compartments in the wheel section. It is an advanced version of a similar device first flown by Explorer XI in April 1961. Its purpose is to detect and identify gamma rays of energy greater than 100 million electron volts and determine their celectial distribution. This information should extend our understanding of the distribution of these rays as well as help in the interpretation of data already obtained from earlier satellite flights.

When a gamma ray enters the device, its normal searching operation is automatically changed to analyze the ray. After the analysis process, the experiment returns to its normal operating mode until another gamma ray is encountered. Changes in operating procedures of the device are controlled by ground command. It uses one watt of power.

Solar X-Ray Detector

Designed to measure the intensity of solar X-rays in the eight to 20 Angstrom range, this device, provided by the University of Michigan, Ann Arbor, Mich., weighs six pounds and uses 0.8 watt of power. Data obtained from the experiment will complement data obtained by the Goddard X-ray Experiment. The instrument operates in both the high and low sensitivity ranges and switches automatically from one range or frequency to another when the X-ray flux reaches a pre-established level. Measurements of this type over a long period of the solar cycle are neededto establish a baseline for defining the total energy output from the Sun in this particular range.

Cosmic Ray Charge Spectrum Detector

The University of Rochester, Rochester, N.Y., has provided a 17-pound detector designed to map the sky, including the Sun, and detect energetic particles penetrating the spacecraft from sources throughout the universe. The experiment can discriminate between particles and gamma rays and, operating in its primary data acquisition mode, it can examine different sequential positions in the sky. It uses 0.7 watt of power.

Solar X-Ray Telescope

This experiment, provided by the University of California, San Diego, will measure the intensity, energy and directional properties of X-rays in the seven to 190 thousand electron volts range. (This corresponds to an Angstrom range of 1.7 to 0.065.) It consists of a detector system of photomultipliers. Anti-coincidence shielding and a self-contained aspect system provide X-ray directional data. The instrument package weighs slightly more than 13 pounds and uses 0.5 watt of power.

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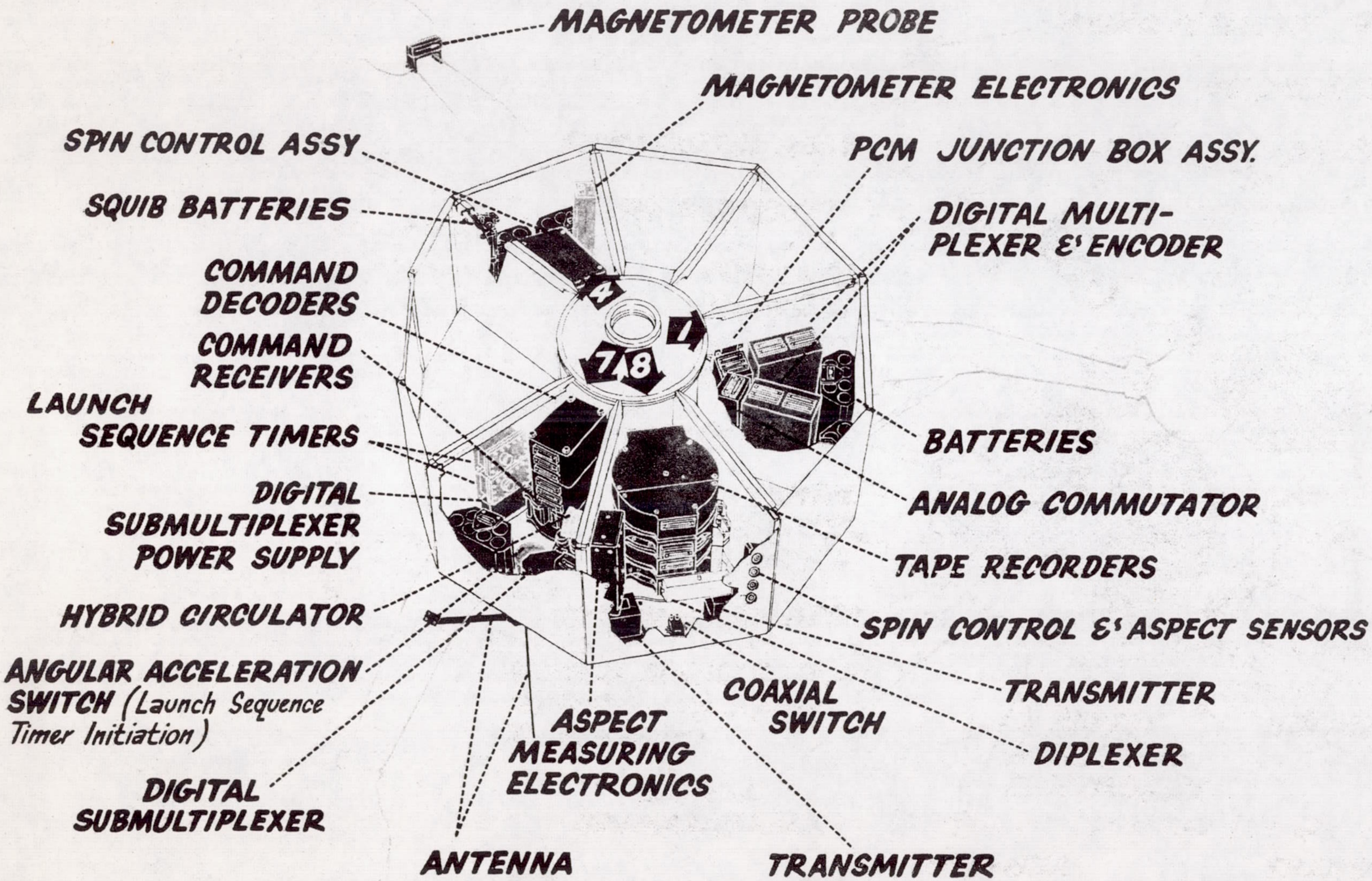


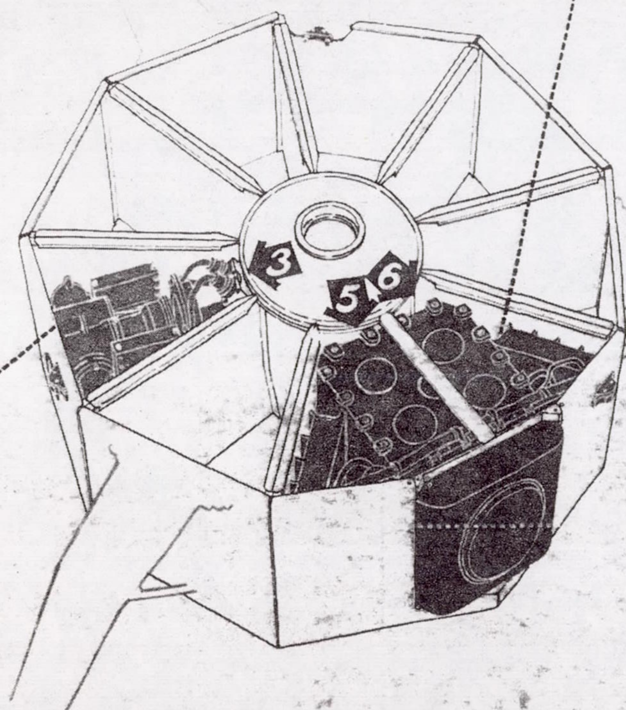
WHEEL ELECTRONIC SYSTEMS

Massachusetts Institute of Technology - Gamma Ray Telescope

Principal Investigator: Dr. W. Kraushaar

Objective: *Detect, Identify & Determine Celestial Distribution & Energy Levels of Gamma Rays (100 Mev & Greater)*

Description: *Gamma Rays are Converted into Electron Pairs in Cesium & Sodium Iodide Scintillators, Pass Through Plastic Scintillators & a Cerenkov Counter into a Lead Sandwich Absorber. Pulse Amplitudes from Scintillators are a Measure of Gamma Ray Energy. Spacecraft & Instrument Aspect Data Determine Celestial Distribution.*



University of Rochester - Particle & Gamma Ray Telescope

Principal Investigator: Dr. M. Kaplon

Objective: *Study Charged Particles of Cosmic Origin.*

Description: *Counter Telescope with Directional Cerenkov Detector. Coincidence Circuitry used to Define Acceptance Cone. Discriminator Outputs Fed to Logic Which Provides the High Energy Particle Radiation Data. Mu Meson Spectrum use to Check Detector Stability.*

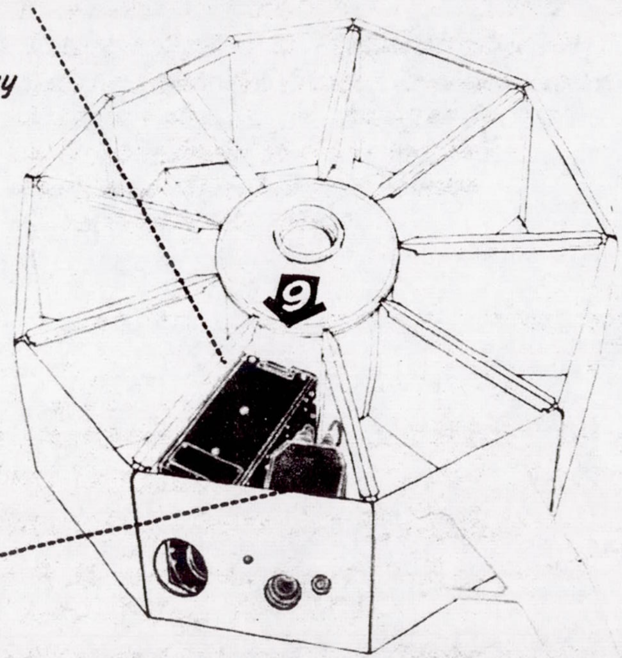
WHEEL EXPERIMENTS I

University of California / San Dieqo - X-Ray Telescope

Principal Investigator: Dr. L. Peterson

Objective: *To Measure Intensity, Energy & Directional Properties of X-Rays (Energy Range; 7-190 Kev)*

Description: *Detector System of Photomultiplier & Sodium Iodide Scintillator Provides Energy Data to Pulse Height Analyzer System. Anti-Coincidence Shielding and Self Contained Aspect System Provide Directional Information.*



University of Michiqan - Solar X-Ray Detector

Principal Investigator: Dr. R. Teske

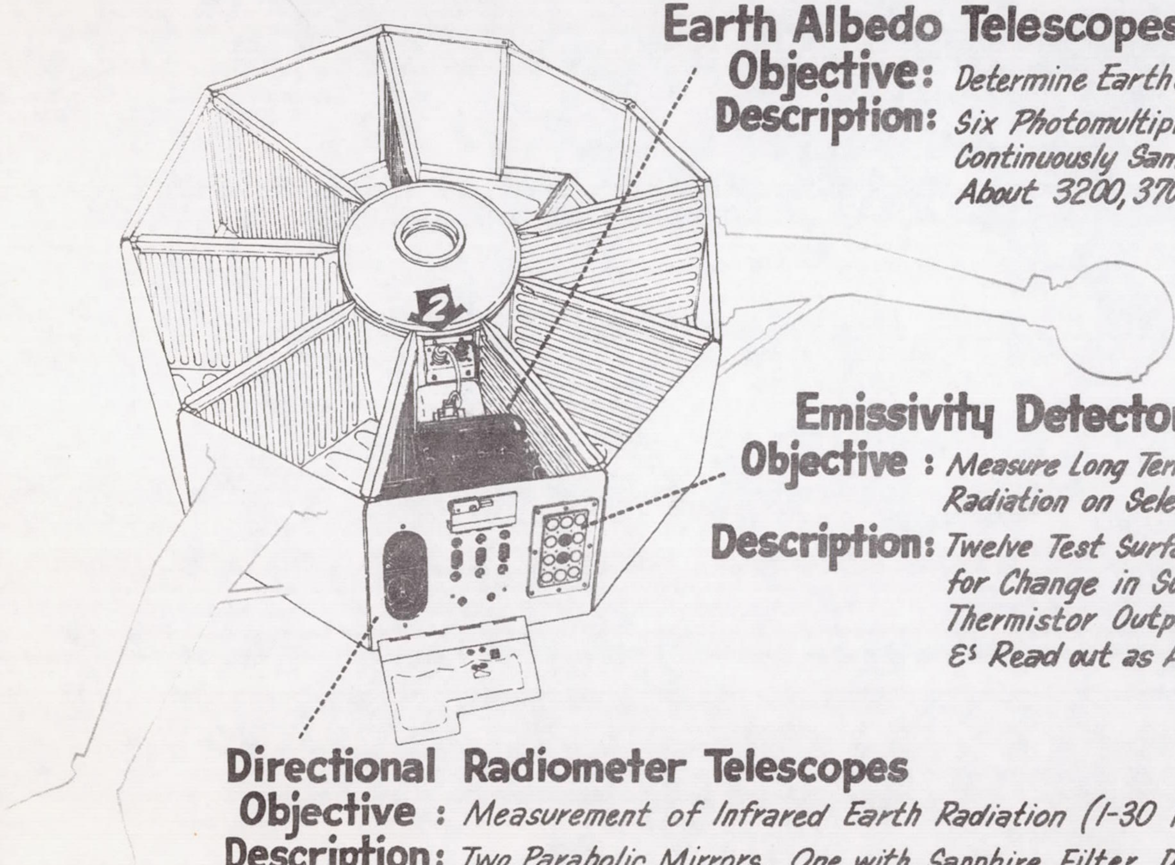
Objective: *To Measure Intensity of Solar X-Rays (8-20 Å)*

Description: *Nitrogen Filled Ion Gauge Coupled to Linear Electrometer Amplifier Produces Analog Output for High Energy Protons Which Enter the Instrument.*

WHEEL EXPERIMENTS II

Ames Research Center

Principal Investigator: Mr. C. Neel



Earth Albedo Telescopes

Objective: *Determine Earth's Reflectance (3200-7800 Å)*

Description: *Six Photomultipliers with Filters Continuously Sample Albedo-Ranges Centered About 3200, 3700, 4500, 5600, 6800, 7800 Å.*

Emissivity Detectors:

Objective : *Measure Long Term Effects of Radiation on Selected Surfaces.*

Description: *Twelve Test Surfaces Sampled for Change in Surface Emissivity. Thermistor Outputs Commutated & Read out as Analog Data.*

Directional Radiometer Telescopes

Objective : *Measurement of Infrared Earth Radiation (1-30 Microns)*

Description: *Two Parabolic Mirrors, One with Sapphire Filter, Detect the Earth Albedo Radiation. Surface Mounted Thermistors Measure Mirror & Focal Point Temperatures.*

WHEEL EXPERIMENTS III

DELTA LAUNCH ROCKET

The three-stage Delta vehicle, built by the Douglas Aircraft Co., will be used to launch the OSO-C satellite. Delta's record to date includes 30 satellites launched into orbit and two launches in which orbit was not achieved. The Delta project is managed by the Goddard Space Flight Center.

The Delta rocket has the following characteristics:

Height:	90 feet
Maximum diameter:	8 feet
Lift-off weight:	About 57 tons

First stage: Modified Air Force Thor, produced by Douglas Aircraft Co.

Fuel:	Liquid (Kerosene/liquid oxygen)
Thrust:	170,000 pounds
Burning time:	About two minutes and 26 seconds
Thor weight:	Over 50 tons

Second stage: Aerojet General Corp., JA 10-118 propulsion system.

Fuel:	Liquid (UDMN/IRFNA)
Thrust:	About 7,500 pounds
Burning time:	About two minutes and 30 seconds.
Weight:	Two and one-half tons

Third stage: Allegany Ballistics Laboratory X-258 motor.

Fuel:	Solid
Thrust:	About 5,700 pounds
Burning time:	23 seconds
Weight:	About 573 pounds
Length:	61.27 inches
Diameter:	18 inches

During first and second stage powered flight, the Western Electric radio-guidance system is used for in-flight trajectory corrections. It also commands second-stage cut-off when the desired position and velocity have been achieved.

Following second stage cutoff, a coast period of approximately seven minutes occurs. Near the end of this period, small rockets mounted on a table between the second and third stage ignite and spin the table up to 120 revolutions per minute. The second stage separates and the third stage ignites, speeding the OSO into orbit.

FACT SHEET

ORBITING SOLAR OBSERVATORY C

SATELLITE

Weight:	About 620 pounds (242 pounds of scientific experiments and associated instruments).
Shape:	Base section: nine-sided wheel with three arms carrying the spin control gas supply; top section: fan-shaped with pointing instrumentation.
Size:	Wheel diameter: 44 inches, increased to 92 inches with three arms extended. Overall height: 37 inches.
Lifetime:	Designed for six months useful lifetime.

LAUNCH PHASE

Launch site:	Complex 17, Cape Kennedy, Eastern Test Range.
Launch rocket:	Three-stage Delta rocket.
Launch azimuth:	108 degrees.
Orbit:	Circular, about 350 miles.
Orbital period:	95 minutes.
Angle of inclination:	33 degrees (roughly between 35° N and 35° S of the equator).

POWER SUBSYSTEM

Solar Power supply:	33 watts maximum using 3.8 square feet of N/P solar cells arranged in 36 parallel strings of 52 cells each on the Sun-facing side of the sail section.
Typical maximum load:	26 watts including 15 watts for satellite systems and 11 watts for experiments.

TRACKING, TELEMETRY AND COMMAND STATIONS

All tracking and telemetry stations are part of the Goddard Space Flight Center's Space Tracking and Data Acquisition Network (STADAN). Secondary stations will be used for acquisition and command only during the early orbit phase of the launch or when no primary station is available to command and record data.

Primary stations:	Fort Myers, Fla.; Quito, Ecuador; Lima, Peru; Santiago, Chile; Blossom Point, Md.
Secondary stations:	Mojave, Calif.; Woomera, Australia; Johannesburg, Republic of South Africa.

OSO-C PARTICIPANTS

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Dr. Homer E. Newell	Associate Administrator for Space Science and Applications
Jesse L. Mitchell	Acting Director, Physics and Astronomy Programs Division OSSA
Richard E. Halpern	OSO Program Manager
Dr. Henry J. Smith	OSO Program Scientist
T. B. Norris	Delta Program Manager

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L. T. Hogarth	OSO Project Manager
Dr. John C. Lindsay	OSO Project Scientist
T. E. Ryan	Tracking and Data Systems Manager
William R. Schindler	Delta Project Manager
Robert H. Gray	Manager, Goddard Launch Operations

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R. H. Gablehouse	OSO Project Manager
L. T. Ostwald	OSO Project Engineer

DOUGLAS AIRCRAFT CO.

Marcus F. Cooper	Director, Florida Test Center, Cape Kennedy
J. Kline	Delta Systems Engineer

EXPERIMENTERS

Pointed:

Air Force Cambridge Research Center	Ultraviolet Scanning Monochromator H. E. Hinterberger
Goddard Space Flight Center	Solar Spectrometer Dr. Werner M. Neupert

Wheel:

Ames Research Center	Thermal Radiation Emissivity Detector C. B. Neel
Ames Research Center	Earth Albedo Telescopes C. B. Neel
Ames Research Center	Directional Radiometer Telescopes C. B. Neel
University of California (San Diego)	Solar X-Ray Telescope L. E. Peterson
Massachusetts Institute of Technology	Celestial Gamma-Ray Detector W. L. Kraushaar
University of Michigan	Solar X-Ray Detector R. G. Teske
University of Rochester	Cosmic Ray Charge Spectrum Detector M. F. Kaplon

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