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(NASA-TM-X-74145) ENCYCLOPEDIA OF SATELLITES AND SOUNDING ROCKETS, AUGUST 1959 - DECEMBER 1969 (NASA) 333 p HC $10.00
CSCL 22A

N76-30240

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ENCYCLOPEDIA

SATELLITES and SOUNDING ROCKETS

of

GODDARD SPACE FLIGHT CENTER

1959-1969

GODDARD SPACE FLIGHT CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

ENCYCLOPEDIA

of

Satellites and Sounding Rockets

August 1959 to December 1969

Goddard Space Flight Center

National Aeronautics and Space Administration

1970

FOREWORD

NASA's Goddard Space Flight Center is devoted to the scientific investigation and exploration of space. It is one of the few installations in the world capable of pursuing the full spectrum of space-science explorations, including theory, experiment design and construction, satellite fabrication and testing, and--after the launch--tracking, data acquisition, and data processing.

Goddard is also the tracking, communications, and computing hub of NASA's worldwide Space Tracking and Data Acquisition Network (STADAN) and Manned Space Flight Network (MSFN). The Center operates worldwide tracking stations which feed data back to Goddard via NASA's Communications Network (NASCOM), which is the largest worldwide real-time communication system.

TABLE OF CONTENTS

This encyclopedia lists major space missions for which the NASA Goddard Space Flight Center has been responsible since its inception in 1959 through December 1969. The material has been gleaned from many sources and every effort has been made to insure its accuracy, however, comments, suggestions and corrections of fact are invited.

Alfred Rosenthal
William Corliss

I. GODDARD SATELLITE PROJECTS

The following table presents key information for the satellite and space-probe projects where Goddard has been responsible for the spacecraft or its successful launch or both. Many satellite projects have involved Goddard personnel heavily; viz., most Explorers and the early communication and weather satellites. In later years, Goddard has launched many satellites for other government agencies and foreign countries. All of these projects are included in the pages that follow.

Key to Satellite Data Arrangement

To save space and avoid repeating identifying legends, satellite data are listed in the format shown below:

SATELLITE NAME		*International Designation*
Launch Date	*Launch Vehicle/Range*	*Period (min)*
Silent Date	*Weight (lb)*	*Apogee/Perigee (mi)*
Reentry Date	*Project Manager*	*Project Scientist*

Objectives:

Experiment-Instrument *Experimenter/Affiliation*

Remarks:

Selected References:

Abbreviations Used in Satellite Table

Launch Vehicles:*	TAD	Thrust-Augmented Delta
	TAID	Thrust-Augmented Improved Delta
Ranges:	ETR	Eastern Test Range (Florida)
	WTR	Western Test Range (California)
Affiliations:	AFCRL	Air Force Cambridge Research Laboratories
	APL	Applied Physics Laboratory of Johns Hopkins University
	ARC	Ames Research Center (NASA)
	BTL	Bell Telephone Laboratories
	CNET	Centre National d'Etudes (France)
	CRPL	Central Radio Propagation Laboratory (National Bureau of Standards)
	DRTE	Defence Research Telecommunications Establishment (Canada)
	DSIR	Department of Scientific and Industrial Research (U.K.)
	ESRO	European Space Research Organization
	ESSA	Environmental Science Service Administration

*See Section IV for descriptions of current Goddard launch vehicles

Affiliations: (continued)

	GSFC	Goddard Space Flight Center
	JPL	Jet Propulsion Laboratory
	MIT	Massachusetts Institute of Technology
	NBS	National Bureau of Standards
	NRC	National Research Council
	NRL	Naval Research Laboratory
	SAO	Smithsonian Astrophysical Observatory
	STL	Space Technology Laboratories
	UCLA	University of California at Los Angeles

Discipline Code:

Scientific experiments are coded by letters designating the following disciplines:

R - Aeronomy	A - Astronomy
E - Particles and Fields	P - Planetary Atmosphere
I - Ionospheric Physics	S - Solar Physics

EXPLORER VI		1959 Delta 1
Aug. 7, 1959	Thor-Able/ETR	750 min
Oct. 6, 1959	142 lb	156/27,357 miles
Jul. 1961	J.C. Lindsay	J.C. Lindsay

Objectives: To measure three specific radiation levels of the Earth's radiation belts; test scanning equipment for Earth's cloud cover; map Earth's magnetic field; measure micrometeoroids; and study behavior of radio waves.

Instrument/Discipline	Experimenter/Affiliation
Triple coincidence cosmic-ray telescope-E	J.A. Simpson/U. of Chicago
	C.Y. Fan
	P. Meyer
Scintillation counter-E	T.A. Farley/STL
	A. Rosen
	C.P. Sonett
Ion chamber and Geiger counter-E	J. Winckler/U. Minnesota
Spin-coil magnetometer-E	E.J. Smith/STL
	D.L. Judge
Fluxgate magnetometer-E	P.J. Coleman/STL
VLF receiver-I	R. Helliwell/Stanford U.
Image-scanning television system	---/STL
Micrometeoroid detector-A	E. Manring/AFCRL

Remarks: All experiments performed satisfactorily. First televised cloud cover picture was obtained. Detected ring of electrical current circling Earth. First detailed study of Van Allen radiation belts.

Selected References:

Fan, C.Y., Meyer, P., Simpson, J.A.: Dynamics and Structure of the Outer Radiation Belt, *J. Geophys. Res.*, *66*, 2607, Sept. 1961.

Hoffman, R.A., Arnoldy, R.L., and Winckler, J.R.: Observations of the Van Allen Radiation Regions During August and September 1959. 3. The Inner Belt, *J. Geophys. Res.*, *67*, 1, Jan. 1962.

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Judge, D.L., McLeod, M.G., and Sims, A.R.: The Pioneer 1, Explorer 6, and Pioneer 5 High Sensitivity Transistorized Search Coil Magnetometer, *IRE Trans., SET-6*, 114, Sept. 1960.

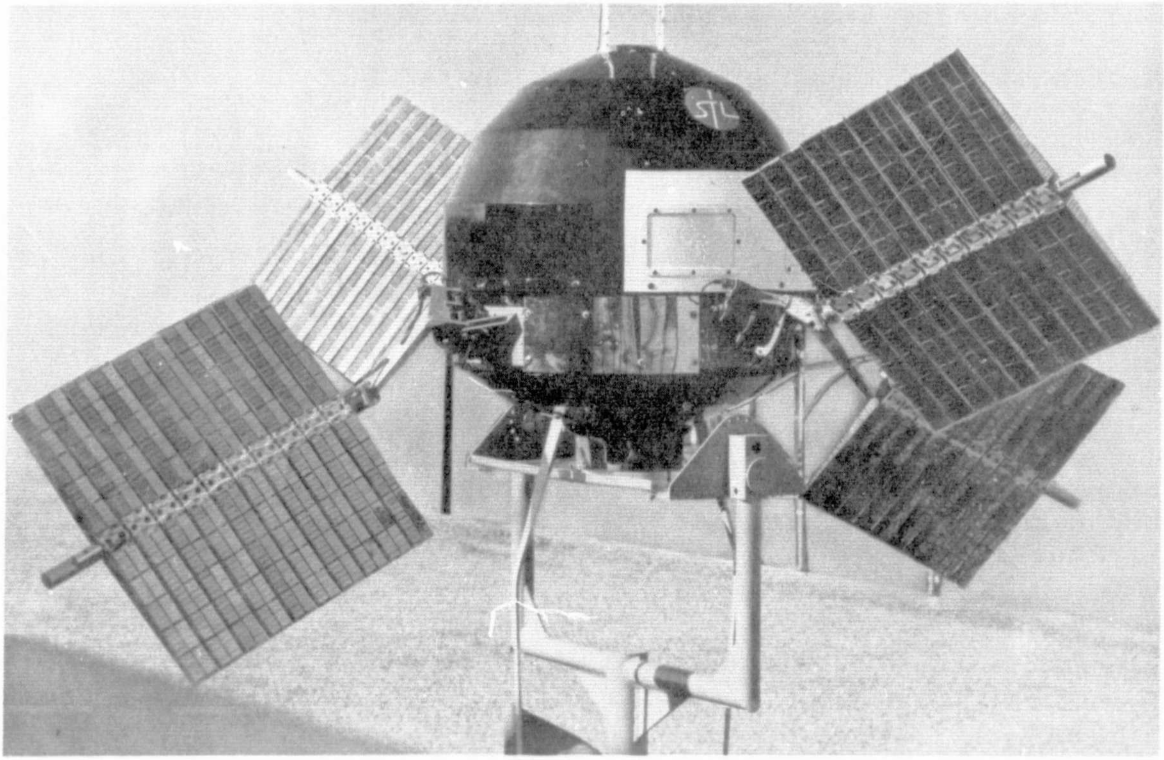
Mueller, G.E.: Pioneer V and Explorer VI, Systems Engineered Space Probes, in *Proceedings of the XIth International Astronautical Congress*, C.W.P. Reutersward, ed., Springer-Verlag, Vienna, 1961, p. 256.

Rosen, A. and Farley, T.A.: Characteristics of the Van Allen Radiation Zones as Measured by the Scintillation Counter on Explorer VI, *J. Geophys. Res., 66*, 2013, July 1961.

Rosen, A. et al: Explorer VI and Pioneer V Data, *NASA CR-3* and *NASA CR-4*, 1963.

Sonett, C.P., Smith, E.J., and Sims, A.R.: Surveys of the Distant Geomagnetic Fields: Pioneer I and Explorer Vi, in *Space Research*, H. Kallmann Bijl, ed., Interscience Publishers, New York, 1960, p. 921.

Sonett, C.P. et al: Current Systems in the Vestigial Geomagnetic Field: Explorer VI, *Phys. Rev. Ltrs., 4*, 161, Feb. 15, 1960.



Vanguard III 1959 Eta I

Sept. 18, 1959	Vanguard/ETR	130 min
Dec. 12, 1959	100 lbs.	319/2329 miles
In orbit	---	---

Objectives: To measure the earth's magnetic field, X-radiation from the sun, and the micrometeoroid environment.

Instrument/Discipline	Experimenter/Affiliation
Proton magnetometer-E	J.P. Heppner/GSFC
X-ray ionization chambers-S	H. Friedman/NRL
Various micrometeoroid detectors-A	H.E. LaGow/GSFC

Remarks: Provided comprehensive survey of earth's magnetic field over area covered; surveyed location of lower edge of Van Allen radiation belt. Count of micrometeoroid impacts.

Selected References:
Anonymous: IGY Satellite 1959 Eta. *IGY Bull.*, no. 28, 10, Oct. 1959.

Cain, J.C. et al: Vanguard III Magnetic Field Observations, *J. Geophys. Res.*, *67*, 5055, Dec. 1962.

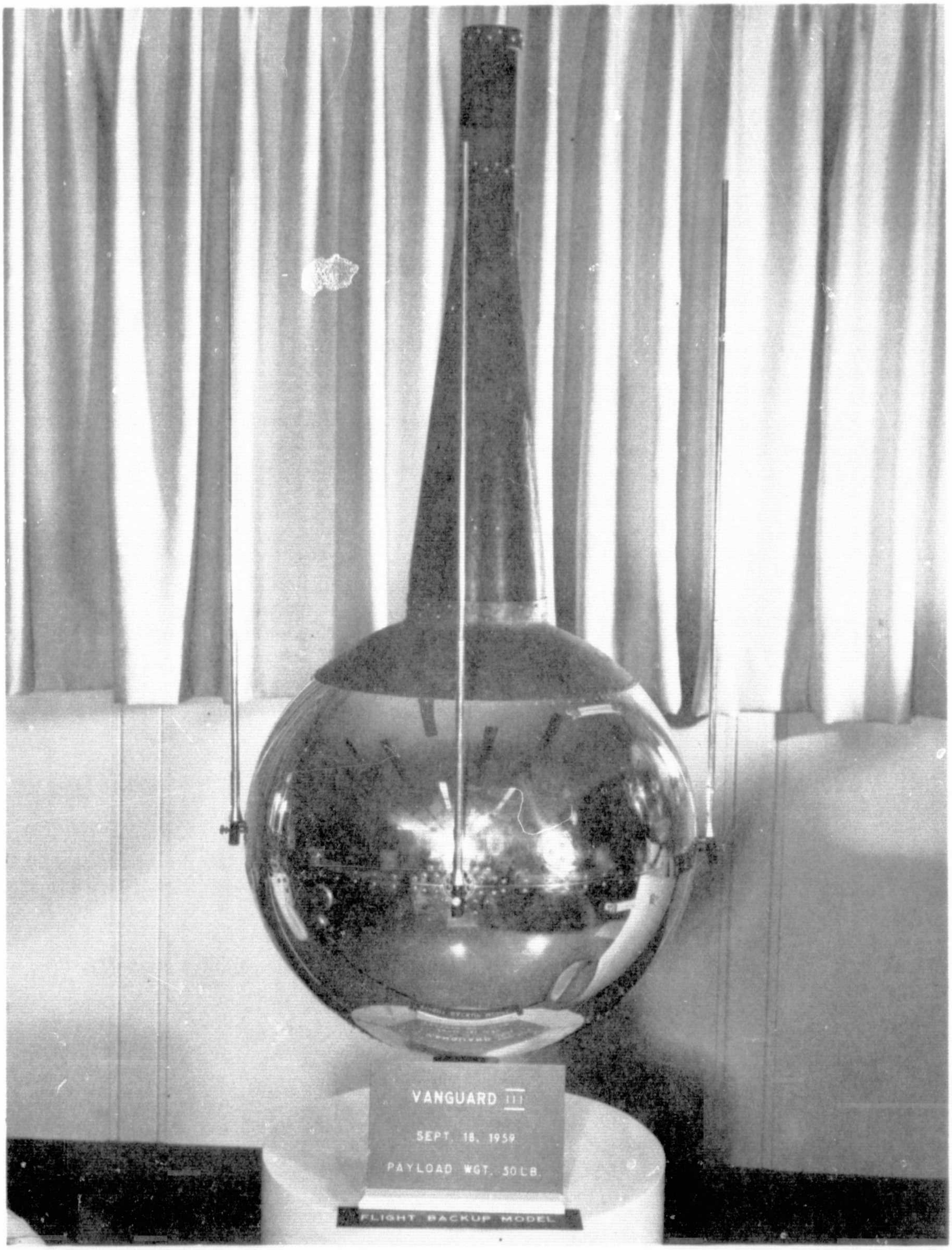
Heppner, J.P. et al: Satellite Magnetic Field Mapping, *NASA TN-D-696*, 1961.

Heppner, J.P. et al: Project Vanguard Magnetic-Field Instrumentation and Measurements, *NASA-TN-D-486*, 1960.

LaGow, H.E. and Alexander, W.M.: Recent Direct Measurements by Satellites of Cosmic Dust in the Vicinity of the Earth, *NASA TN-D-488*, 1960.

Shapiro, I.R., Stolarik, J.D., and Heppner, J.P.: Data Report on Whistlers Observed by Vanguard III (1959 Eta 1), *NASA TN-D-2313*, 1964.

VANGUARD III (Continued)



EXPLORER VII 1959 Iota 1

Oct. 13, 1959	Juno II/ETR	101 min.
Aug. 24, 1961	91.5 lb	342/680 miles
In orbit	---	---

Objectives: To carry out solar ultraviolet; X-ray; cosmic-ray; earth radiation, and micrometeoroid experiments.

Instrument/Discipline	Experimenter/Affiliation
Thermal radiation balance	V. Suomi/U. Wisconsin
Solar X-ray and Lyman-alpha ion chambers-S	H. Friedman,NRL
	R.W. Kreplin
	T. Chubb
Cosmic-ray ion chamber-E	G. Groetzinger/Martin Co.
	P. Schwed
	M. Pomerantz/Bartol Research
Geiger counters-E	J. Van Allen/St. U. of Iowa
	G. Ludwig
	H. Whelpley
Ground-based observation of radio signals-I	G. Swenson/U. Illinois
	C. Little/Nat. Bu. of Standards
	G. Reid/U. Alaska
	O. Villard, Jr./Stanford
	W. Ross/Penn State
	W. Dyke/Linfield Res. Inst.
Micrometeoroid penetration sensor-A	H. LaGow/GSFC

Remarks: Provided significant geophysical information on radiation and magnetic storms; demonstrated method of controlling internal temperatures; first micrometeoroid penetration sensor.

Selected References:

Boehm, J.: Considerations to the Development of Explorer VIII Satellite, *IRE Trans., MIL-4*, 86, 1960.

LaGow, H.E. and Secretan, L.: Results of the Micrometeoroid Penetration Experiment on the Explorer VII Satellite (1959 Iota) *NASA TN-D-1722*, 1963.

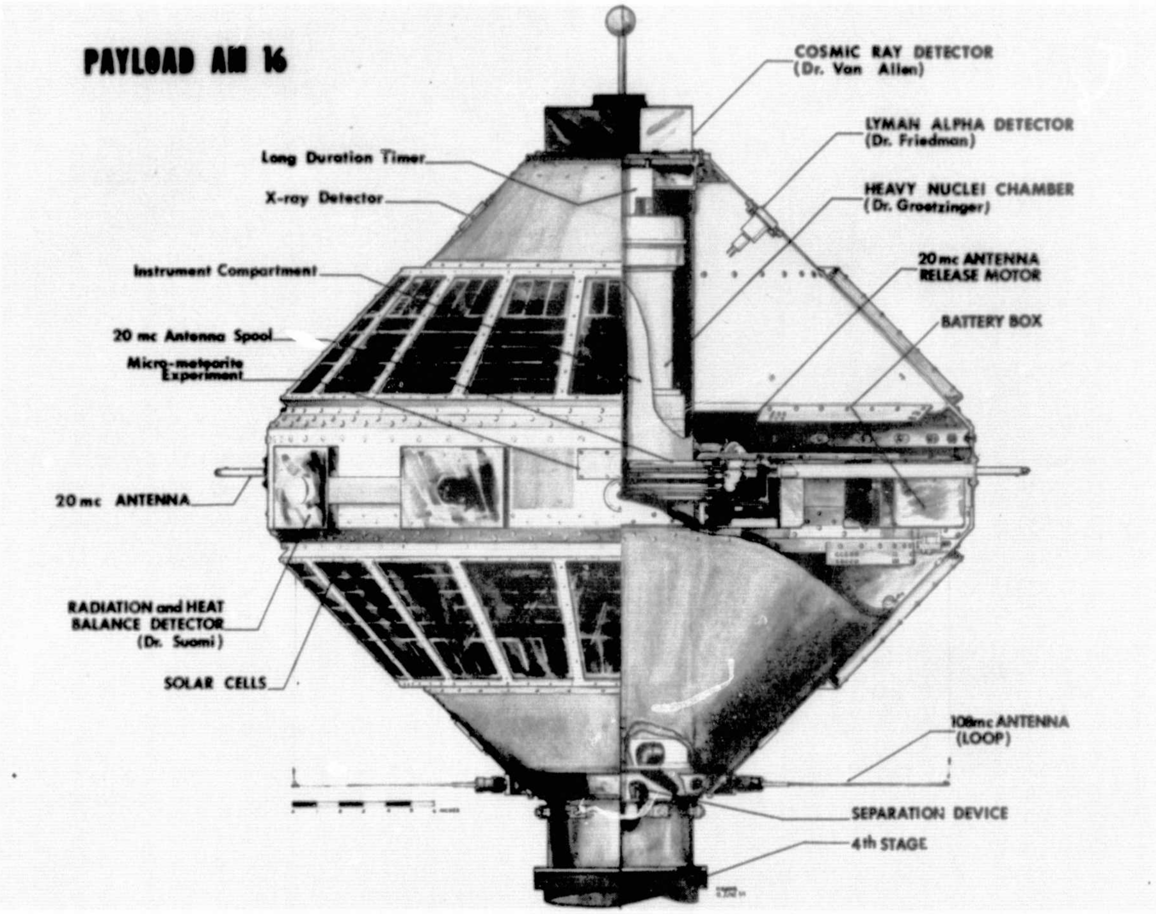
EXPLORER VII (Continued)

Ludwig, G.H. and Whelpley, W.A.: Corpuscular Radiation Experiment of Satellite 1959 Iota (Explorer VII), *J. Geophys. Res., 65*, 1119, April 1960.

NASA: Explorer VII Satellite, in *NASA TN-D-608*, vol. 1, 1961.

Schwed, P. et al: Satellite-Borne Instrumentation for Observing Flux of Heavy Primary Cosmic Radiation, *J. Franklin Inst., 271*, 175, April 1961.

Van Allen, J.A. and Lin, W.C.: Outer Radiation Belt and Solar Proton Observations with Explorer VII During March-April 1960, *J. Geophys. Res., 65*, 2998, Sept. 1960.



PIONEER V 1960 Alpha 1

March 11, 1960	Thor-Able/ETR	311.6 days
June 26, 1960	95 lb	74,900,000/
In solar orbit	J.C. Lindsay	92,300,000 mi.
		J.C. Lindsay

Objectives: To investigate interplanetary space between orbits of Earth and Venus, test extreme long-range communications, study methods for measuring astronomical distances.

Instrument/Discipline	Experimenter/Affiliation
Triple coincidence cosmic ray telescope-E	J. A. Simpson/U. Chicago
Search-coil magnetometer and photo-electric cell	D.L. Judge/STL
Ionization chamber and Geiger counter-E	J. Winckler/U. Minnesota
Micrometeoroid counter-A	E. Manring/AFCRL

Remarks: Highly successful exploration of interplanetary space between orbits of Earth and Venus; established communications record of 22.5 million miles on June 26, 1960; made measurements of solar flare effects, particle energies and distribution, and magnetic field phenomena in interplanetary space.

Selected References:

Anonymous: Pioneer V Space Probe, *IGY Bull.*, no. 34, 5, April 1960.

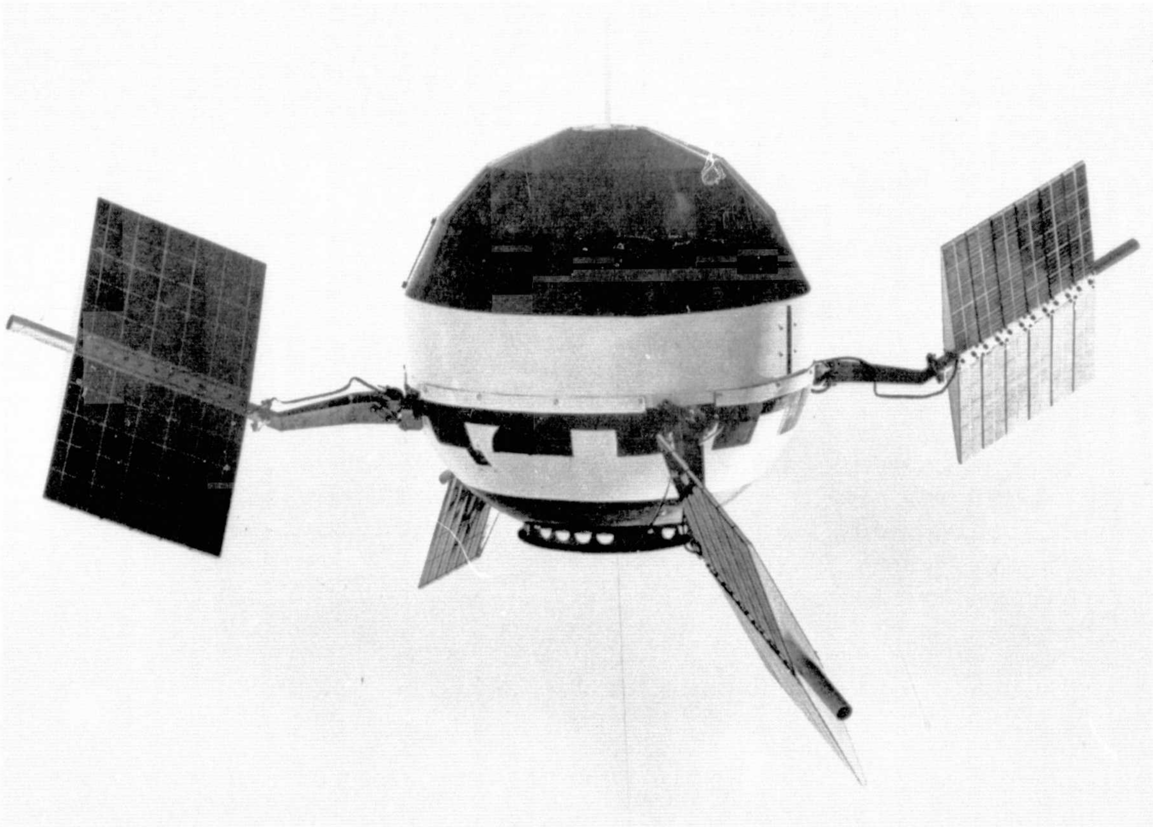
Coleman, P.J. et al: Some Preliminary Results of the Pioneer V Magnetometer Experiment, *J. Geophys. Res.*, *65*, 1960.

Judge, D.L., McLeod, M.G., and Sims, A.R.: The Pioneer 1, Explorer 6, and Pioneer 5 High Sensitivity Transistorized Search Coil Magnetometer, *IRE Trans.*, *SET-6*, 114, Sept. 1960.

PIONEER V (Continued)

Mueller, G.E.: Pioneer V and Explorer VI, Systems Engineered Space Probes, in *Proceedings of the XIth International Astronautical Congress*, C.W.P. Reutersward, ed., Springer-Verlag, Vienna, 1961, p. 256.

Rosen, A. et al: Explorer VI and Pioneer V Data, *NASA CR-3* and *NASA CR-4*, 1963.



TIROS I — 1960 Beta 2

April 1, 1960	Thor-Able/ETR	99.1 min.
June 16, 1960	270 lb	428.7/465.9 miles
In orbit	W.G. Stroud	H.I. Butler

Objectives: To test experimental television techniques leading to eventual worldwide meteorological information system.

Instrument/Discipline	Experimenter/Affiliation
TV camera systems (2)	-----

Remarks: Provided first global cloud cover photographs (22,952 total) from near circular orbit.

Selected References:

Bartko, F. et al: The Tiros Low Resolution Radiometer, *NASA TN-D-614*, 1964

Fritz, S.: Pictures from Meteorological Satellites and Their Interpretation, *Space Sci. Rev.*, *3*,541, Nov. 1964.

Hanel, R.A. and Wark, D.Q.: Infrared Imaging from Satellites, *J. SMPTE*, *69*, 25, Jan. 1960.

Hanel, R.A.: Low Resolution Radiometer, *ARS J.*, *31*, 246, Feb. 1961.

NASA: Final Report on the Tiros I Meteorological Satellite System, *NASA TR-R-131*, 246, Feb. 1962.

Nordberg, W.: Research with Tiros Radiation Measurements, *Astronautics and Aerospace Eng.*, *1*, 76, April 1963.

Rasool, S.I.: Global Distribution of the Net Energy Balance of the Atmosphere from Tiros Radiation Data, *Science*, *143*, 567, Feb. 7, 1964.

TIROS I (Continued)

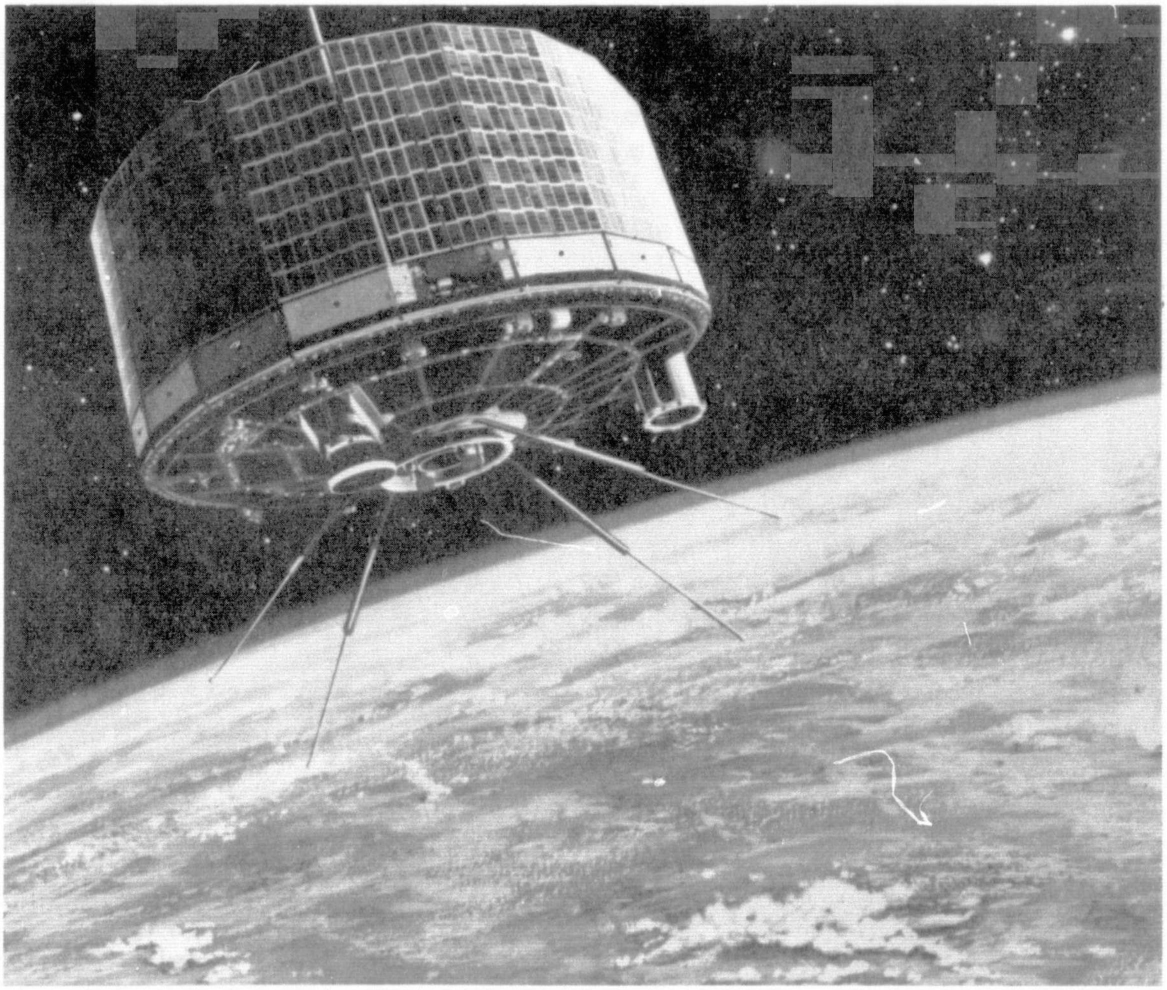
Schnapf, A.: Tiros I, II, and III, Design and Performance, *IAS Paper 62-79*, 1962.

Sternberg, S.: TIROS---Meteorological Satellite, *Astronautics, 5*, 32, June 1960 (whole issue on Tiros).

Sternberg, S.: Performance and Evaluation of Satellites TIROS I and TIROS II, *ARS J., 31*, 1495, Nov. 1961.

Wexler, H.: Tiros Experiment Results, *Space Sci. Rev., 1*, 7, 1962.

Wexler, H.: Interpretation of Cloud Pictures from Tiros I Satellite, in *Space Research II*, H.C. van de Hulst, C. de Jager, A.F. Moore, eds., Interscience Publishers, New York, 1961, p. 645.



ECHO I		1960 Iota 1

August 12, 1960	Delta/ETR	118.3 min.
Passive	124 lb	945/1049 miles
May 24, 1968	R. J. Mackey	---

Objectives: To place 100-foot inflatable sphere into orbit; measure reflective characteristics of sphere; study effects of space environment; radio propagation experiments.

Instrument/Discipline	Experimenter/Affiliation
Passive communication satellite	---

Remarks: Demonstrated use of radio reflector for global communications; numerous successful transmissions. Visible to the naked eye. Orbit characteristics perturbed by solar pressure due to high area-to-mass ratio.

Selected References:

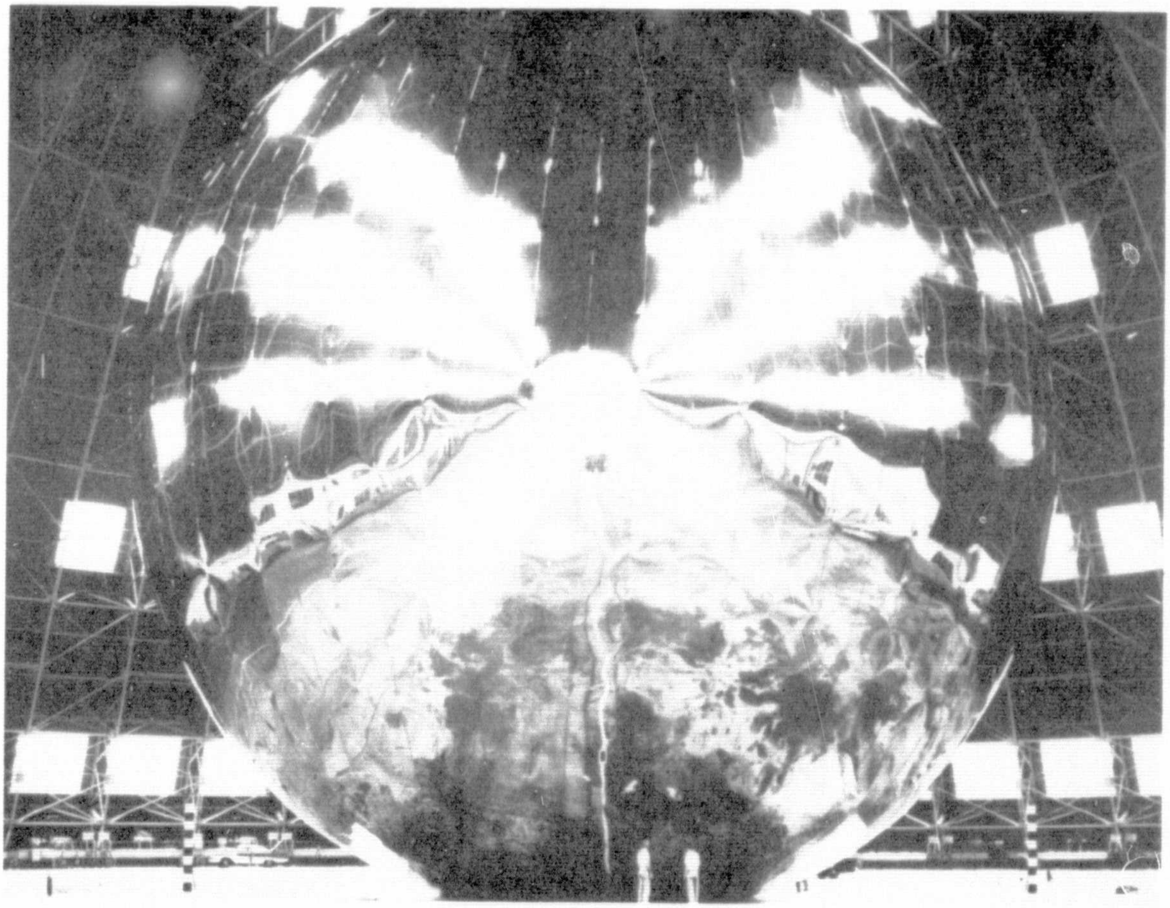
Anonymous: Echo I, *IGY Bull.*, no. 39, 13, Sept. 1960.

Jaffe, L.: Project Echo Results, *Astronautics*, *6*, 32, May 1961.

Jakes, W.C., ed.: Project Echo, *Bell Lab. Rec.*, *39*, 306, Sept. 1961.

Jones, H.M.: Solar Radiation Pressure Effects, Gas Leakage Rates, and Air Densities Inferred from the Orbit of Echo I, in *Space Research II*, H.C. van de Hulst, C. de Jager, A.F. Moore, eds., Interscience Publishers, New York, 1961, p. 339.

ECHO I (Continued)



EXPLORER VIII | 1960 Xi 1

Nov. 3, 1960	Juno II/ETR	112.7 min.
Dec. 28, 1960	90 lb	258/1423 miles
In orbit	R.E. Bourdeau	R.E. Bourdeau

Objectives: To investigate the ionosphere by direct measurement of positive ion and electron composition; collect data on the frequency, momentum, and energy of micrometeoroid impacts; establish the altitude of the base of the exosphere.

Instrument/Discipline	Experimenter/Affiliation
RF impedance probe-I	J.A. Kane/GSFC
Ion traps-I	R. Bourdeau/GSFC
	G. Serbu
	E. Whipple
	J. Donley
Langmuir probe-I	R. Bourdeau/GSFC
	G. Serbu
	E. Whipple
	J. Donley
Rotating-shutter electric field meter-I	J. Donley/GSFC
Micrometeoroid detector-A	W.M. Alexander/GSFC
	C. McCracken
	O. Berg
Micrometeoroid microphone-A	W. M. Alexander/GSFC
	C. McCracken

Remarks: The micrometeoroid influx rate was measured. A layer of helium was discovered in upper atmosphere.

Selected References:

Bourdeau, R.E.: Ionosphere Direct Measurements Satellite, *IGY Bull.*, no. 42, 10, Dec. 1960

Bourdeau, R.E.: Measurements of Sheath Currents and Equilibrium Potential on the Explorer VIII Satellite, *J. Astronautical Sci.*, *8*, 65, 1961.

Bourdeau, R.E. and Donley, J.L.: Explorer VIII Satellite Measurements in the Upper Ionosphere, *NASA TN-D-2150*, 1964.

Bourdeau, R.E., Donley, J.L., and Whipple, E.C.: Instrumentation of the Direct Measurements Satellite (Explorer VIII) *NASA TN-D-414*, 1962.

EXPLORER VIII (Continued)

Bourdeau, R.E. et al: Experimental Evidence for the Presence of Helium Ions Based on Explorer VIII Satellite Data, *J. Geophys. Res., 67*, 467, Feb. 1962.

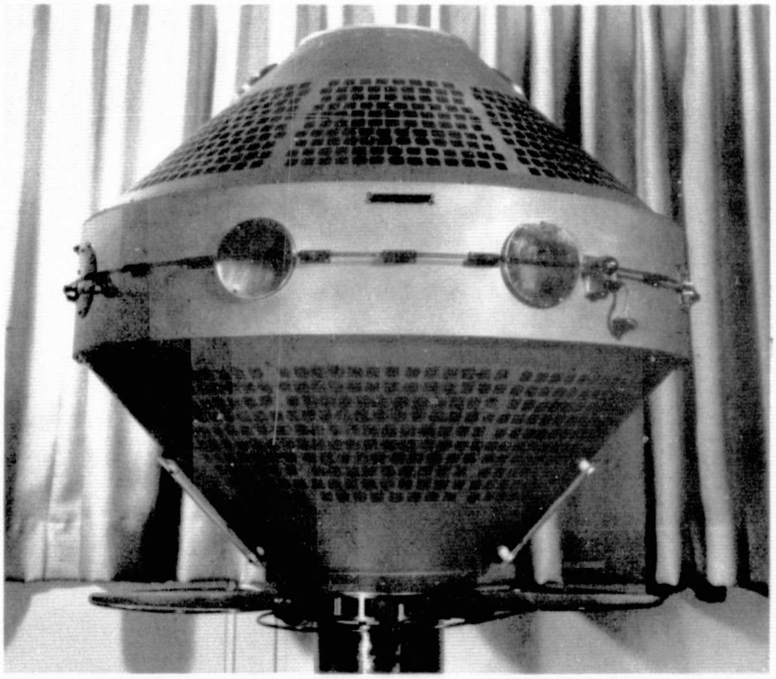
Bourdeau, R.E. and Bauer, S.J.: Structure of the Upper Atmosphere Deduced from Charged Particle Measurements on Rockets and the Explorer VIII Satellite, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 173.

D'Aiutolo, C.T.: Review of Micrometeroid Environment Based on Results from Explorer VIII and Explorer XVI Satellites, in *Space Research IV*, P. Muller, ed., Interscience Publishers, New York, 1964, p. 858.

Flatley, T.W. and Evans, H.E.: The Development of the Electric Field Meter for the Explorer VIII Satellite (1960), *NASA TN-D-1044*, 1962.

McCracken, C.W. and Alexander, W.M.: The Distribution of Small Interplanetary Dust Particles in the Vicinity of the Earth, *NASA TN-D-1349*, 1962

Serbu, G.P., Bourdeau, R.E., and Donley, J.L.: Electron Temperatures on the Explorer VIII Satellite, *J. Geophys. Res., 66*, 4313, Dec. 1961.



TIROS II 1960 Pi 1

Nov. 23, 1960	Delta/ETR	98.2 min.
Dec. 4, 1961	277 lb	406/431 miles
In orbit	R. A. Stampfl	---

Objectives: To test experimental television techniques and infrared equipment leading to eventual worldwide meteorological information system.

Instrument/Discipline	Experimenter/Affiliation
Two TV camera systems	W. Nordberg/GSFC
Widefield radiometer	R. Hanel/GSFC
Scanning radiometer	---

Remarks: Orbit achieved. Narrow-angle camera and IR instrumentation sent good data. Transmitted 36,156 pictures.

Selected References:

Anonymous: The Tiros II Cloud-Cover and Infrared Satellite, *IGY Bull.*, no. 43, 9, Jan. 1961.

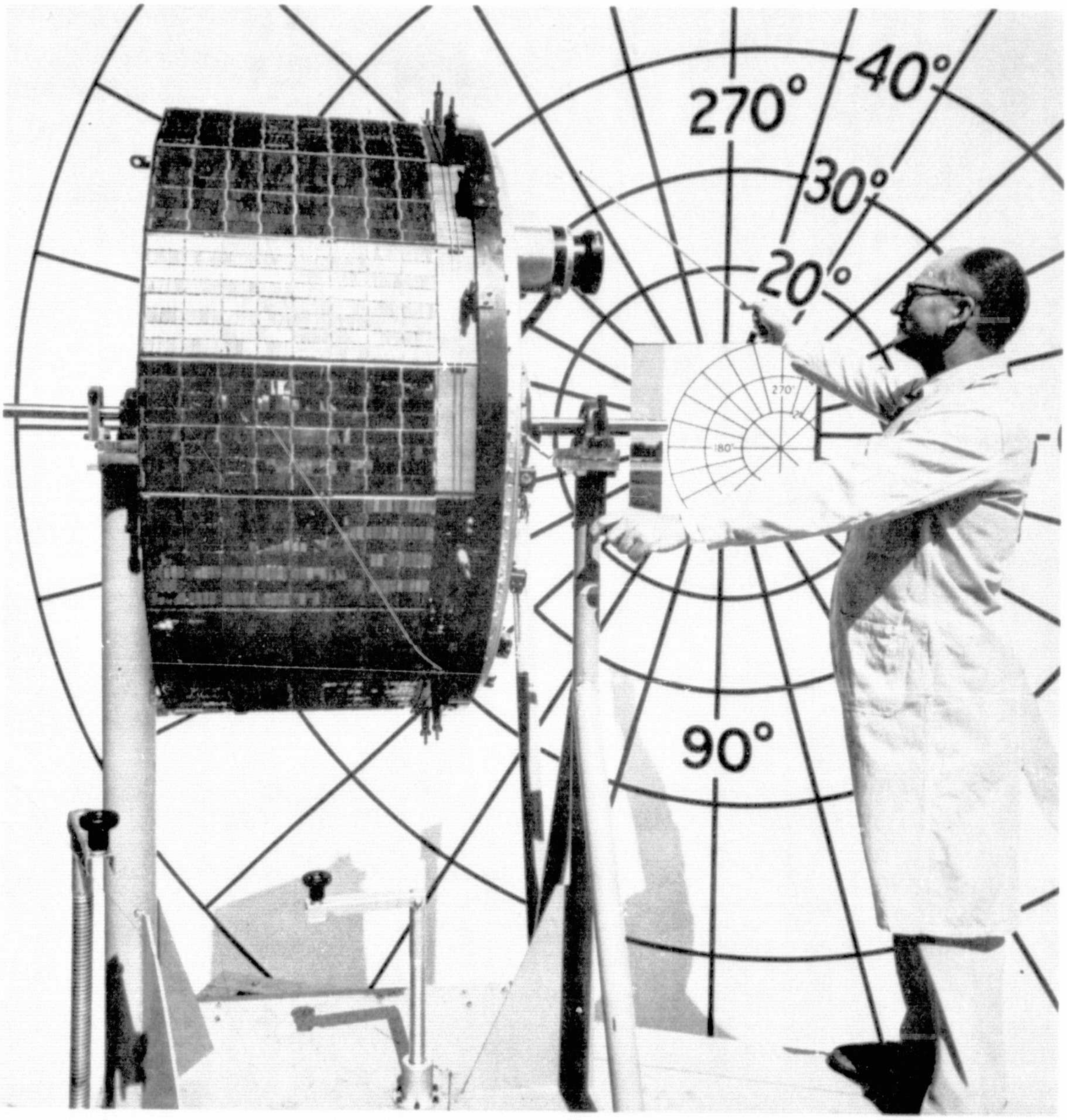
Astheimer, R.W., DeWaard, R., and Jackson, E.A.: Infrared Radiometer Instruments on Tiros II, *J. Opt. Soc. Amer.*, *51*, 1386, Dec. 1961.

Bandeen, W.R. et al: Infrared Reflected Solar Radiation Measurements from the Tiros II Meteorological Satellite, *J. Geophys. Res.*, *66*, 3169, Oct. 1961.

Hanel, R.A.: The Tiros II Radiation Experiment, in *Space Research II*, H.C. van de Hulst, C. de Jager, and A.F. Moore, eds., Interscience Publishers, New York, 1961, p. 652.

See also: References under Tiros I.

TIROS II (Continued)



EXPLORER IX — 1961 Delta 1

Feb. 16, 1961	Scout/Wallops Is.	118.3 min.
Passive	80 lb	395/1605 miles
April 9, 1964	---	---

Objectives: To study performance, structural integrity, and environmental conditions of Scout research vehicle and guidance control system. Inject inflatable sphere into Earth orbit to determine density of atmosphere. (Joint project with Langley Research Center).

Instrument/Discipline	Experimenter/Affiliation
None	---

Remarks: Balloon and fourth stage achieved orbit. Transmitter on balloon failed to function properly, requiring optical tracking of balloon.

Selected References:

Anonymous: The Explorer IX Atmospheric-Density Satellite, *IGY Bull.*, no. 46, 12, April 1961.

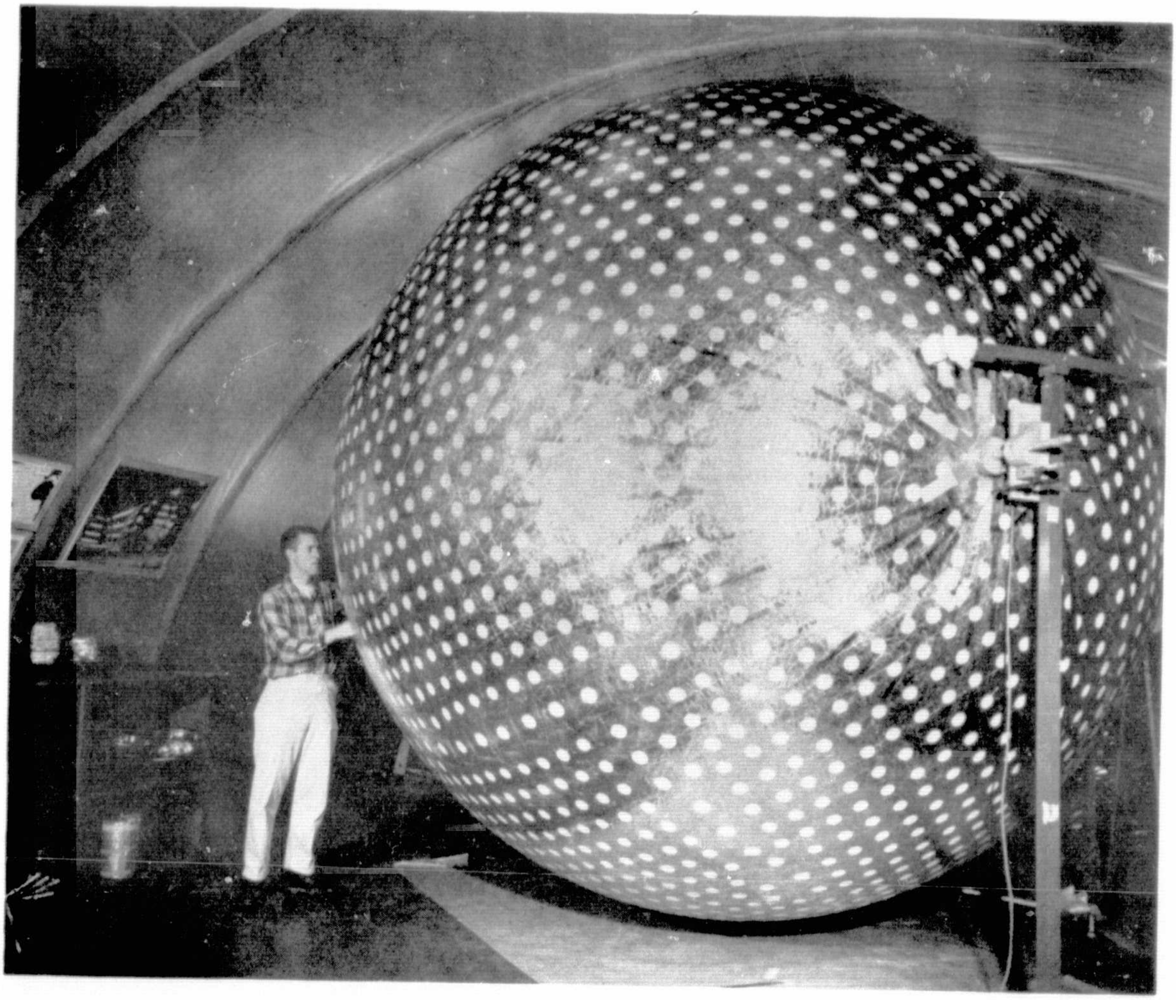
Coffee, C.W., Bressette, W.E., and Keating, G.M.: Design of the NASA Lightweight Inflatable Satellites for the Determination of Atmospheric Density at Extreme Altitudes, *NASA TN-D-1243*, 1962.

Keating, G.M. et al: Determination of Mean Atmospheric Densities from the Explorer IX Satellite, *NASA TN-D-2895*, 1965.

O'Sullivan, W.J., Coffee, C.W., and Keating, G.M.: Air Density Measurements from the Explorer IX Satellite, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 89.

Woerner, C.V. and Coffee, C.W.: Comparison of Ground Tests and Orbital Launch Results for the Explorer IX and Explorer XIX Satellites, *NASA TN-D-2466*, 1964.

EXPLORER IX (Continued)



EXPLORER X 1961 Kappa 1

March 25, 1961	Delta/ETR	112 hr.
March 27, 1961	79 lb	100/186,000 mi.
June 1968	J. P. Heppner	J. P. Heppner

Objectives: To gather information on terrestrial and interplanetary magnetic fields and the way these fields affect and are affected by solar plasma.

Instrument/Discipline	Experimenter/Affiliation
Rubidium-vapor and flux-gate magnetometers-E	J. P. Heppner/GSFC T. L. Skillman C. S. Scearce
Plasma probe-E	H. Bridge/MIT F. Scherb B. Rossi

Remarks: Probe transmitted valuable data continuously for 52 hours as planned. Demonstrated the existence of a geomagnetic cavity in the solar wind and the existence of solar proton streams transporting solar interplanetary magnetic fields past the Earth's orbit.

Selected References:

Anonymous: Explorer X, Magnetic-Field and Plasma-Probe Satellite, *IGY Bull.*, no.48, 1, June 1961.

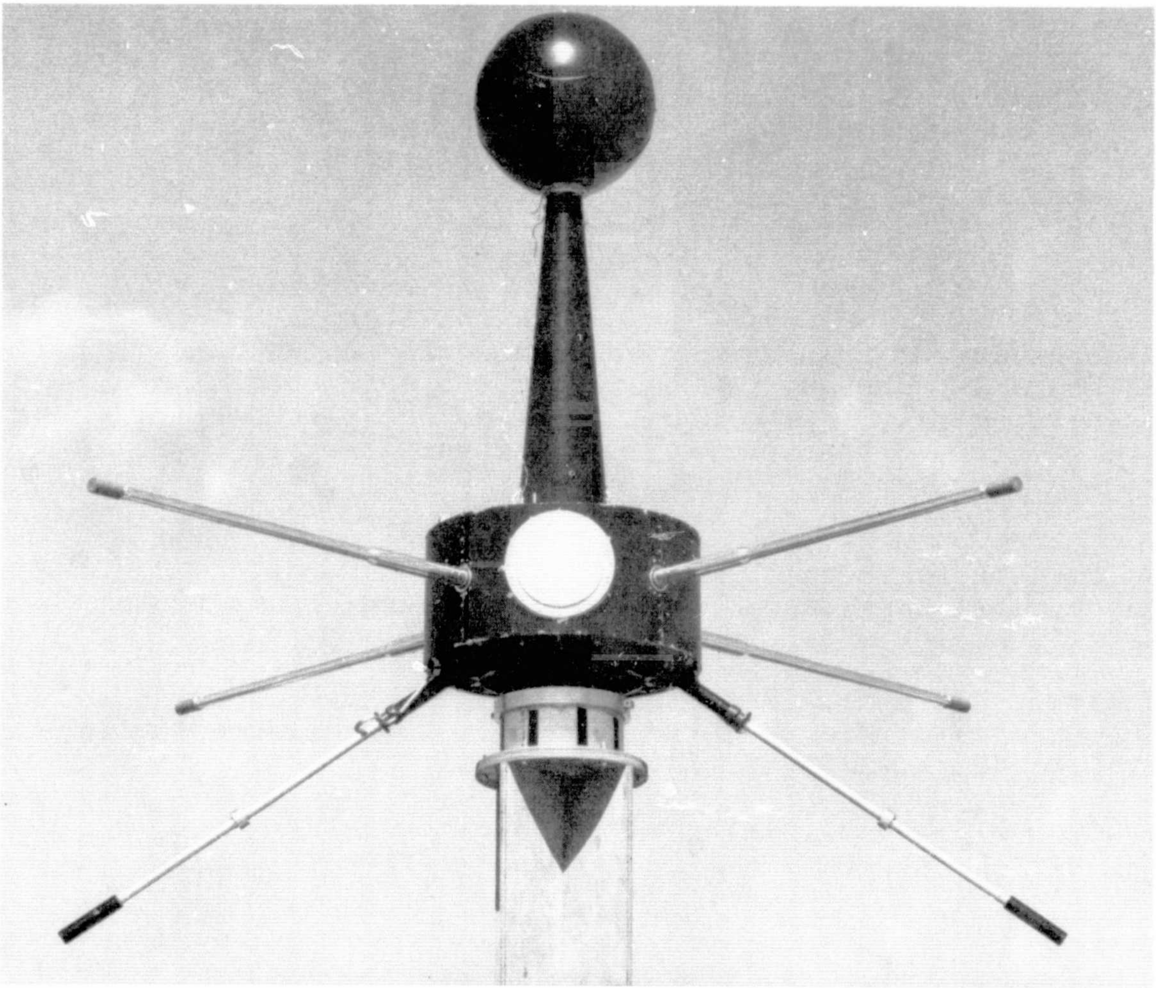
Bonetti, A. et al: Explorer X Plasma Measurements, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 540.

Bridge, H.S. et al: Plasma Probe Instrumentation on Explorer X, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 1113.

EXPLORER X (Continued)

Heppner, J.P. et al: Explorer X Magnetic Field Results, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 553.

Scherb, F.: Velocity Distributions of the Interplanetary Plasma Detected by Explorer 10, in *Space Research IV*, P. Muller, ed., Interscience Publishers, New York, 1964, p. 797.



EXPLORER XI — 1961 Nu 1

April 27, 1961	Juno II/ETR	108.1 min.
Dec. 6, 1961	82 lb	308/1113.2 mi.
In orbit	J. Kupperian, Jr.	J. Kupperian, Jr.

Objectives: To orbit a gamma-ray astronomy telescope satellite to detect high-energy gamma rays from cosmic sources and map their distribution in the sky.

Instrument/Discipline	Experimenter/Affiliation
Gamma-ray telescope-A	W. Kraushaar/MIT G. Clark

Remarks: Detected first gamma rays from space. Directional flux obtained. Disproved one part of "steady state" evolution theory.

Selected References:

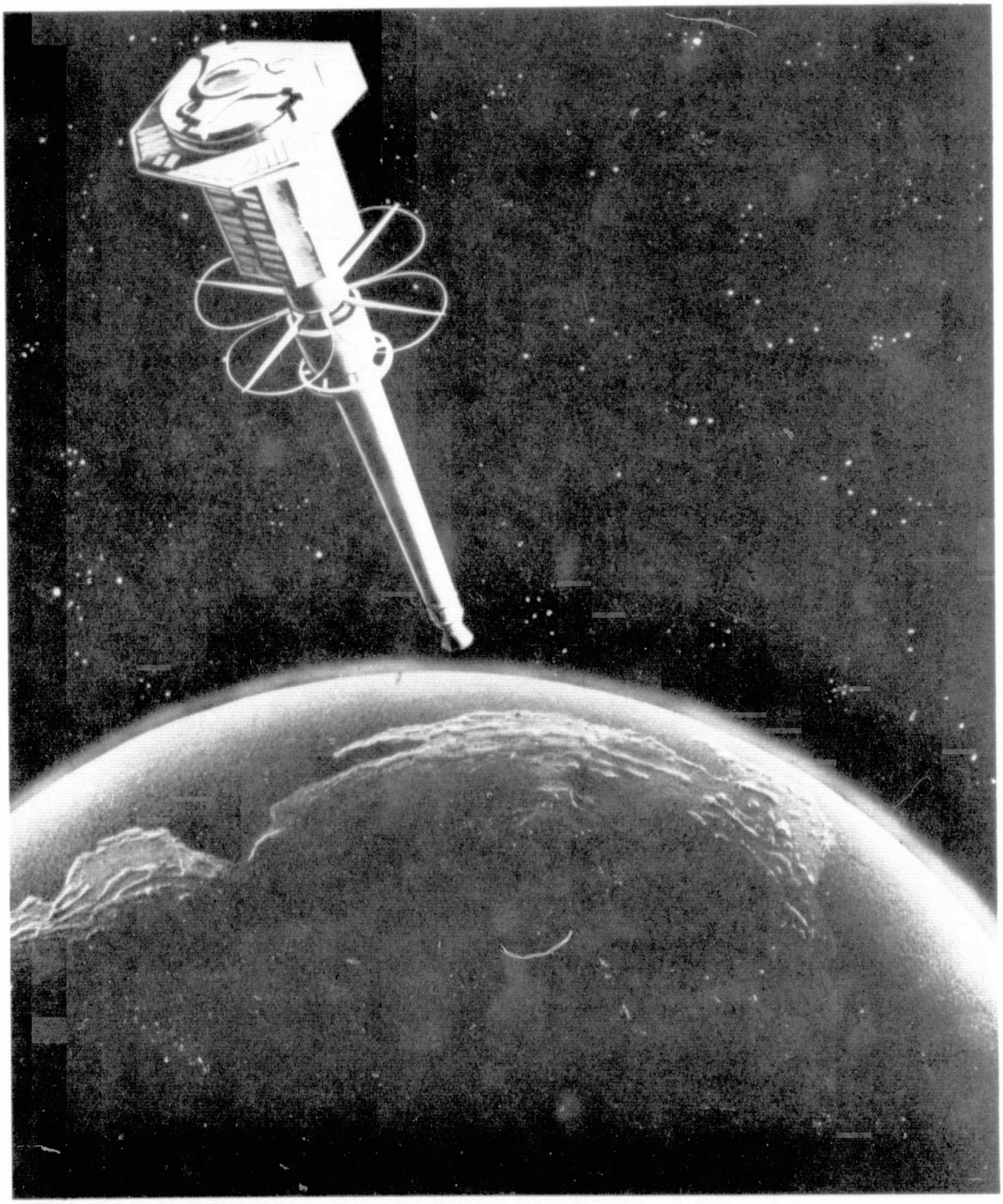
Anonymous: Explorer XI Gamma-Ray Satellite, *IGY Bull.*, no. 50, 10, Aug. 1961.

Clark, G.W. and Kraushaar, W.L.: Results on Gamma-Ray Astronomy from Explorer XI, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 1087.

Kraushaar, W.L. and Clark, G.W.: Search for Primary Cosmic Gamma Rays with the Satellite Explorer XI, *Phys. Rev. Ltrs.*, *8*, 106, 1962.

Kraushaar, W. et al: Explorer XI Experiment on Cosmic Rays, *Astrophys. J.*, *141*, 845, April 1, 1965.

EXPLORER XI (Continued)



TIROS III | 1961 Rho 1

July 12, 1961	Delta/ETR	100.4 min.
Feb. 27, 1962	285 lb	461.02/506.44 mi.
In orbit	R. Rados	---

Objectives: To develop satellite weather observation system; obtain photos of Earth's cloud-cover for weather analysis; determine amount of solar energy absorbed, reflected, and emitted by the Earth.

Instrument/Discipline	Experimenter/Affiliation
Omnidirectional radiometer	V. Suomi/U. Wisconsin
Widefield radiometer	R. Hanel/GSFC
Scanning radiometer	W. Nordberg/GSFC
Two TV cameras	--

Remarks: Cameras and IR instrumentation transmitted good data. Transmitted 35,033 pictures.

Selected References:

Arking, A.: Lattitudinal Distribution of Cloud Cover from Tiros III Photographs, *Science, 143,* 569, Feb. 7, 1964.

See also: References under Tiros I.

TIROS III (Continued)

EXPLORER XII | | 1961 Upsilon 1

Aug. 16, 1961	Delta/ETR	26.4 hr.
Dec. 6, 1961	83 lb	180/47,800 miles
Sept. 1963	P. Butler	F.B. McDonald

Objectives: To investigate solar wind, interplanetary magnetic fields, distant portions of Earth's magnetic field, energetic particles in interplanetary space and in the Van Allen belt. (An Energetic Particles Explorer [EPE])

Instrument/Discipline	Experimenter/Affiliation
Proton analyzer-E	M. Bader/ARC
Fluxgate magnetometer	L. Cahill/U. New Hampshire
Various cosmic-ray instruments-E	B.J. O'Brien/St. U. of Iowa
Geiger and scintillation counters	F.B. McDonald/GSFC
Ion-electron detector-I	L. Davis/GSFC

Remarks: All instrumentation operated normally. Ceased transmitting on Dec. 6, 1961, after sending 2568 hours of real-time data. Provided significant geophysical data on radiation and magnetic fields.

Selected References:

Anonymous: Energetic-Particles Satellite: Explorer XII, *IGY Bull.*, no. 53, Nov. 1961.

Bader, M.: Preliminary Explorer XII Data on Protons Below 20 kev, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 358.

Bryant, D.A. et al: Explorer XII Observations of Solar Cosmic Rays and Energetic Storm Particles Following the Solar Flare of 28 September 1961, *J. Geophys. Res.*, *67*, 4983, Dec. 1962.

Bryant, D.A. et al: Cosmic Ray Observations in Space, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 376.

Cahill, L.J.: A Study of the Outer Magnetic Field, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 324.

EXPLORER XII (Continued)

Davis, L.R. and Williamson, J.M.: Low-Energy Trapped Proteons, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 365.

Desai, U.D., Van Allen, R.L., and Porreca, G.: Explorer XII Satellite Instrumentation for the Study of the Energy Spectrum of Cosmic Rays, *NASA TN-D-1698*, 1963.

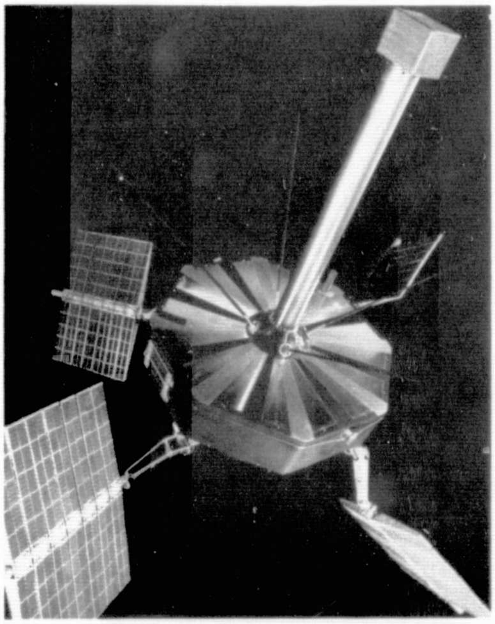
Hoffman, R.A., Davis, L.R., and Williamson, J.M.: Protons of 0.1 Mev and Electrons of 20 kev at 12 Earth Radii During Sudden Commencement on September 30, 1961, *J. Geophys. Res.*, *67*, 5001, Dec. 1962.

Mead, G.D. and Cahill, L.J., Jr.: Explorer 12 Measurements of the Distortion of the Geomagnetic Field by the Solar Wind, *NASA TM-X-55622*, 1966.

Nishida, A. and Young, J.H.: Explorer XII Observations of Magnetic Sudden Impulses on the Earth's Magnetosphere, *NASA CR-53231*, 1964.

O'Brien, B.J.: Absolute Electron Intensities in the Heart of the Earth's Outer Radiation Zone, *J. Geophys. Res.*, *67*, 397, Jan. 1962.

Patel, V.L.: Low Frequency Hydromagnetic Waves in the Magnetosphere: Explorer XII, *Planetary and Space Sci.*, *13*, 485, June 1965.



EXPLORER XIII — 1961 Chi 1

Aug. 25, 1961	Scout/Wallops Is.	97.5 min.
Aug. 28, 1961	187 lb	74/722 miles
Aug. 28, 1961	C.T. D'Aiutolo	----

Objectives: To test performance of the vehicle and guidance; to investigate nature and effects on space flight of micrometeoroids. (Joint project with Langley Research Center).

Instrument/Discipline	Experimenter/Affiliation
Cadmium sulphide cell detector-A	M.W. Alexander/GSFC L. Secretan
Wire grid detector-A	L. Secretan/GSFC
Piezoelectric detectors-A	A.G. Beswick/LERC
Pressurized-cell detectors-A	C.A. Gurtler/LERC
Foil-type detectors-A	E. Davison/LERC

Remarks: Orbit lower than planned. Reentered August 28, 1961. No significant data.

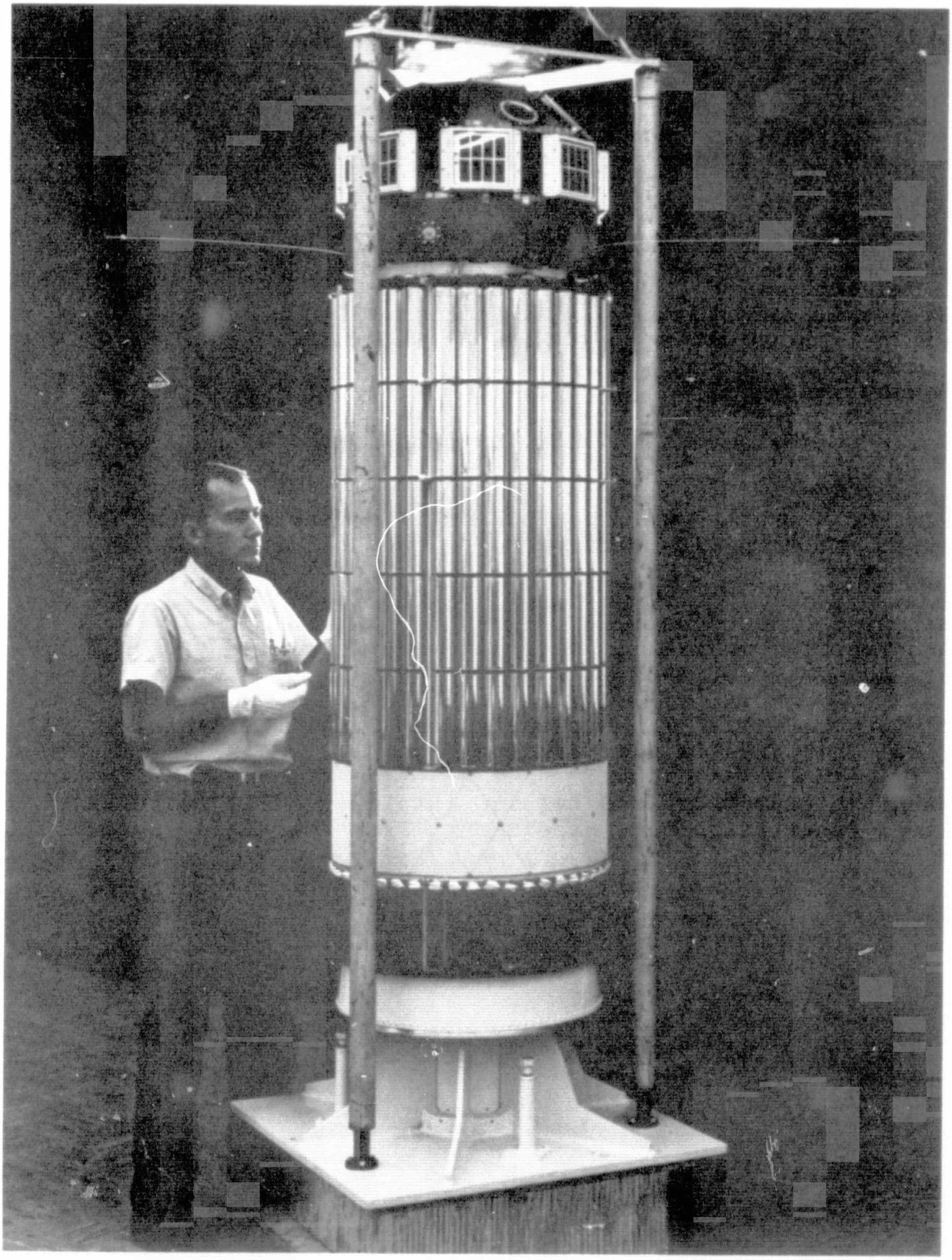
Selected References:

Anonymous: Explorer 13 Micrometeroid Satellite, *IGY Bull., no. 50, 14, Oct. 1961.*

D'Aiutolo, C.T.: The Micrometeoroid Satellite Explorer XIII (1961 Chi), *NASA TN-D-2468*, 1964.

NASA: Micrometeoroid Satellite (Explorer XIII) Stainless-Steel Penetration Rate Experiment, *NASA TN-D-1986*, 1963.

EXPLORER XIII (Continued)



P-21 ELECTRON DENSITY PROFILE PROBE None

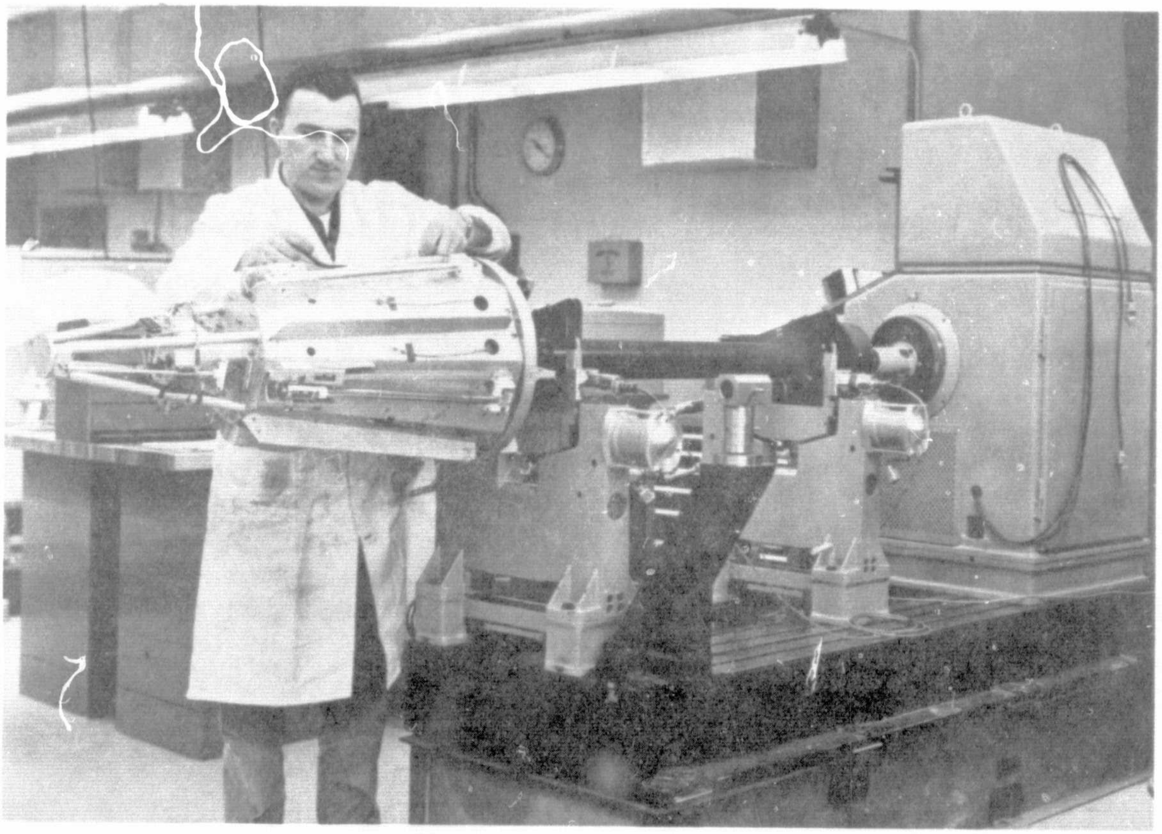
Oct. 19, 1961	Scout/Wallops Is.	---
Oct. 19, 1961	94 lb	---
Suborbital	J. E. Jackson	S. J. Bauer

Objectives: To measure electron densities and to investigate radio propagation at 12.3 and 73.6 MHz under daytime conditions.

Instrument/Discipline	Experimenter/Affiliation
RF probe-I	H. Whale/GSFC
CW propagation-I	G. H. Spaid/GSFC
	J. E. Jackson/GSFC

Remarks: Probe achieved altitude of 4261 miles and transmitted good data. Electron density was obtained to about 1500 miles, the first time such measurements had been taken at this altitude.

P-21 ELECTRON DENSITY PROFILE PROBE (Continued)



TIROS IV 1962 Beta 1

Feb. 8, 1962	Delta/ETR	100.4 min.
June 19, 1962	285 lb	471/525 miles
In orbit	R. Rados	---

Objectives: To develop principles of a weather satellite system; obtain cloud and radiation data for use in meteorology.

Instrument/Discipline	Experimenter/Affiliation
Omnidirectional radiometer-P	V. Suomi/U. Wisconsin
Widefield radiometer	R. Hanel/GSFC
Scanning radiometer	W. Nordberg/GSFC
Two TV camera systems	----

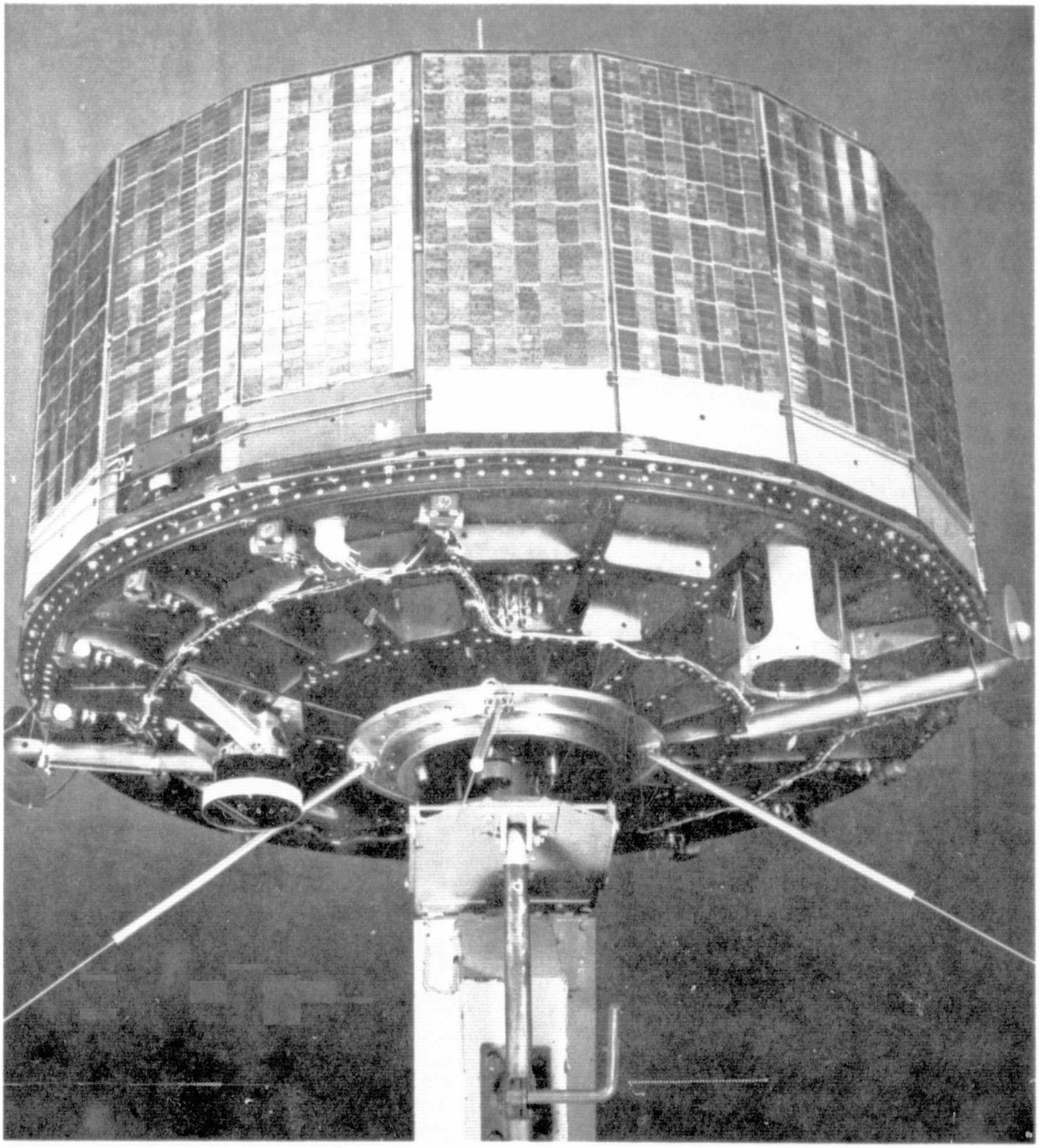
Remarks: All systems operated properly. Ice reconnaissance project established; supported Mercury, Ranger, Antarctic Resupply Joint Task Force 8. Returned 32,593 pictures.

Selected References:

NASA: Tiros IV Radiation Data Catalog and Users' Manual. *NASA TM-X-51826*, 1963.

See also: References under Tiros I.

TIROS IV (Continued)



ORBITING SOLAR OBSERVATORY I — 1962 Zeta 1

March 7, 1962	Delta/ETR	96.1 min.
Aug. 6, 1963	440 lb	343.5/369 miles
In orbit	J. C. Lindsay	J. C. Lindsay

Objectives: To measure solar electromagnetic radiation in the ultraviolet, X-ray, and gamma-ray regions; to investigate effect of dust particles on surfaces of spacecraft.

Instrument/Discipline	Experimenter/Affiliation
X-ray spectrometer-S	W. Behring/GSFC W. Neupert
Scintillators and ion chambers-S	K. Frost/GSFC W. White
Dust particle detectors-A	W. M. Alexander/GSFC C. McCracken
Ultraviolet monitors-S	W. White/GSFC K. Hallam
Gamma-ray scintillators-S	W. White/GSFC K. Frost
X-ray telescope and scintillator-S	J. R. Winckler/U. Minnesota L. Peterson
Solar gamma-ray telescope-S	M. Savedoff/U. Rochester G. Fazio
Neutron monitor-E	W. Hess/U. California
Scintillator-E	S. Bloom/U. California

Remarks: Orbit achieved. Experiments transmitted as programmed. Provided data on 75 solar flares.

Selected References:

Bartoe, O.E. et al: Design and Development of the Orbiting Solar Observatory (OSO), *Annals N.Y. Acad. Sci.*, *134*, 194, Nov. 22, 1965.

Behring, W.E., Neupert, W.M., and Lindsay, J.C.: Preliminary Solar Flare Observations with a Soft X-Ray Spectrometer on the Orbiting Solar Observatory, *NASA TN-D-2303*, 1964.

Dolder, F.P. et al: The Orbiting Solar Observatory Spacecraft, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 1207.

ORBITING SOLAR OBSERVATORY I (Continued)

Fazio, G.G. and Hafner, E.M.: The OSO 1 High-Energy Gamma-Ray Experiment, *J. Geophys. Res.*, *72*, 2452, May 1, 1967.

The OSO-1 Solar Neutron Experiment, *Solar Physics*, *2*, 202, Sept. 1967.

Hicks, D.B., Ried, L., and Peterson, L.E.: X-Ray Telescope for an Orbiting Solar Telescope, *Trans. IEEE*, *NS-12*, 54, Feb. 1965.

Lindsay, J.C.: Scientific Results of the First Orbiting Solar Observatory, *Trans. Amer. Geophys. Union*, *44*, 722, Sept. 1963.

Millard, J.P. and Neel, C.B.: Measurements of Albedo and Earth Radiation from OSO-1, *AIAA J.*, *3*, 1317, July 1965.

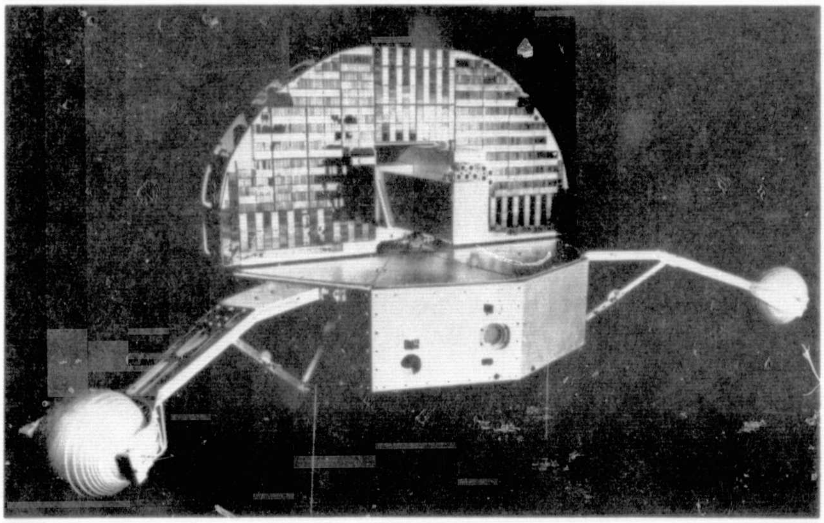
NASA: Orbiting Solar Observatory, *NASA SP-57*, 1965.

NASA: OSO Spacecraft Manual, *NASA TM-X-55616*, 1966.

Neupert, W.M. and Behring, W.E.: Solar Observations with a Soft X-Ray Spectrometer, *NASA TN-D-1466*, 1962.

Neupert, W.M., Behring, W.E., and Lindsay, J.C.: The Solar Spectrum from 50A to 400A, *NASA TN-D-2303*, 1964.

Peterson, L.E.: Upper Limits of the Cosmic-Ray Flux from OSO-1, in *Space Research VI*, R.L. Smith-Rose, ed., Spartan Books, Washington, 1966, p. 53.



P-21A ELECTRON DENSITY PROFILE PROBE None

March 29, 1962	Scout/Wallops Is.	---
March 29, 1962	94 lb	---
Suborbital	J. E. Jackson	S. J. Bauer

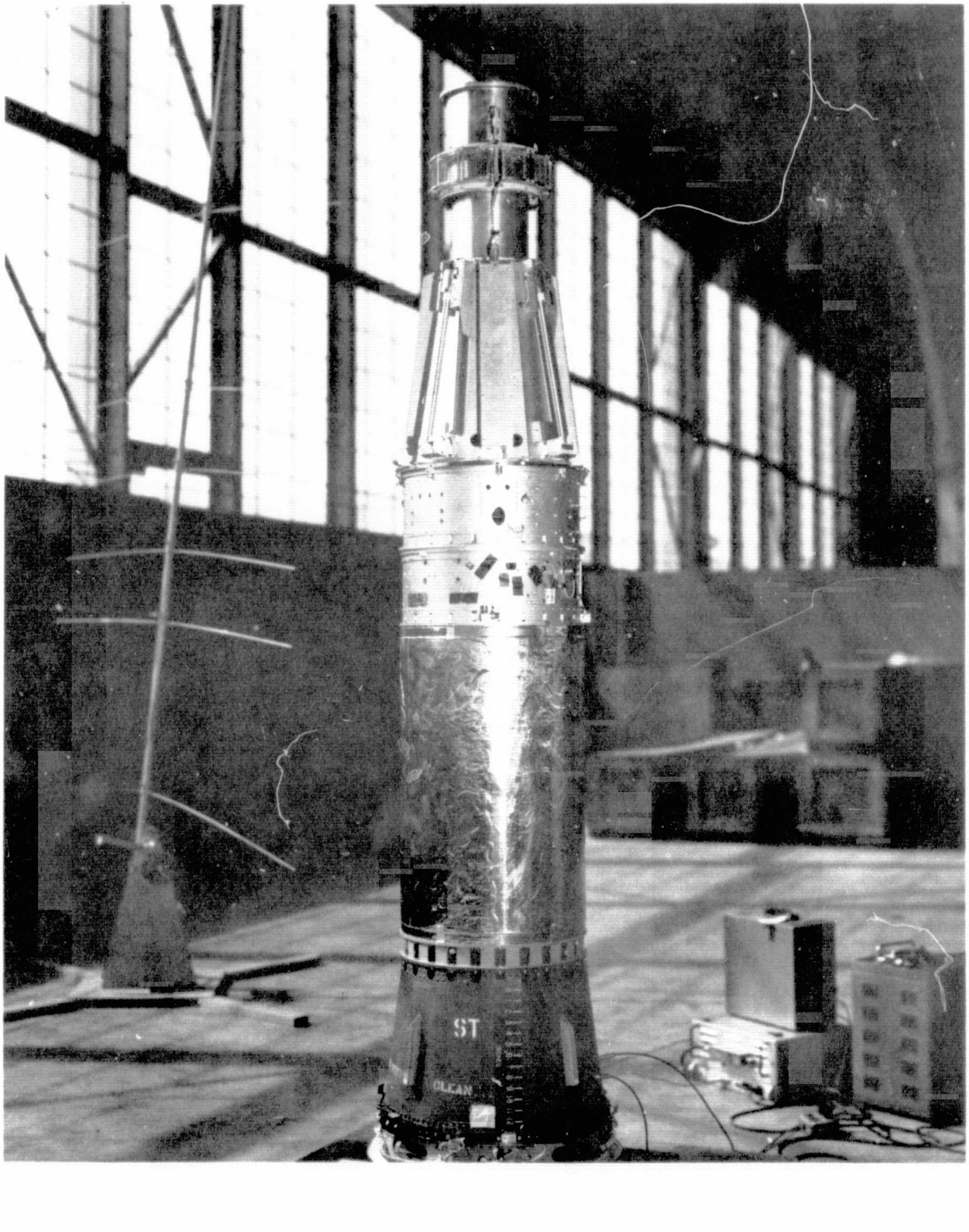
Objectives: To measure electron density profile, ion density, and intensity of ions in the atmosphere.

Instrument/Discipline	Experimenter/Affiliation
CW propagation-I	S. J. Bauer/GSFC
RF probe-I	H. White/GSFC
Ion traps-I	R. E. Bourdeau/GSFC
	E. Whipple
	J. Donley
	G. Serbu

Remarks: Probe achieved altitude of 3910 miles. Afforded nighttime observations. Determined that characteristics of the ionosphere differ drastically from daytime when the temperature of the ionosphere is much cooler.

Selected References:

P-21A ELECTRON DENSITY PROFILE PROBE (Continued)



ARIEL I 1962 Omicron 1

April 26, 1962	Delta/ETR	100.9 min.
Nov. 9, 1964	132 lb	242.1/754.2 miles
In orbit	R.C. Baumann	R.E. Bourdeau

Objectives: To study the relationships between ionosphere and cosmic rays.

Instrument/Discipline	Experimenter/Affiliation
Electron density sensor-I	J. Sayers/U. Birmingham (U.K.)
Langmuir probe-I	R.L.F. Boyd/U. College, London (U.K.)
Cosmic-ray Cerenkov counter-E	H. Elliot/Imperial College, London (U.K.)
Ion mass sphere-I	R.L.F. Boyd/U. College, London (U.K.)
Lyman-alpha ion chambers-S	R.L.F. Boyd/U. College, London (U.K.)
X-ray counters-S	R.L.F. Boyd/U. College, London (U.K.)

Remarks: First international satellite. Contained six British experiments. All experiments except Lyman-alpha transmitted as programmed. Tracking and data acquisition stopped on June 30, 1964. Restarted on Aug. 25, 1964 for a 2-month period. Good data were acquired from electron temperature gauge.

Selected References:

Baumann, R.C.: The Ariel I Satellite, *NASA GSFC X-673-63-75*, 1963.

Boyd, R.L.F. and Willmore, A.P.: A Method of Studying the Energy Distributions of Ionospheric Ions and Electrons, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 1168.

Elliot, H.: Cosmic Ray Measurements in the U.S./U.K. Satellite S-51, in *Cosmic Rays, Solar Particles, and Space Research*, B. Peters, ed., Academic Press, New York, 1963.

ARIEL I (Continued)

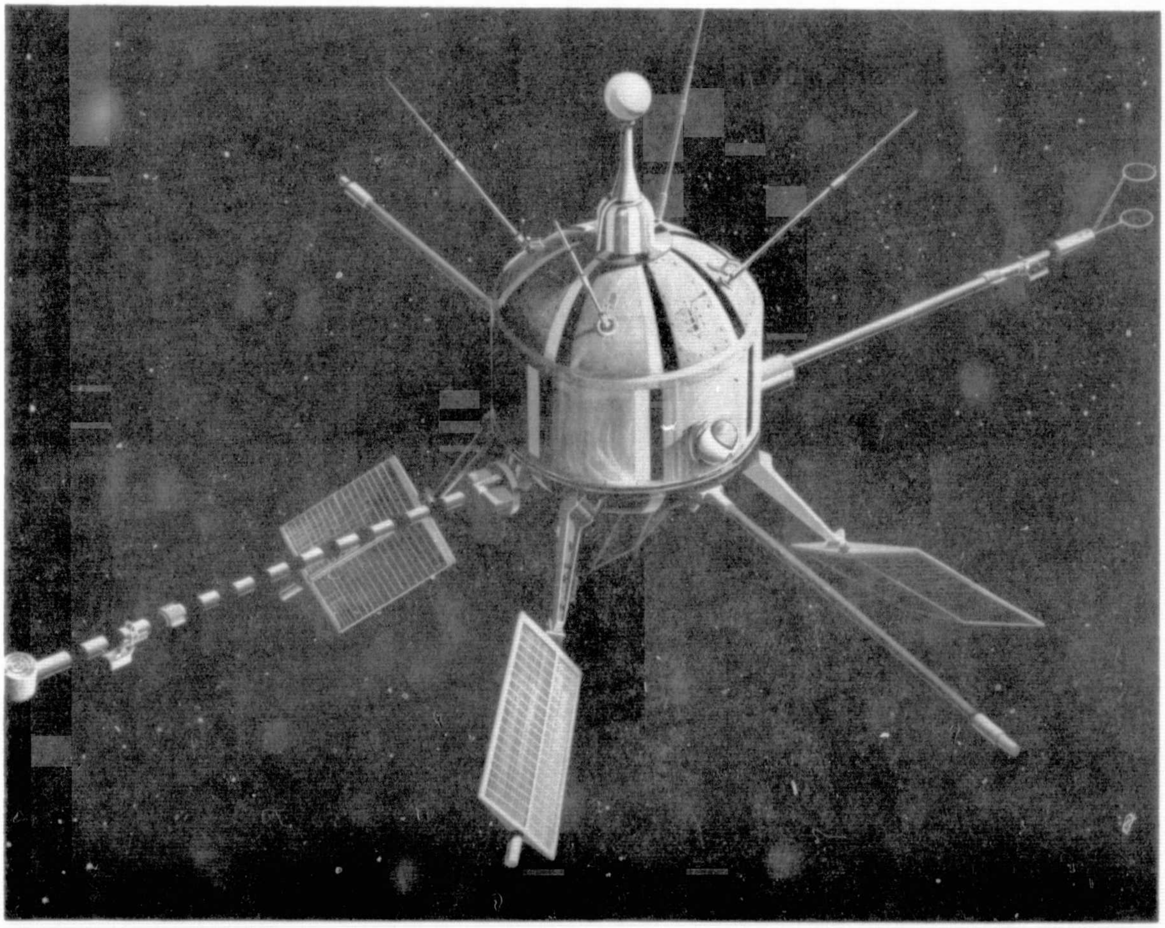
NASA: Ariel I, The First International Satellite, *NASA SP-43*, 1963.

NASA: Ariel I, The First International Satellite, Experimental Results, *NASA SP-119*, 1966.

Pounds, K.A. and Wilmore, A.P.: Instrumentation of Satellite UK 1 for Obtaining Low Resolution Solar X-Ray Spectra, in *Space Research III*, W. Priester, ed., Interscience Publishers, New York, 1963, p. 1195.

Robins, M.O.: The Ariel I Satellite Project and Some Scientific Results, *AIAA Paper 63-468*, 1963.

Stubbs, P.: The Changing Picture of the Ionosphere, *New Scientist, 15*, 94, July 12, 1962.



TIROS V		1962 Alpha Alpha 1
June 19, 1962	Delta/ETR	100.5 min.
May 14, 1963	285 lb	367/604 miles
In orbit	R. Rados	---

Objectives: To develop principles of a weather satellite system; obtain cloud-cover data for use in meteorology.

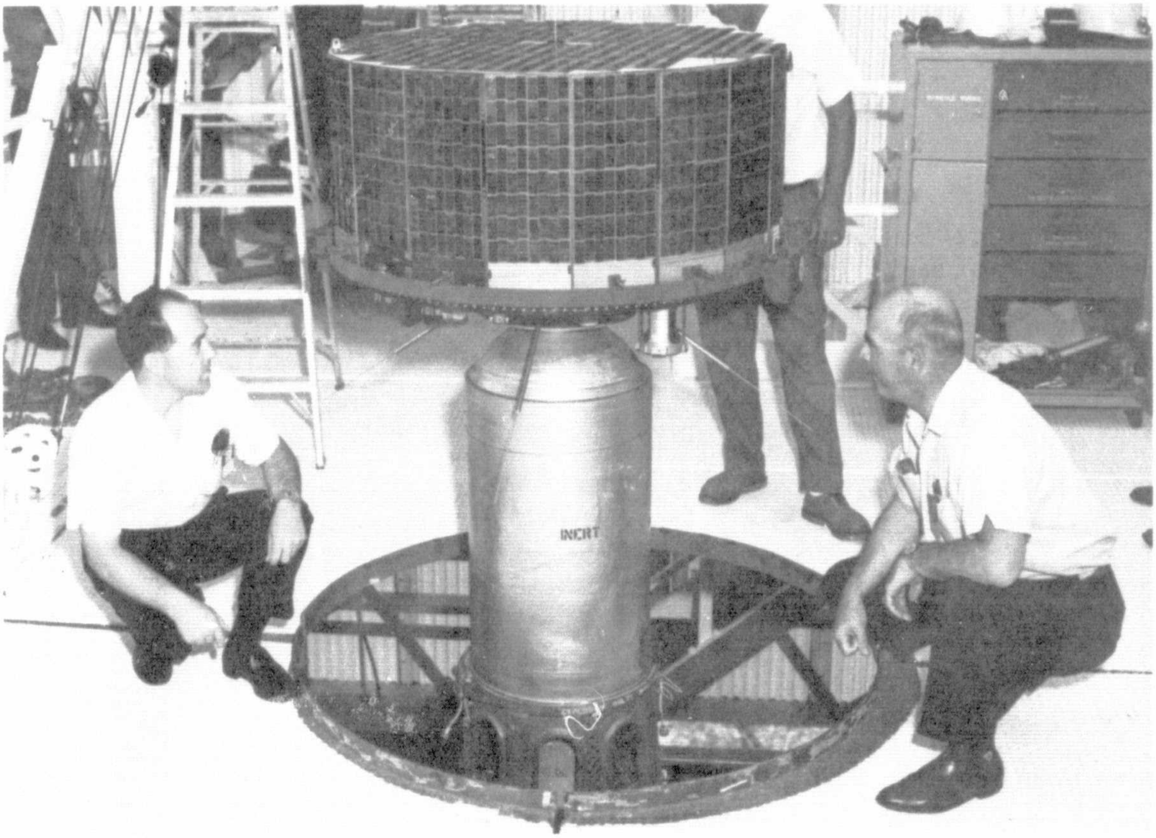
Instrument/Discipline	Experimenter/Affiliation
Two TV camera systems	---- GSFC

Remarks: Launched at a higher inclination (58°) than previous TIROS satellites to provide greater coverage. Time of launch chosen to include normal hurricane season for South Atlantic. One TV system transmitted good data for 10.5 months.

Selected References:

See: References under Tiros I.

TIROS V (Continued)



TELSTAR I — 1962 Alpha Epsilon 1

July 10, 1962	Delta/ETR	157.8 min.
Feb. 21, 1963	175 lb	592.6/3503.2 mi.
In orbit	C. P. Smith, Jr.	---

Objectives: Joint AT&T-NASA investigation of wideband satellite communications.

Instrument/Discipline	Experimenter/Affiliation
Electron and proton counters-E	W. Brown/BTL

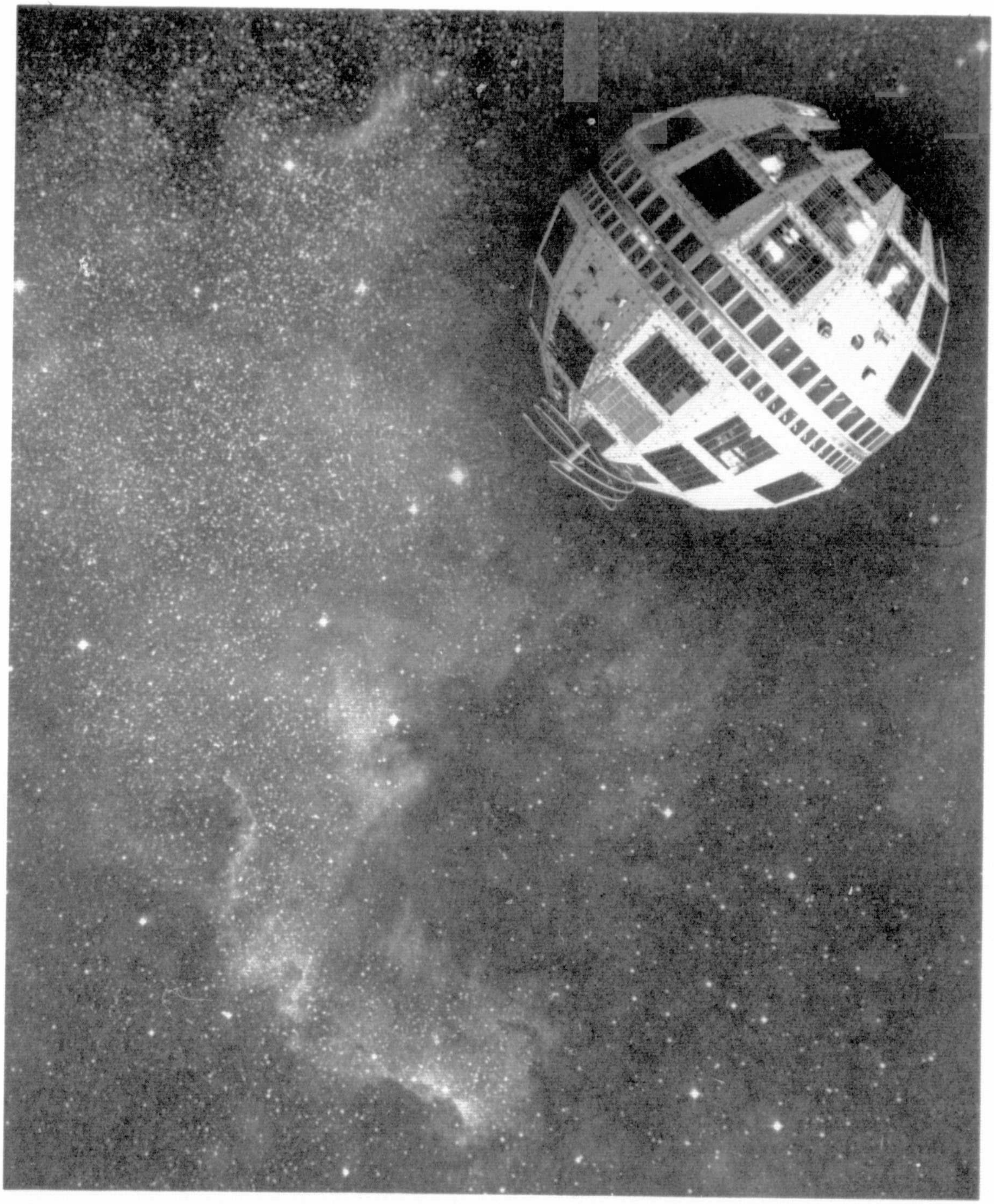
Remarks: Television and voice transmissions were made with complete success. Conducted more than 300 technical tests and over 400 demonstrations; 50 TV programs-5 in color. BTL provided spacecraft and ground-station facilities. Government was reimbursed for cost incurred.

Selected References:
Brown, W.L.: Studies of Trapped Radiation by the Telstar I and Explorer XV Satellites, in *Proceedings of the Space Plasma Science Symposium*, C.C. Chang and S.S. Huang, eds., D. Reidel Publishing Co., Dordrecht, 1965.

Buck, T.M., Wheatley, G.H., and Rodgers, J.W.: Silicon P-N Junction Radiation Detectors for the Telstar Satellite, *Trans. IEEE, NS-11*, 294, June 1964.

NASA: Telstar I, *SP-32*, 1963 (3 vols.).

TELSTAR I (Continued)



TIROS VI | 1962 Alpha Psi 1

Sept. 18, 1962	Delta/ETR	98.7 min.
Oct. 11, 1963	285 lb	425/442 miles
In orbit	R. Rados	---

Objectives: To develop principles of a weather satellite system; obtain cloud-cover data for use in meteorology.

Instrument/Discipline	Experimenter/Affiliation
Two TV camera systems	---

Remarks: Medium angle camera failed Dec. 1, 1962 after taking 1074 pictures. Other camera provided good data for 13 months after launch.

Selected References:

See: References under Tiros I.

TIROS VI (Continued)

ALOUETTE I 1962 Beta Alpha 1

Sept. 29, 1962	Thor-Agena/WTR	105.4 min.
Active	320 lb	620/638 miles
In orbit	J. E. Jackson	---

Objectives: To measure the electron density distribution in the ionosphere between the satellite height (620 miles) and the F2 peak (approx. 180 miles) and to study for a period of 1 year the variations of electron density distribution with time of day and with latitude under varying magnetic and auroral conditions with particular emphasis on high-latitude effects. To obtain galactic noise measurements, study the flux of energetic particles, and investigate whistlers.

Instrument/Discipline	Experimenter/Affiliation
Topside sounder-I	E. S. Warren/DRTE
	G. L. B. Nelms
	G. E. Lockwood
	E. L. Hagg
	L. E. Petrie
	D. B. Muldrew
	R. W. Knecht/CRPL/NBS
	T. W. Van Zandt
	W. Calvert
	J. W. King/DSIR/England
	S. J. Bauer/GSFC
	L. Blumle
	R. Fitzenreiter
	J. E. Jackson
Energetic particle counters-E	D. C. Rose/NRC
	I. B. McDiarmid/Canada
VLF receiver (whistler)-I	J. S. Belrose/DRTE
Cosmic noise receiver-A	T. R. Hartz/DRTE

Remarks: The Alouette satellite is a project of the Canadian Defence Research Board. This international project was a part of NASA's topside-sounder program and was the first NASA-launched satellite from WTR. Alouette was the first spacecraft designed and built by any country other than the U. S. and the USSR.

ALOUETTE I (Continued)

Selected References:
Benson, R.F.: An Analysis of Alouette 1 Plasma Resonance Observations, *NASA TM-X-63163*, 1968.

Bauer, S.J. and Krishnamurthy, B.V.: Behavior of the Topside Ionosphere During a Great Magnetic Storm, *NASA TM-X-63034*, 1967.

Chapman, J.H.: Alouette Topside Sounder Satellite: Experiments Data, and Results, *J. Spacecraft, 1*, 684, Nov. 1964.

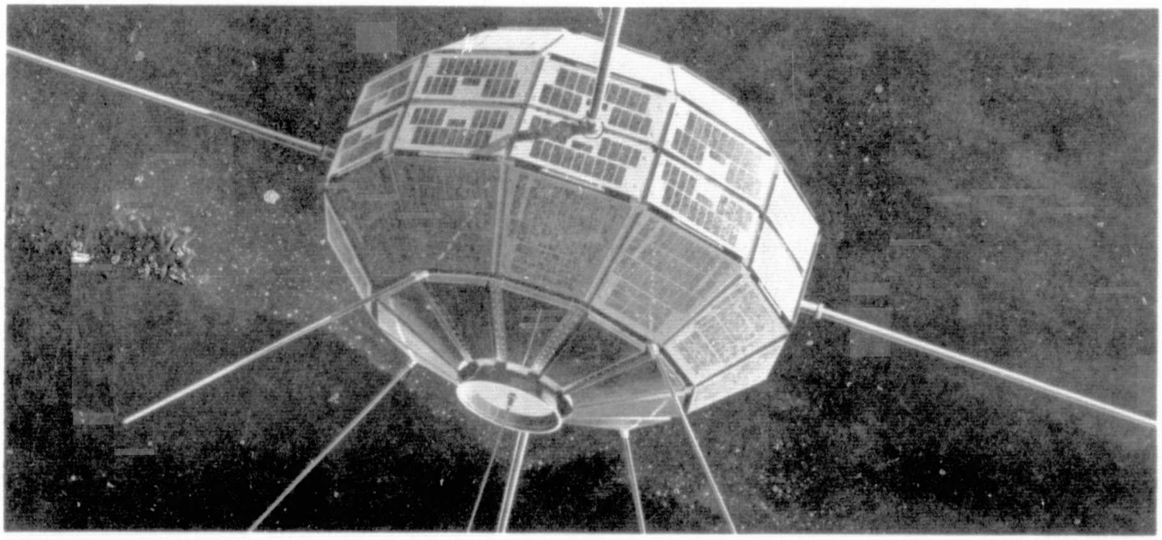
Jackson, J.E., Knecht, R.W., and Russell, S.: First Topside Soundings of the Ionosphere, *NASA TN-D-1538*, 1963.

Lockwood, G.E.K.: Plasma and Cyclotron Spike Phenomena Observed in Topside Ionograms, *Can. J. Phys., 41*, 190, Jan. 1963.

McDiarmid, I.B. et al: High Latitude Particle Flux Measurements from the Satellite 1962 Beta Alpha (Alouette), in *Space Research IV*, P. Muller, ed., Interscience Publishers, New York, 1964, p. 606.

Molozzi, A.R.: Instrumentation of the Topside Sounder Contained in the Satellite 1962 Beta Alpha (Alouette), in *Space Research IV*, P. Muller, ed., Interscience Publishers, New York, 1964, p. 413.

Thomas J.O.: Canadian Satellites: The Topside Sounder Alouette, *Science, 139*, 229, Jan. 18, 1963.



EXPLORER XIV — 1962 Beta Gamma 1

Oct. 2, 1962	Delta/ETR	36.6 hr.
Feb. 1964	89 lb	184/54,123 miles
Uncertain	P. G. Marcotte	F. B. McDonald

Objectives: To correlate energetic particles activity with observations of the Earth's magnetic fields; to monitor the existence of transient magnetic fields associated with plasma streams. (An Energetic Particles Satellite).

Instrument/Discipline	Experimenter/Affiliation
Proton analyzer-E	M. Bader/ARC
Fluxgate magnetometer-E	L. Cahill/U. of New Hampshire
Trapped-particle detector-E	J. A. Van Allen/State U. of Iowa
	B. J. O'Brien
Various radiation detectors-E	F. B. McDonald/GSFC
	L. R. Davis
	U. Desai

Remarks: NASA's second Energetic Particles Explorer. Studied Earth's radiation belt.

Selected References:

Anonymous: Explorer XIV Energetic Particles Satellite, *IG Bull.*, no. 66, 585, Dec. 1962.

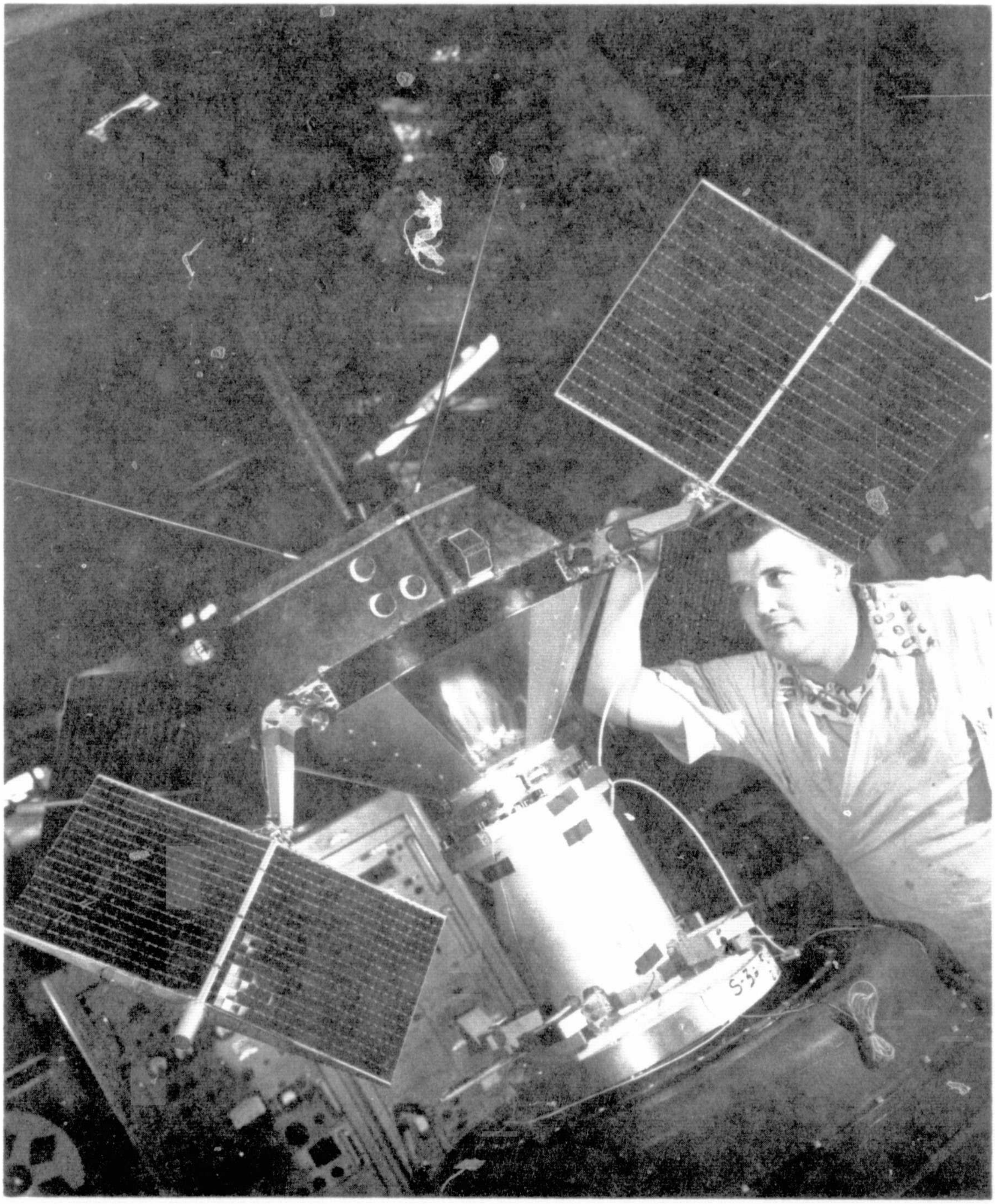
Bryant, D.A. et al: Studies of Solar Protons with Explorers XII and XIV, *NASA GSFC X-611-64-217*, 1964.

Cahill, L.J.: Preliminary Results of Magnetic Field Measurements in the Tail of the Geomagnetic Cavity, *NASA CR-53342*, 1964.

Frank, L.A. et al: Absolute Intensities of Geomagnetically Trapped Particles with Explorer 14, *J. Geophys. Res.*, *68*, 1573, March 15, 1963.

Frank, L.A., Van Allen, J.A., and Hills, H.K.: A Study of the Charged Particles in the Earth's Outer Radiation Zone with Explorer 14, *J. Geophys. Res.*, *69*, 2171, June 1, 1964.

EXPLORER XIV (Continued)



EXPLORER XV

1962 Beta
Lambda 1

Oct. 27, 1962	Delta/ETR	5 hr.
Feb. 9, 1963	100 lb	195/10,950 mi.
Uncertain	J.W. Townsend	W. Hess

Objectives: To study artificial radiation belt created by high altitude nuclear explosion. (An Energetic Particles Explorer)

Instrument/Discipline	Experimenter/Affiliation
Electron detectors-I	W. Brown/BTL
	U. Desai/GSFC
Scintillators-E	C. McIlwain/U. California
Ion-electron detector-E	L. Davis/GSFC
Fluxgate magnetometer-E	L. Cahill/U. New Hampshire
Solar-cell damage-I	H.K. Gummel/BTL

Remarks: Good data received on artificial radiation belt, although despin system failed. Part of Project SERB.

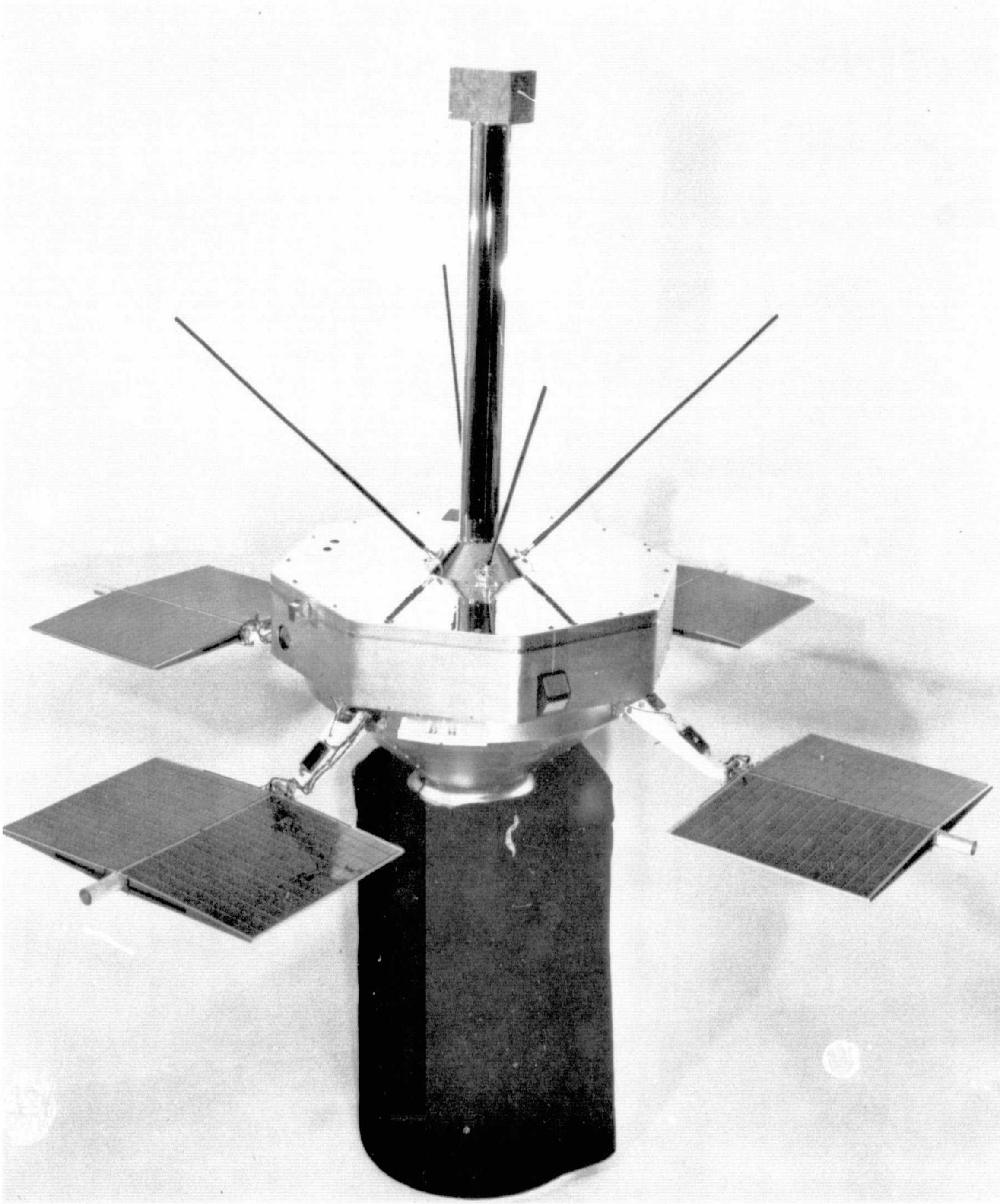
Selected References:

Anonymous: Explorer XV Energetic-Particles Satellite, *IG Bull.*, no. 68, Feb. 1963.

Bell Laboratories: Final Report on Bell Telephone Laboratories Experiments on Explorer XV, *NASA CR-67106*, 1964.

Various authors: Collected Papers on the Artificial Radiation Belt from the July 9, 1963 Nuclear Detonation, *J. Geophys. Res.*, *68*, 605, Feb. 1, 1962.

EXPLORER XV (Continued)



RELAY I

1962 Beta Upsilon 1

Dec. 13, 1962	Delta/ETR	185.1 min.
Retired Feb. 1965	172 lb	819.64/4612.18 mi.
In orbit	W. Sunderlin	R. Waddel

Instrument/Discipline	Experimenter/Affiliation
Measure proton energy (2.5-25.0 Mev)-E	W. Brown/BTL
Measure electron energy (1.25-2.0 Mev)-E	W. Brown/BTL
Directional and omni-directional electron and proton detectors-E	C. McIlwain/U. California

Remarks: Orbit achieved. TV, telephone, teletype, facsimile, and digital-data transmissions were made with satisfactory results. Conducted more than 2000 technical tests and 172 successful demonstrations. Tests terminated Feb. 1965.

Selected References:

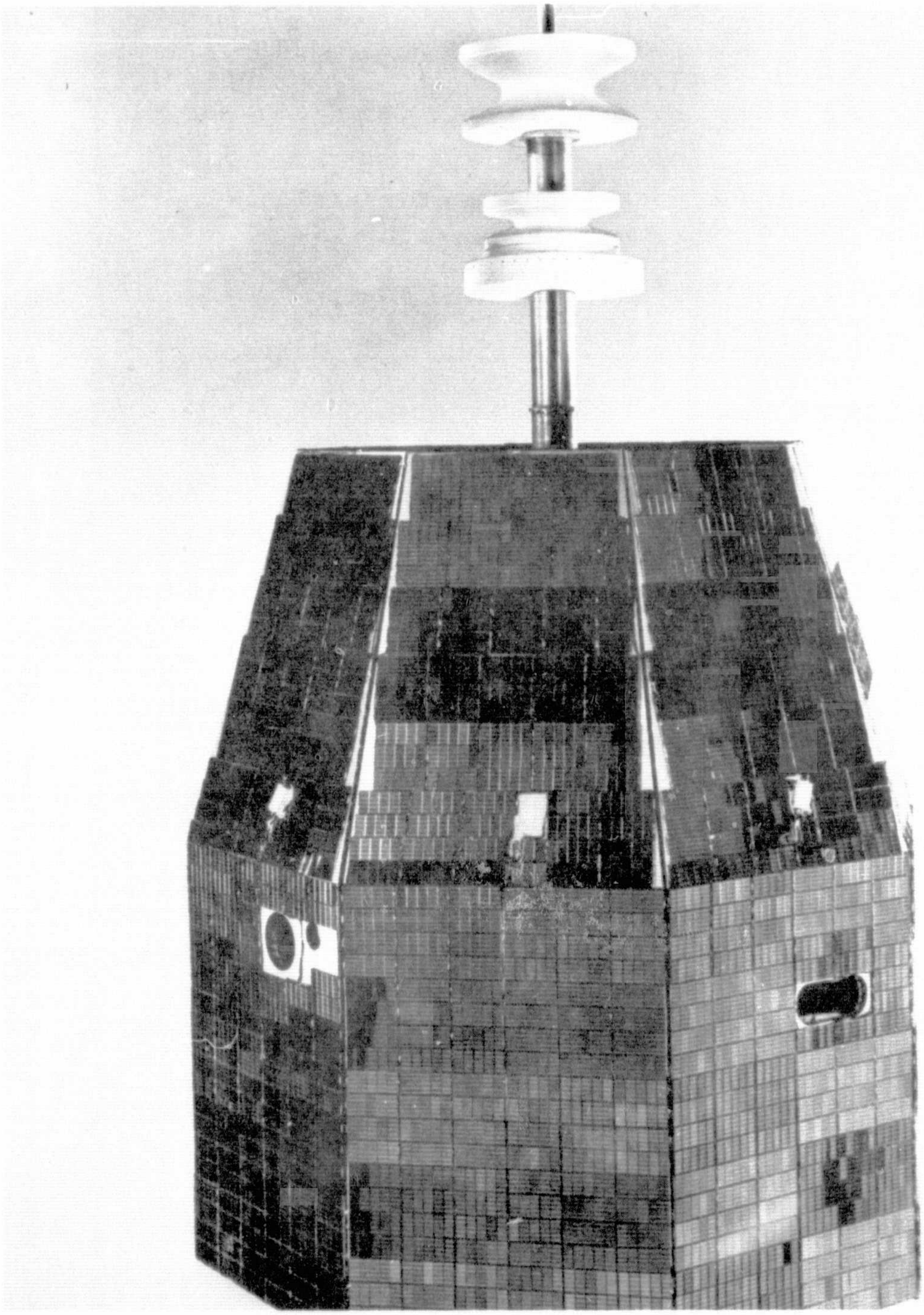
Anonymous: Development of the Relay Communications Satellite, *Interavia, 17,* 758, June 1962.

Cherecwich, P.: First Design Details, Project Relay Communications Satellite, *Electronics, 35,* 46, Oct. 5, 1962.

McIlwain, C.E. et al: Relay I Trapped Radiation Measurements, *NASA TN-D-2516,* 1964.

NASA: Relay Program, Final Report, *NASA SP-151,* 1968.

RELAY I (Continued)



SYNCOM I 1963 4A

Feb. 14, 1963	Delta/ETR	24 hr.
Feb. 14, 1963	86 lb	21,195/22,953 mi.
In orbit	R. J. Darcey	---

Objectives: To provide experience in using communications satellites in a 24-hour orbit. To flight-test a new, simple approach to satellite attitude control. To develop transportable ground facilities to be used in conjunction with communications satellites. To develop capability of launching satellites into 24-hour orbit using existing vehicles plus apogee kick techniques, and to test component life at 24-hour-orbit altitude.

Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: Twenty seconds after firing apogee rocket, all satellite transmissions stopped. The satellite was sighted on Feb. 28, 1963 and later dates. It was travelling in a near-synchronous orbit eastward at about 2.8° per day.

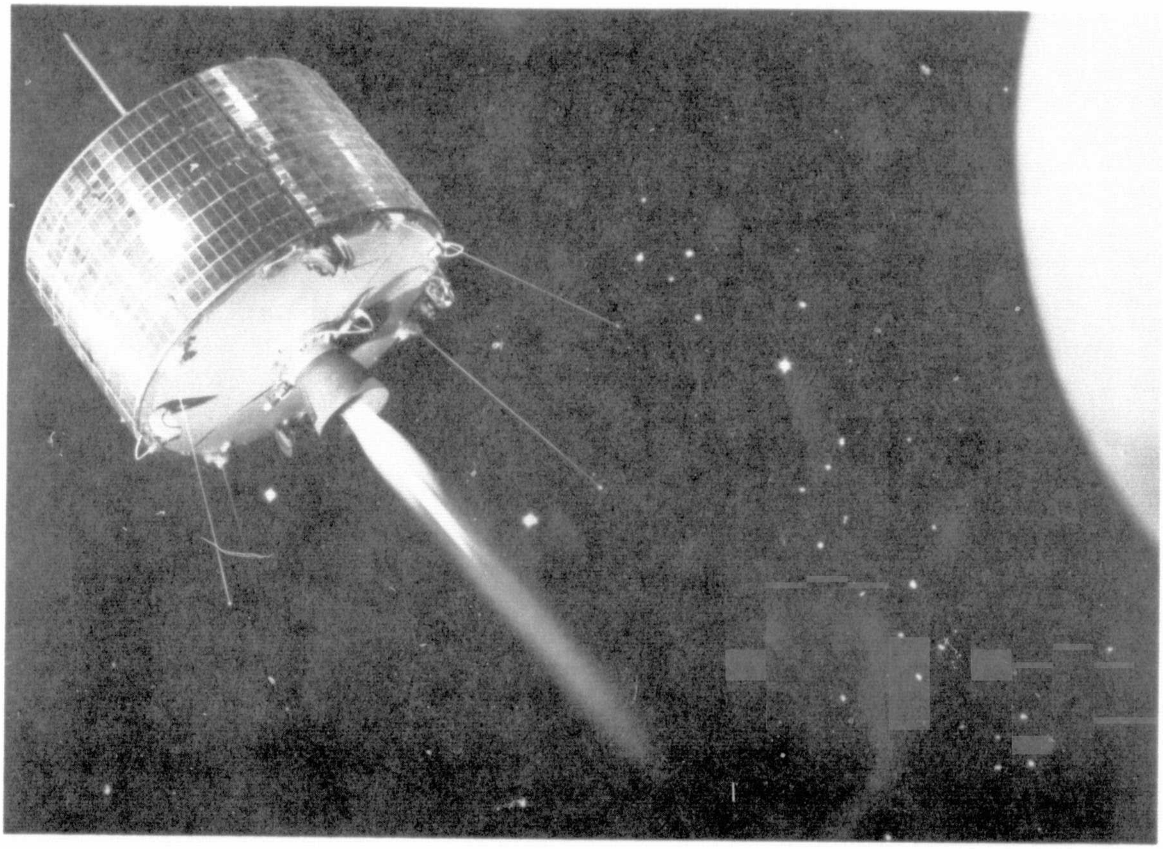
Selected References:

Bentley, R.M. and Owens, A.T.: SYNCOM Satellite Program. *J. Spacecraft and Rockets, 1,* 395, July 1964.

NASA: Syncom Engineering Report, *NASA TR-R-233,* 1966.

NASA: Syncom Engineering Report, vol. II, *NASA TR-R-252,* 1967.

SYNCOM I (Continued)



EXPLORER XVII 1963 9A

April 3, 1963	Delta/ETR	96.4 min.
July 10, 1963	405 lb	158.1/568 mi.
Nov. 24, 1966	N. W. Spencer	---

Objectives: To measure the density, composition, pressure, and temperature of the Earth's atmosphere from 135 to 540 miles and to determine the variations of these parameters with time of day, latitude, and, in part, season.

Instrument/Discipline	Experimenter/Affiliation
Two mass spectrometers-P	C. Reber/GSFC
Four pressure gauges-P	R. Horowitz/GSFC
	G. Newton/GSFC
Two Langmuir probes-I	N. Spencer/GSFC
	L. Brace

Remarks: Confirmed that the Earth is surrounded by a belt of neutral helium at an altitude of from 150 to 600 miles.

Selected References:

Brace, L.H. and Spencer, N.W.: First Electrostatic Probe Results from Explorer 17, *J. Geophys. Res., 69*, 4686, Nov.1, 1964.

Brace, L.H., Spencer, N.W., and Dalgarno, A.: Investigation of the Major Constituents of the April-May 1963 Heterosphere by the Explorer XVII Satellite, *Planetary and Space Sci., 13*, 617, July 1965.

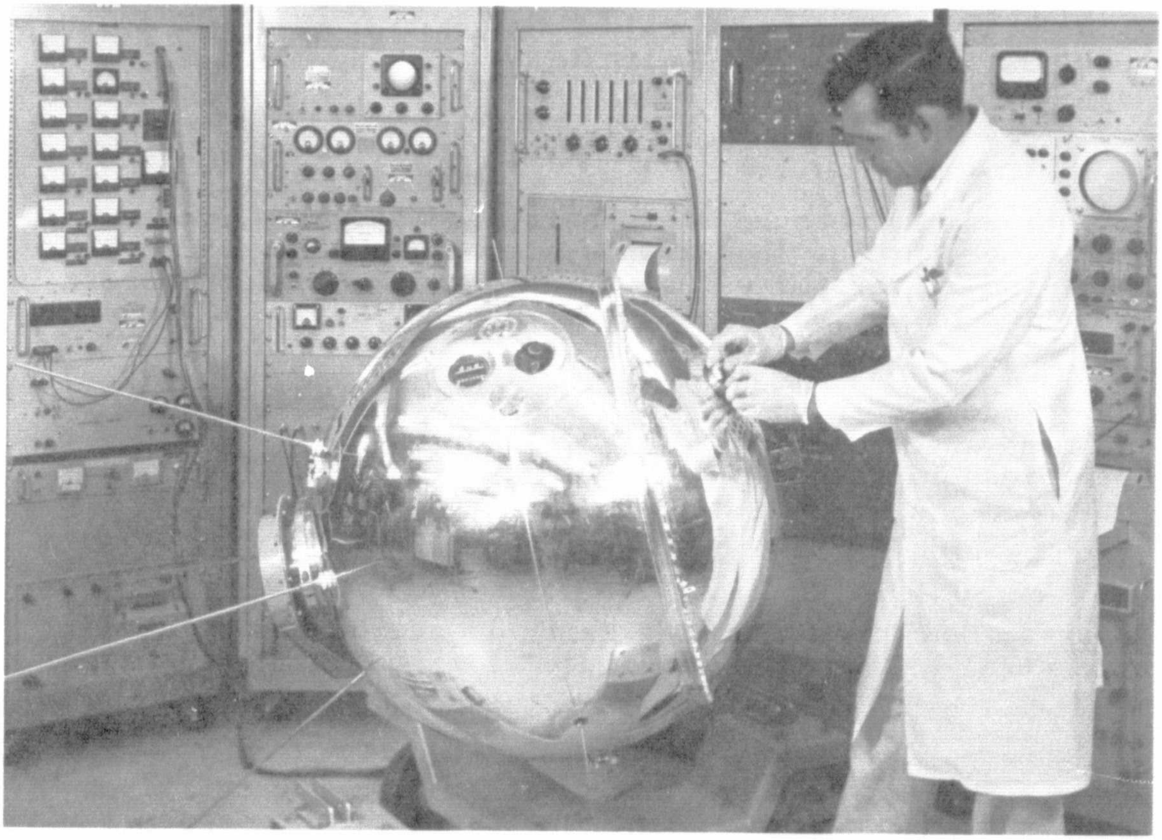
Newton, G.P. et al: Response of Modified Redhead Magnetron and Bayard-Alpert Vacuum Gauges Aboard Explorer XVII, *NASA TN-D-2146*, 1963.

Slowey, J.: Atmospheric Densities and Temperatures from the Drag Analysis of the Explorer 17 Satellite, *NASA CR-58032*, 1964.

Spencer, N.W. et al: New Knowledge of the Earth's Atmosphere from the Aeronomy Satellite (Explorer XVII), *NASA GSFC X-651-64-114*, 1964.

Spencer, N.W.: The Explorer XVII Satellite, *Planetary and Space Sci., 13*, 593, July 1965.

EXPLORER XVII (Continued)



TELSTAR II 1963 13A

May 7, 1963	Delta/ETR	225 min.
May 1965	175 lb	604/6713 mi.
In orbit	C. P. Smith, Jr.	---

Objectives: Joint AT&T-NASA investigation of wideband communications.

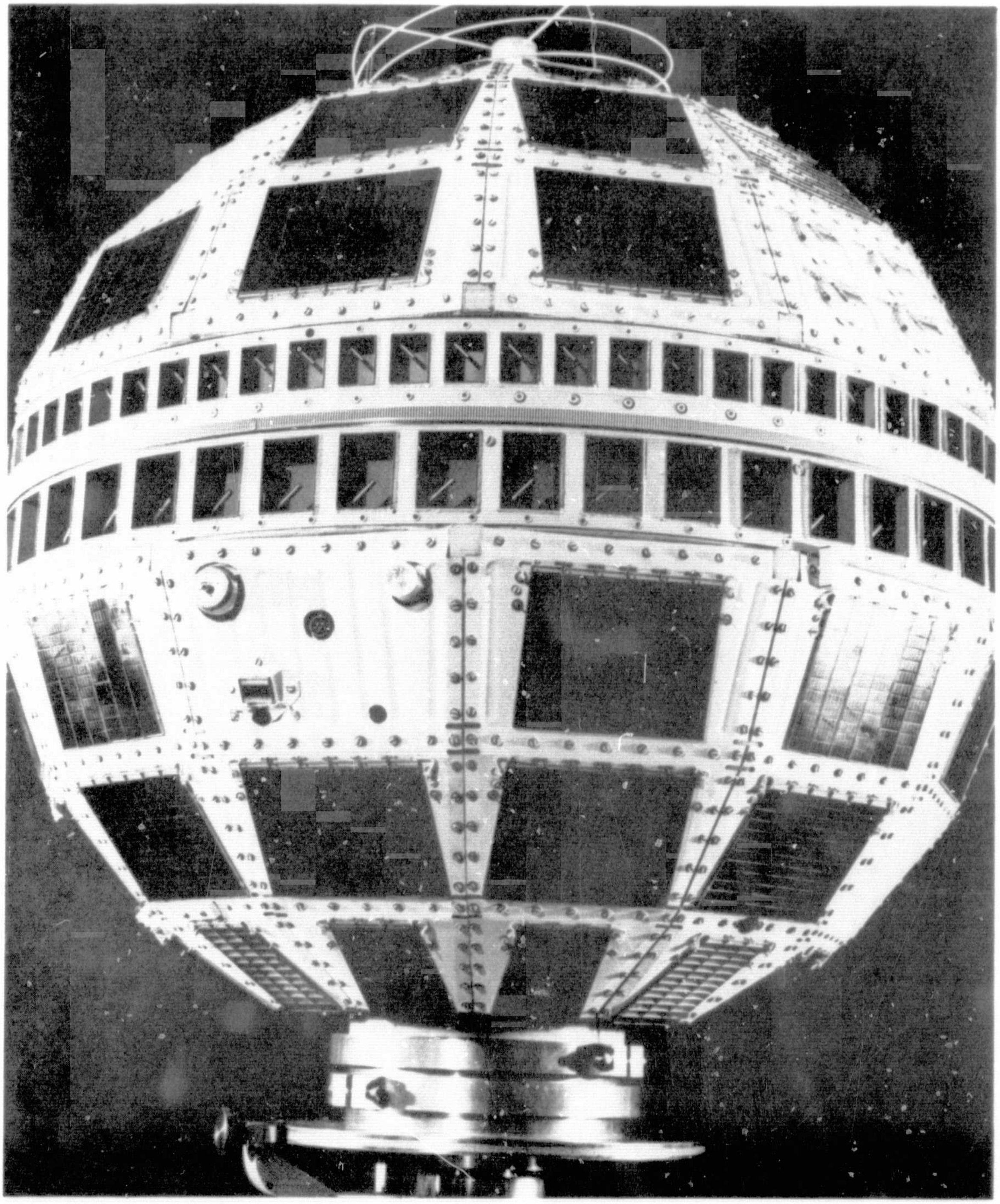
Instrument/Discipline	Experimenter/Affiliation
Electron detector-E	BTL

Selected References:

Bell Telephone Laboratories: Communications and Radiation Experiments with Telstar II, in *NASA SP-32*, vol. 4, 1965, p. 2263.

See also: References under Telstar I.

TELSTAR II (Continued)



TIROS VII		1963 24A
June 19, 1963	Delta/ETR	97.4 min.
Retired	297 lb	385.02/401.14 mi.
In orbit	R. Rados	----

Objectives: To launch into orbit a satellite capable of viewing the Earth's surface, cloudcover, and atmosphere by means of television cameras and radiation sensors. To control satellite attitude by magnetic means. To acquire and process collected data.

Instrument/Discipline	Experimenter/Affiliation
Omnidirectional radiometer-P	V. Suomi/U. Wisconsin
Scanning radiometer	A. McCulloch/GSFC
Electron temperature experiment-R	N. Spencer/GSFC
Two TV camera systems	---

Remarks: TV coverage extended to 65° N and 65° S latitudes. Launch date selected to provide maximum northern hemisphere coverage during 1963 hurricane season. Electron temperature probe malfunctioned 26 days after launch.

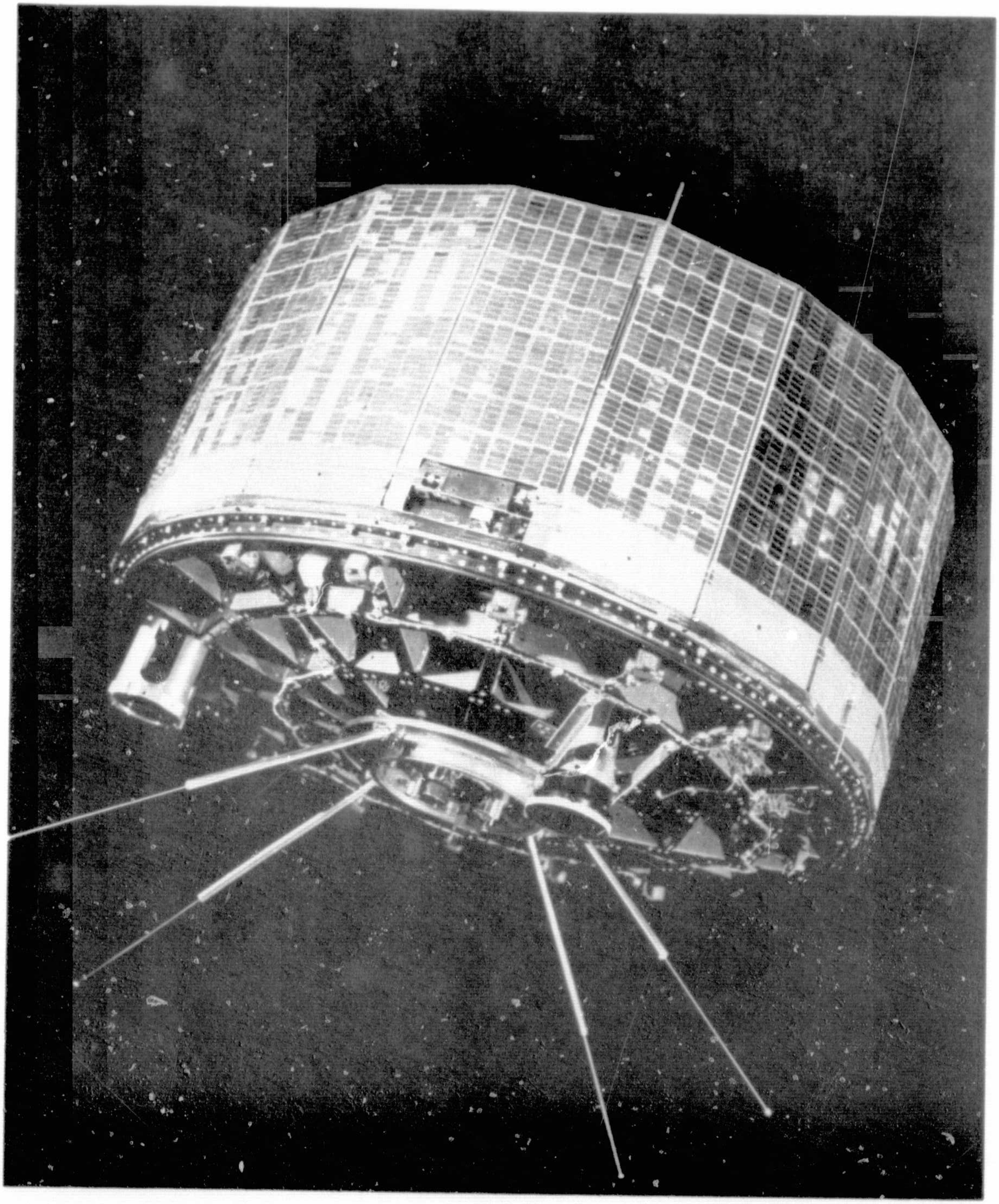
Selected References:

Nordberg, W. et al: Stratospheric Temperature Patterns Based on Radiometric Measurements from Tiros VII Satellite, *NASA GSFC X-651-64-115*, 1964.

Kreins, E.R., and Allison, L.J.: An Atlas of Tiros 7 Monthly Maps of Emitted Radiation in the 8/12 Micron Atmospheric Window over the Indian Ocean Area, *NASA TN-D-5101*, 1969.

See also: References under Tiros I.

TIROS VII (Continued)



SYNCOM II 1963 31A

July 26, 1963	Delta/ETR	24 hr.
Retired	80 lb	22,062/22,750 mi.
In orbit	R. J. Darcey	---

Objectives: To provide experience in using communications satellites in a 24-hour orbit. To flight-test a new, simple approach to satellite attitude and period control. To develop transportable ground facilities to be used in conjunction with communications satellites. To develop capability of launching satellites into 24-hour orbit using existing vehicles plus apogee kick techniques, and to test component life at 24-hour-orbit altitude.

Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: Orbit and attitude control of the spin-stabilized synchronous satellite achieved. Data, telephone, and facsimile transmission were excellent. Television video signals also were successfully transmitted, even though the satellite was not designed for this capability.

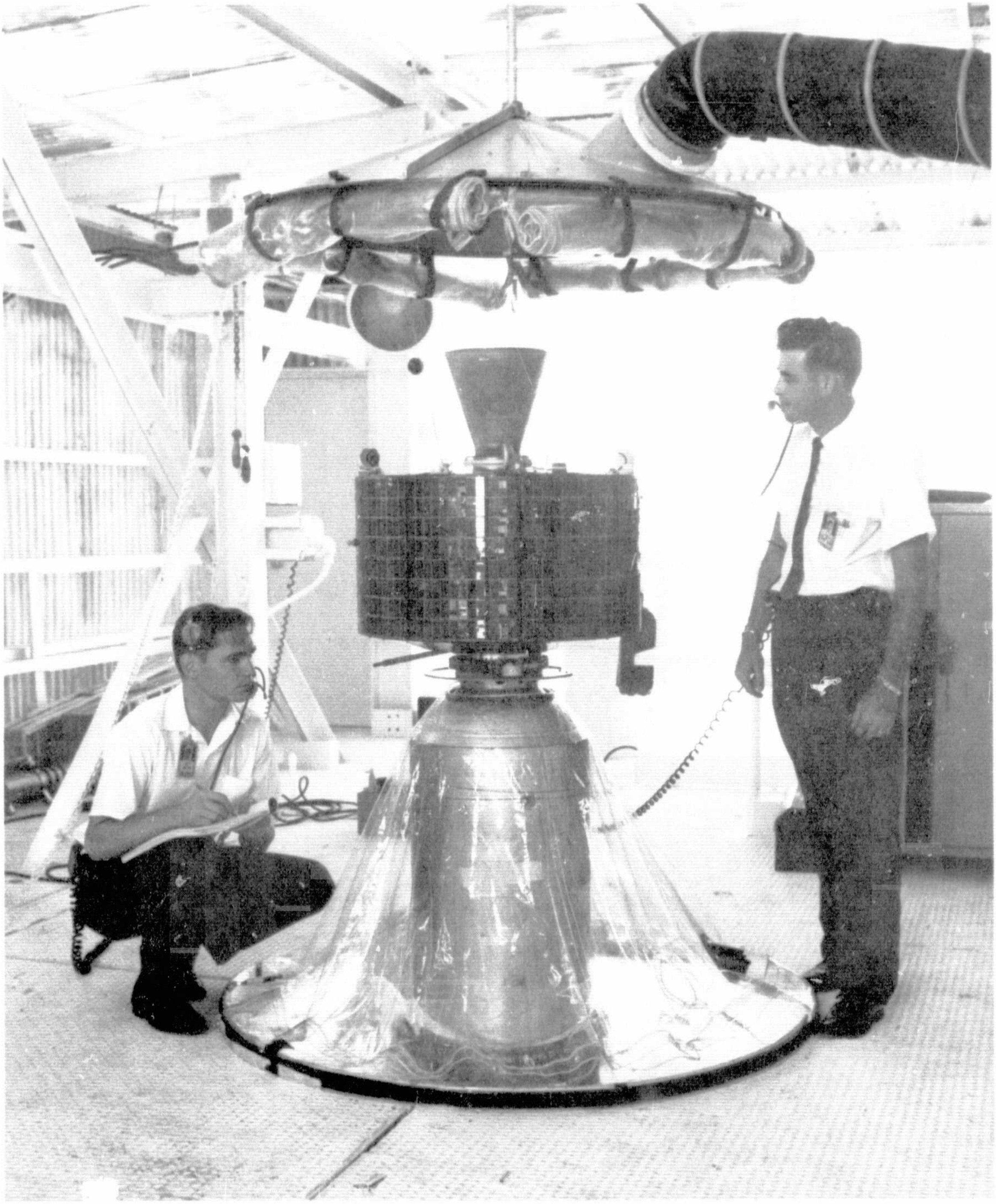
Selected References:

Bentley, R.M. and Owens, A.T.: Syncom Satellite Program, *J. Spacecraft and Rockets*, *1*, 395, July-Aug. 1964.

Wagner, C.A.: Determination of the Ellipticity of the Earth's Equator from Obersations on the Drift of the Syncom II Satellite, *NASA TN-D-2759*, 1965.

See also: References under Syncom I.

SYNCOM II (Continued)



EXPLORER XVIII 1963 46A

Nov. 27, 1963	Delta/ETR	93 hr.
May 1965	138 lb	122/121,605 miles
Dec. 1965	P. Butler	F. B. McDonald

Objectives: To study the radiation environment of cislunar space over a significant portion of a solar cycle. To study the quiescent properties of the interplanetary magnetic field and its dynamical relationships with the sun. To develop a solar flare prediction capability for Apollo. To extend the knowledge of solar-terrestrial relationships. To further the development of simple, inexpensive, spin-stabilized spacecraft for interplanetary investigations. An Interplanetary Monitoring Platform (IMP).

Instrument/Discipline	Experimenter/Affiliation
Ion and electron probes-I	G. P. Serbu/GSFC R. Bourdeau
Fluxgate magnetometers-E	N. F. Ness/GSFC
Cosmic-ray telescope-E	J. A. Simpson/U. Chicago
Geiger counter and ion chamber-E	K. A. Anderson/U. California
Plasma probe-E	H. S. Bridge/MIT
Scintillator and Geiger telescopes-E	F. McDonald/GSFC G. Ludwig
Rubidium-vapor magnetometer-E	N.F. Ness/GSFC
Plasma analyzer-E	J. Wolfe/ARC

Remarks: All experiments and equipment operated satisfactorily with the exception of the thermal ion experiment which transmitted 10 percent good data. First accurate measurement of interplanetary magnetic field and shock front. First satellite to survive a severe Earth shadow of 7 hr., 55 min. Electronic equipment estimated to have cooled below -60°C.

EXPLORER XVIII (Continued)

Selected References:

Balasubrahmanyan, V.K. et al: Results from the IMP 1 GM Counter Telescope Experiment, *NASA GSFC X-611-65-49*, 1965.

Bridge, H. et al: Preliminary Results of Plasma Measurements on IMP-A, in *Space Research V*, D.G. King-Hele, P. Muller, and G. Righini, eds., Interscience Publishers, New York, 1965, p. 969.

Carr, F.A.: Flight Report, International Monitoring Platform, IMP-1---Explorer XVIII, *NASA TN-D-3352*, 1960.

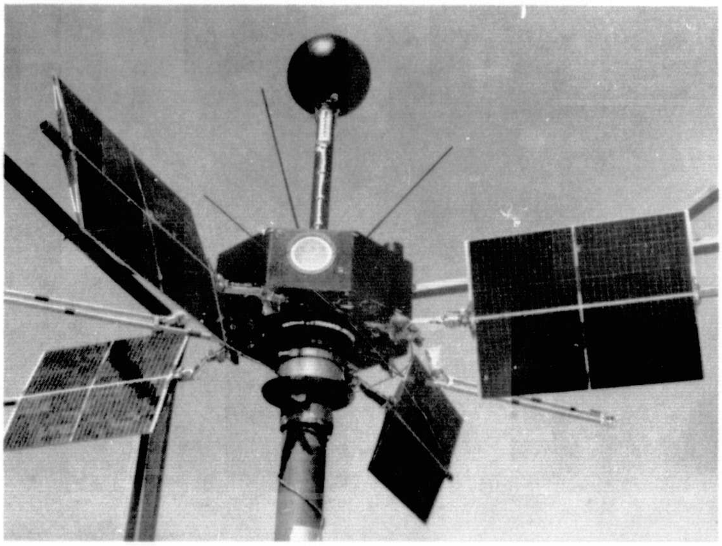
Fan, C.Y. et al: Cosmic Radiation Helium Spectrum below 90 Mev per Nucleon Measured on Imp 1 Satellite, *J. Geophys. Res.*, *70*, 3515, Aug. 1, 1965.

McDonald, F.B. and Ludwig, G.H.: Measurement of Low Energy Primary Cosmic Ray Protons on IMP-1 Satellite, *NASA GSFC X-611-64-363*, 1964.

Ness, N.F. et al: A Summary of Results from the IMP-I Magnetic Field Experiment, *NASA GSFC X-612-65-180*, 1965.

Ness, N.F.: The Earth's Magnetic Tail, *J. Geophys, Res.*, *70*, 2989, July 1, 1965.

Serbu, G.P.: Results from the IMP-I Retarding Potential Analyzer, in *Space Research V*, D.G. King-Hele, P. Muller, and G. Righini, eds., Interscience Publishers, New York, 1965, p. 564.



TIROS VIII 1963 54A

Dec. 21, 1963	Delta/ETR	99.3 min.
Retired	265 lb	435.01/468.30 mi.
In orbit	R. Rados	---

Objectives: To launch into orbit a satellite capable of viewing cloudcover and the Earth's atmosphere by means of television cameras. To acquire and process collected data from satellite and to control its attitude by magnetic means.

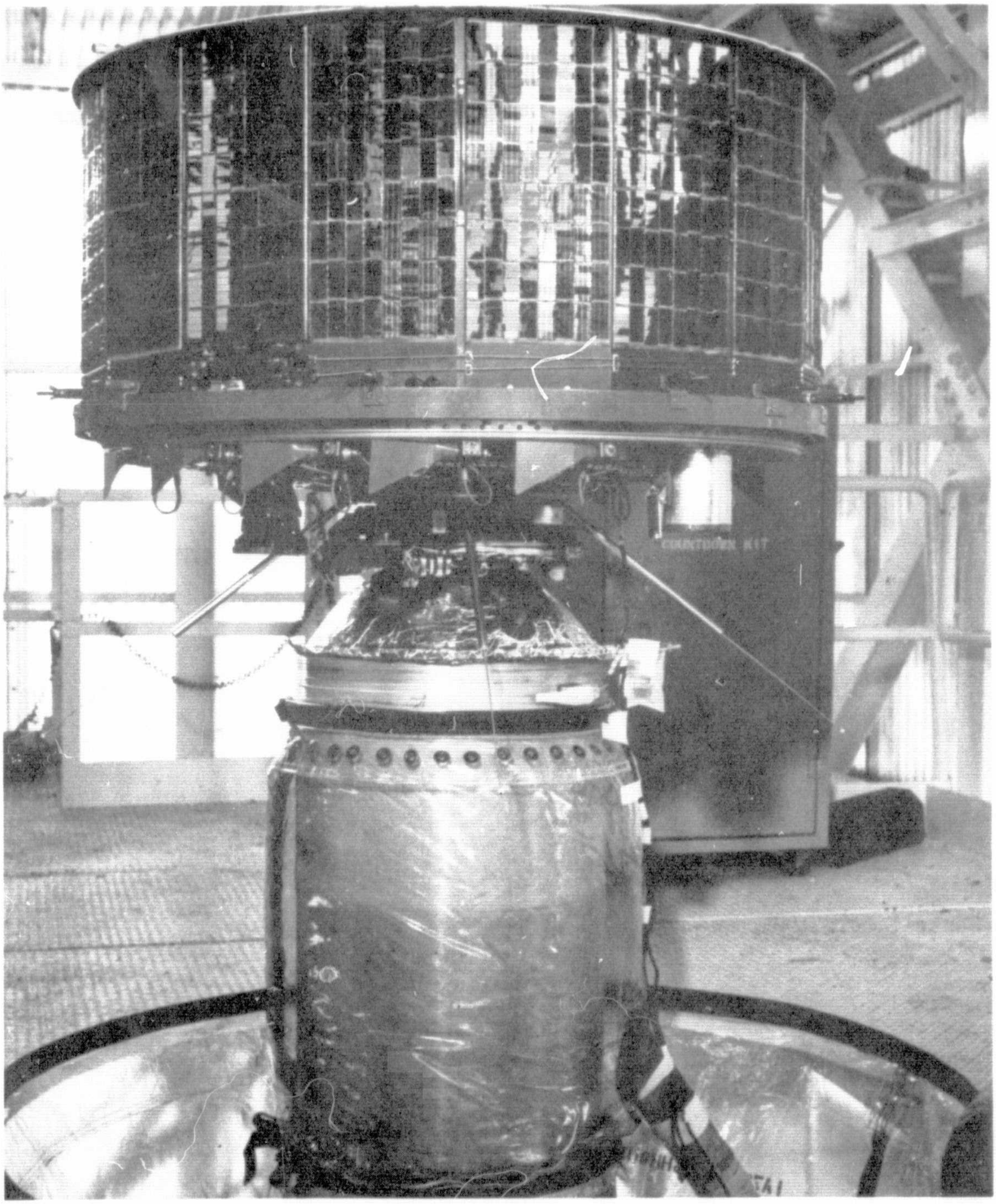
Instrument/Discipline	Experimenter/Affiliation
One standard TIROS TV system	-- --
One APT camera system	C. Hunter/GSFC

Remarks: This satellite proved for the first time the feasibility of APT (automatic picture transmission) as inexpensive direct facsimile readout. Abandoned June 1967, after 3.5 years and over 100,000 photos.

Selected References:

See: References under Tiros I.

TIROS VIII (Continued)



RELAY II 1964 3A

Jan. 21, 1964	Delta/ETR	194.7 min.
Active	184 lb	1298/4606 miles
In orbit	W. Sunderlin	R. Waddel

Objectives: To investigate wideband communications between ground stations by means of low-altitude orbiting spacecraft. Communications signal evaluated was an assortment of TV signals, multichannel telephones, and other communications. To measure the effects of the space environment on the system.

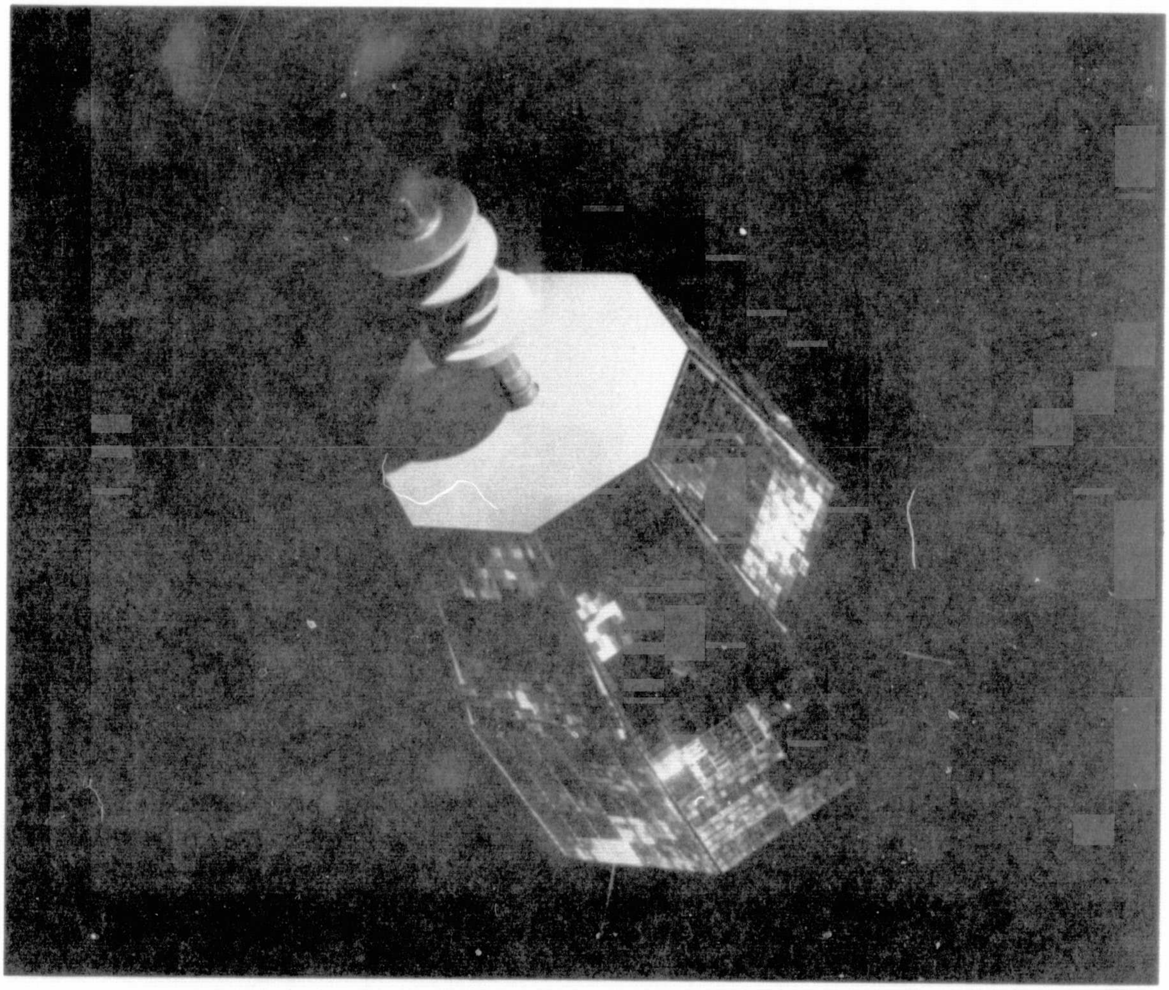
Instrument/Discipline	Experimenter/Affiliation
Determine radiation damage to solar cells and semiconductor diodes	R. Waddel/GSFC
Proton and electron detectors-E	W. Brown/BTL
Directional and omnidirectional electron and proton detectors-E	C. McIlwain/U. California

Remarks: TV, telephone, teletype facsimile, and digital data transmissions were made with satisfactory results. Conducted more than 1500 technical tests and 95 successful demonstrations. 300-channel telephony. Retired Sept. 1965.

Selected References:

See: References under Relay I.

RELAY II (Continued)



ECHO II 1964 4A

Jan.25, 1964	Thor-Agena/WTR	109 min.
Passive	565 lb	642/816 mi.
June 7, 1969	H. L. Eaker	---

Objectives: To demonstrate a rigidization technique applicable to passive-communications satellites; to advance the state-of-the-art represented by the presently orbiting Echo I satellite; to constitute a step toward the development of the technology necessary for establishment of a global passive communications network for civilian use.

Instrument/Discipline	Experimenter/Affiliation	
Passive communication satellite	---	---

Remarks: 135 ft. inflatable sphere. Spacecraft successfully inflated and employed for many communications experiments. Tracking also provided upper air data.

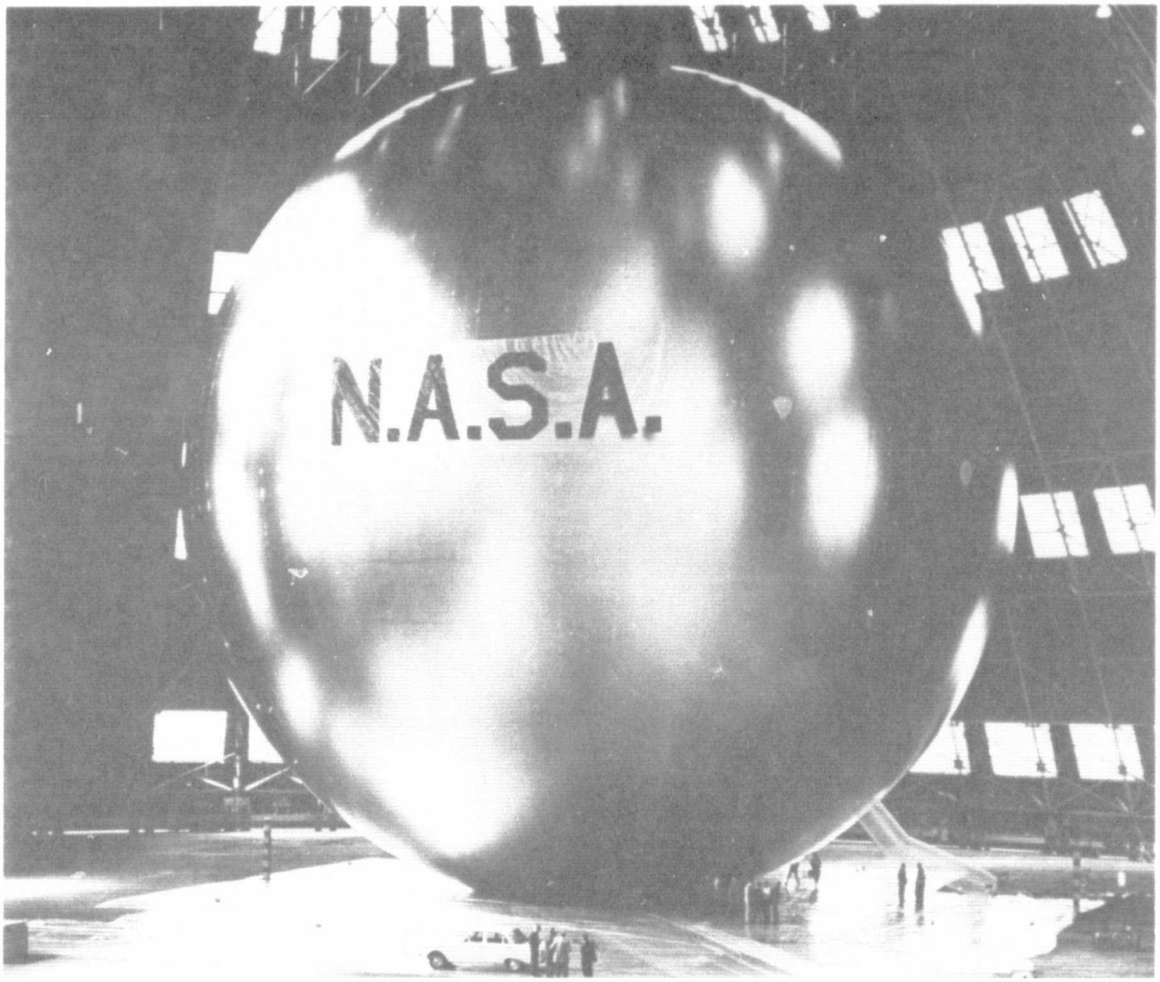
Selected References:

Collins Radio Co.: Echo II Experimental Program, Final Report, *NASA CR-89620*, 1965.

Kampinsky, A. and Ritt, R.K.: Experimental and Theoretical Evaluation of a Passive Communications Satellite (Echo II), *NASA TN-D-3154*, 1966.

Talentino, J.P.: Development of the Fabrication and Packaging Techniques for the Echo II Satellite, *NASA-TM-X-55764*, 1966.

ECHO II (Continued)



BEACON EXPLORER A		None
Mar. 19, 1964	Delta/ETR	---
Mar. 19, 1964	155 lb	---
Suborbital	F. T. Martin	R. E. Bourdeau

Objectives: To study for a minimum period of 1 year the variations of electron density distribution as a function of latitude, and seasonal and diurnal time, under varying magnetic and solar conditions.

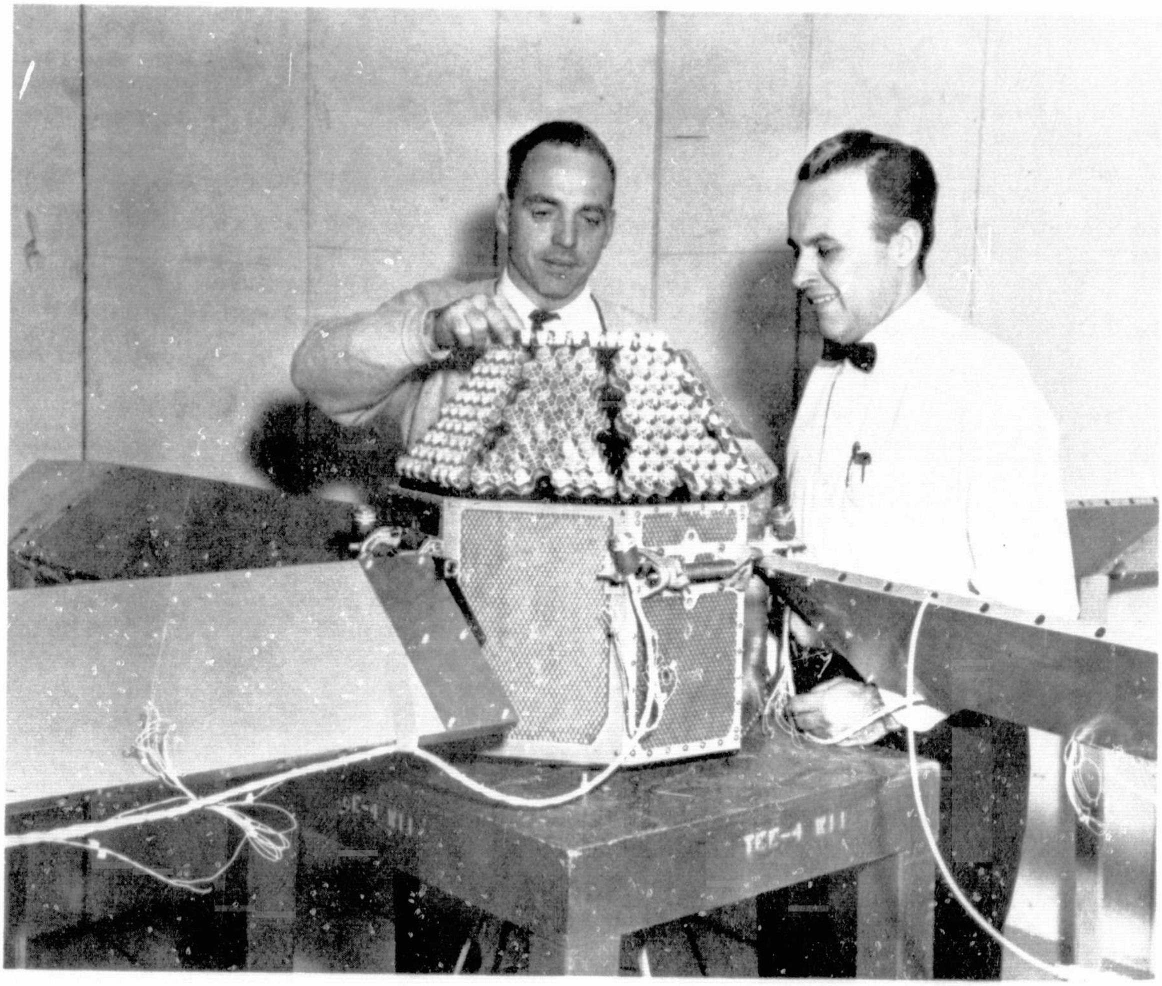
Instrument/Discipline	Experimenter/Affiliation
Ionosphere beacon-I	G. W. Swenson/U. Illinois
	W. J. Ross/Pennsylvania State U.
	U. K. Garriott/Stanford U.
	R. S. Lawrence/NBS
	L. J. Blumle/GSFC
Electron density-I	L. Brace/GSFC
Laser tracking	H. Plotkin/GSFC

Remarks; Doppler tracking data both from Antigua and Brazil tracking stations indicated that the satellite did not achieve orbital velocity. The satellite reentered the Earth's atmosphere over the South Atlantic coast of Argentina and disintegrated. This was the first Delta vehicle failure in 23 launch attempts.

Selected References:

See: References under Explorer XXII.

BEACON EXPLORER A (Continued)



ARIEL II 1964 15A

Mar. 27, 1964	Scout/Wallops Is.	102 min.
Nov. 1964	165 lb	180/840 miles
Nov. 18, 1967	E. Hymowitz	L. Dunkelman

Objectives: To measure vertical distribution of ozone; to study galactic radio noise, and to measure micrometeoroid flux. A joint U.S. - U.K. program.

Instrument/Discipline	Experimenter/Affiliation
Galactic radio noise receiver 0.75- to 3.0-MHz frequency range-A	F.G. Smith/U. of Cambridge (U.K.)
Ozone photometers and spectrometer-P	F.H. Stewart/Air Ministry (U.K.)
Micrometeoroid detectors-A	R.C. Jennison/U. Manchester, Jodrell Bank (U.K.)

Remarks: This satellite is a cooperative U.S. - U.K. effort. The U.K. was responsible for all flight instrumentation pertaining to the experiments and for data-reduction analysis. The U.S. was responsible for the design, fabrication, and testing of the prototype-flight spacecraft and all subsystems, except for the experiment requirements. Tracking and data acquisition were a joint responsibility. Made global survey of ozone with spectrometer.

Selected References:

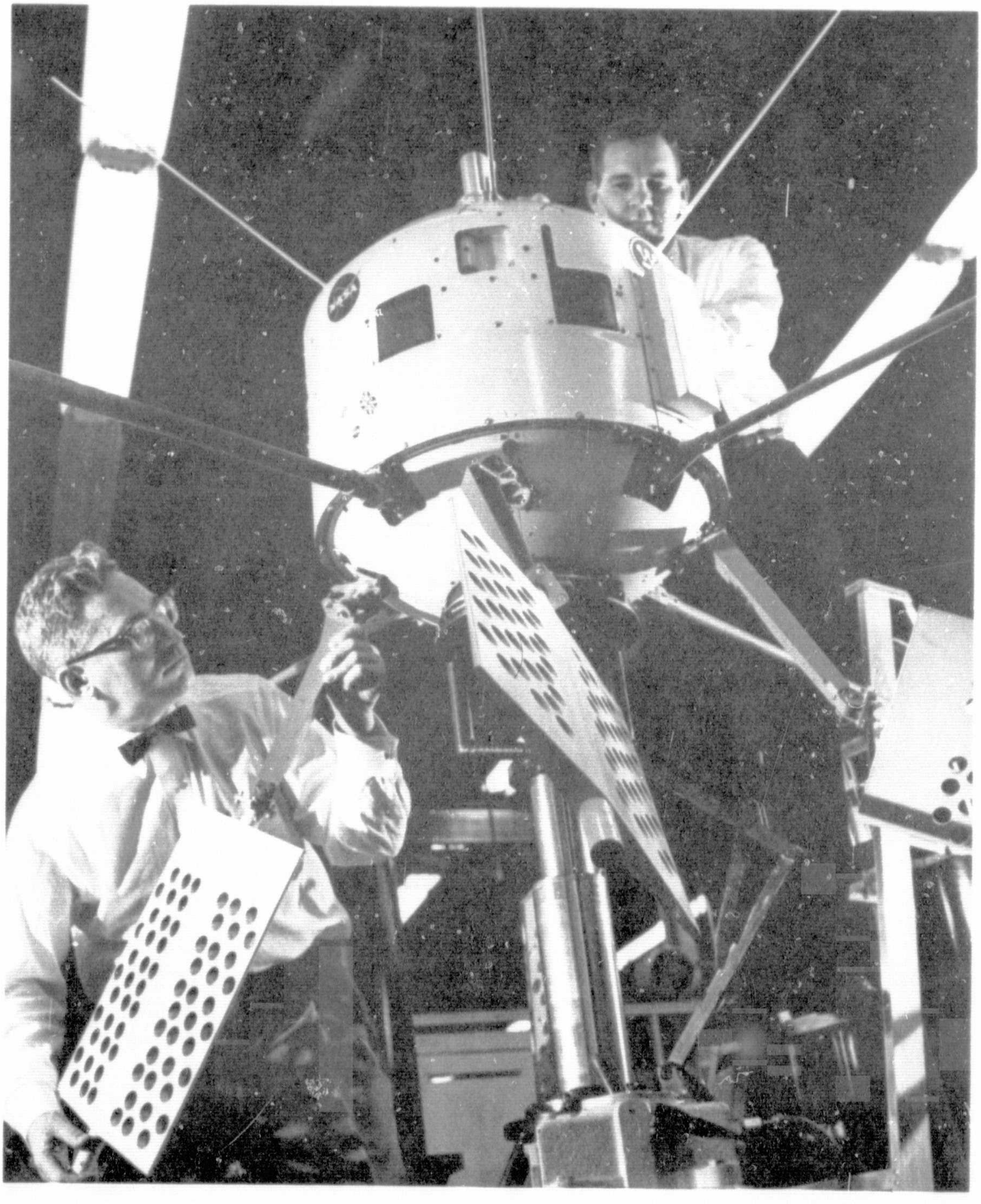
Anonymous: Ariel II--Second US/UK Cooperative Scientific Satellite, *IG Bull.*, no. 85, 7, July 1964.

Hugill, J. and Smith, F.G.: Cosmic Radio Noise Measurements from Ariel II. I. Receiving System and Preliminary Results, *Roy. Astron. Soc., Monthly Notices, 131,* 137, 1965.

Jennison, R.C. et al: The Ariel II Micrometeorite Penetration Experiments, *Proc. Roy. Soc., 300,* 251, Aug. 30, 1967.

Jennison, R.C. and McDonnell, J.A.M.: Interpretation of the Interplanetary Dust Measurements in the Ariel II Satellite, in *Space Research VI,* R.L. Smith-Rose, ed., Spartan Books, Washington, 1966, p. 937.

ARIEL II (Continued)



SYNCOM III 1964 47A

Aug. 19, 1964	TAD/ETR	24 hr.
Active	83 lb	22,164/22,312 mi.
In orbit	R. J. Darcey	---

Objectives: To provide experience in using communications satellites in a 24-hour near-equatorial orbit. To flight-test a new, simple approach to satellite attitude and period control. To develop transportable ground facilities to be used in conjunction with communications satellites. To develop capability of launching satellites into 24-hour near-equatorial orbit using existing vehicle plus apogee-kick techniques and to test component life at 24-hour orbit altitude.

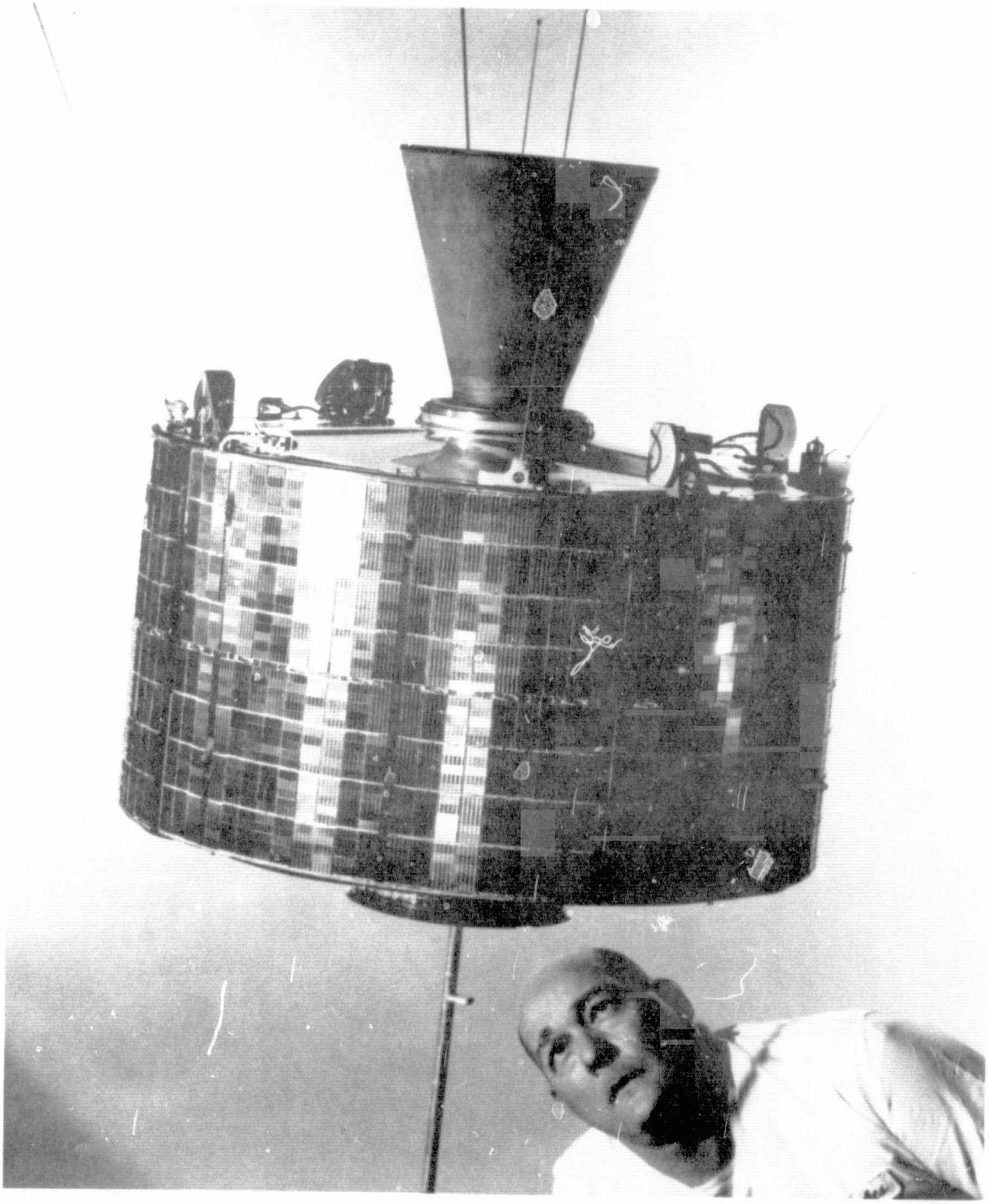
Instrument/Discipline	Experimenter/Affiliation
Synchronous communications satellite	---

Remarks: Orbit and attitude control of the spin-stabilized satellite into near-equatorial synchronous orbit achieved. Data, telephone, and facsimile transmissions were excellent. Television video signals were successfully transmitted through the wideband (13-MHz) transponder.

Selected References:
NASA: Syncom Engineering Report, vol. II, *NASA TR-R-252*, 1967.

See also: References under Syncom I.

SYNCOM III (Continued)



EXPLORER XX 1964 51A

Aug. 25, 1964	Scout/WTR	104 min.
July 1966	98 lb	538/628 mi.
In orbit	E. D. Nelsen	---

Objectives: To measure the electron density distribution in space and time between the height of the maximum electron density in the F2 region (approximately 180 miles) and the height of the satellite (620 miles) including the geometry and number of irregularities. To determine the ion and electron densities and temperatures in the vicinity of the satellite and to estimate cosmic noise in the 2- to 7-MHz frequency range.

Instrument/Discipline	Experimenter/Affiliation
Fixed-frequency sounder-I	R. Knecht/CRPL/NBS
Ion probe-I	R. L. F. Boyd/ U. College, London A. P. Willmore
Galactic radio noise receiver-A	R. Stone/GSFC

Remarks: NASA's first topside sounder. Explorer XX (An Ionosphere Explorer) employed six fixed frequencies. Helped map topside ionosphere.

Selected References:

Anonymous: Ionosphere Satellite---Explorer XX, *IG Bull.*, no. 91, Jan. 1965.

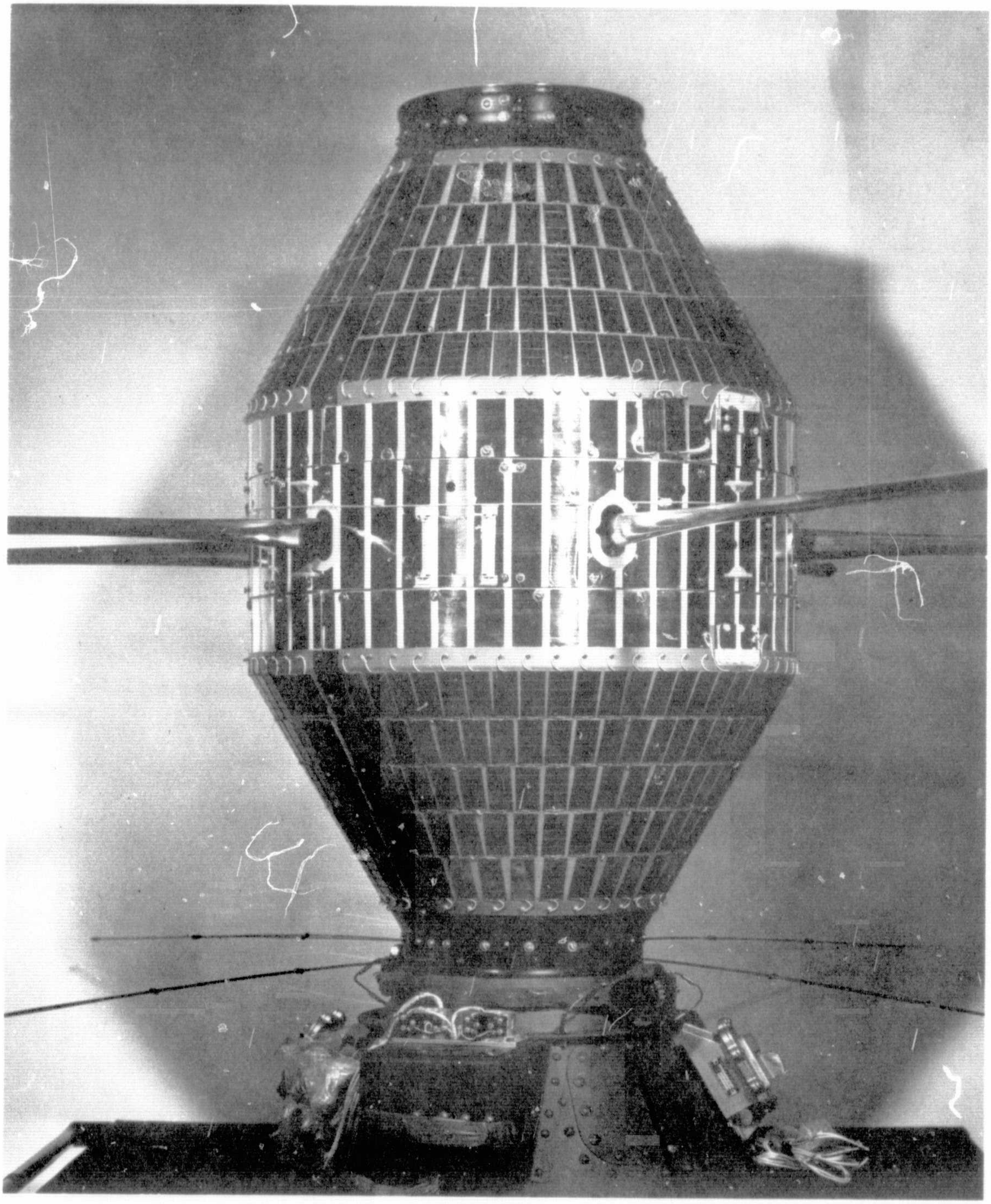
Blumle, L.J.: The National Aeronautics and Space Administration Topside Sounder Program, *NASA TN-D-1913*,1964.

Chomet, M., Gross, S., and Stone, R.: A Cosmic Radio Noise Astronomy Experiment for the Ionospheric Explorer, *IEEE Conv. Rec.*, *12*, 156, pt. 8, 1964.

Zimmer, F.C.: Design Features of Ionospheric Explorer XX (S-48) and Post Launch Observations of Spacecraft Performance, *Paper*, *International Space Electronics Symposium*, 1964.

EXPLORER XX (Continued)

Russell, S., and Zimmer, F.C.: Development of the Fixed-Frequency Topside-Sounder Satellite, *IEEE Proc.*, *57*, 876, June 1969.



NIMBUS I | 1964 52A

Aug. 28, 1964	Thor-Agena/WTR	98.7 min.
Sept. 23, 1964	830 lb.	263/579 mi.
In orbit	H. Press	W. Nordberg

Objectives: To provide a large amply powered, Earth-stabilized spacecraft to test a variety of sensors for atmospheric research, coupled with a ground data-handling system for acquiring and processing atmospheric data in real time.

Instrument/Discipline	Experimenter/Affiliation
Advanced vidicon camera system	G. Burdett/GSFC
Automatic picture transmission system	G. Hunter/GSFC
High-resolution infrared radiometer	L. Foshee/GSFC

Remarks: Due to premature burnout of Thor-Agena second stage, the spacecraft was launched into an elliptical orbit instead of the intended 550-mile circular orbit. Contained APT system. Returned 27,000 cloud-cover photos.

Selected References:

Allison, L.J. and Kennedy, J.S.: An Evaluation of Sea Surface Temperature as Measured by the Nimbus I High Resolution Infrared Radiometer, *NASA TN-D-4078*, 1967.

Kuers, G.: The Interpretation of Daytime Measurements by the Nimbus 1 and 2 High Resolution Infrared Radiometers, *NASA TN-D-4452*, 1968.

Michelson, L.: The History of Nimbus 1 at General Electric, in *AIAA Unmanned Spacecraft Meeting, Proceedings*, AIAA CP-12, New York, 1965, p. 306.

NASA: Observations from the Nimbus 1 Meteorological Satellite, *NASA SP-89*, 1965.

Sabatini, R.R., and Sissala, J.E.: Nimbus Earth Resources Observations, project Nero, *NASA CR-100020*, 1968.

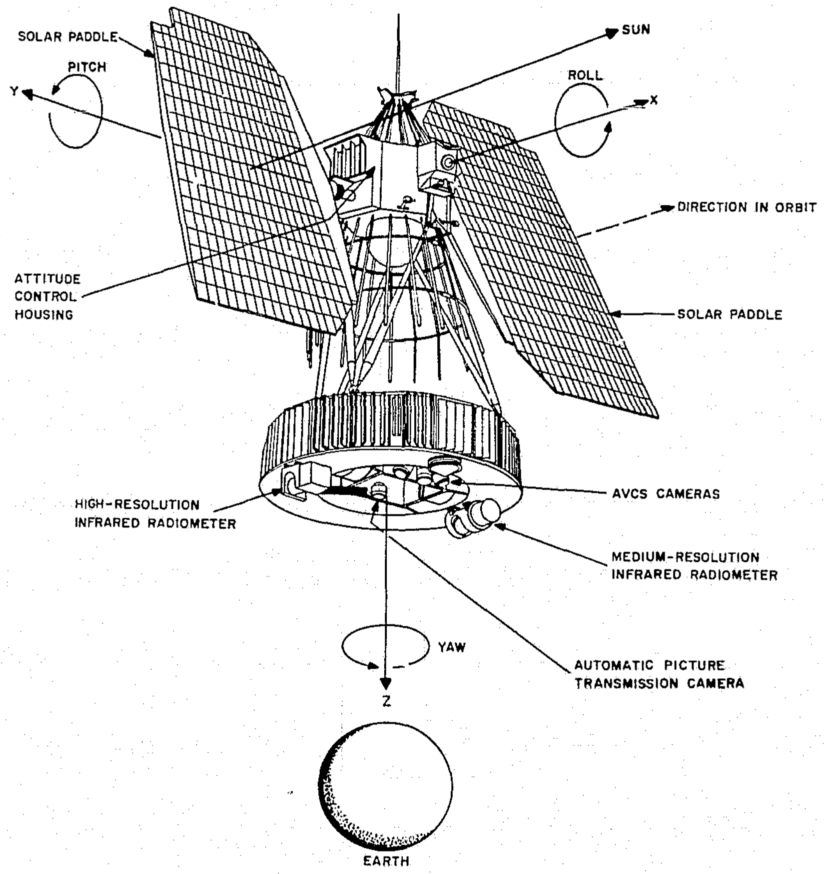
NASA: Nimbus I Automatic Picture Transmission (APT) TV-Camera System, *NASA TM-X-55669*, 1966.

Nordberg, W.: Development of Meteorological Satellites in the United States, *NASA TM-X-63313*, 1968.

Pouquet, J.: Remote Detection of Terrain Features from Nimbus I High Resolution Infrared Radiometer Nighttime Measurements, *NASA TN-D-4603*, 1968.

Press, H.: The Nimbus Meteorological Satellite Program, in *Meteorological and Communication Satellites*, M. Lunc, ed., Gordon and Breach, New York, 1966, p. 1

Press, H. and Huston, W.B.: Nimbus: A Progress Report, *Astro. & Aero.*, *6*, 56, March 1968.



ORBITING GEOPHYSICAL OBSERVATORY I — 1964 54A

Sept. 5, 1964	Atlas-Agena/ETR	63.8 hr
Active	1073 lb.	174/92,774 miles
In orbit	W. E. Scull	G. H. Ludwig

Objectives: To launch and operate an orbital spacecraft carrying many (up to 50) interrelated experiments to make geophysical measurements about the Earth.

Instrument/Discipline	Experimenter/Affiliation
Triaxial search-coil magnetometer-E	E. J. Smith/JPL R. E. Holzer/UCLA
Rubidium-vapor magnetometers-E and Fluxgate	J. P. Heppner/GSFC
Spherical ion and electron trap-I	R. C. Sagalyn/AFCRL
Planar ion and electron trap-I	E. C. Whipple/GSFC
Radio propogation experiment-I	R.S. Lawrence/NBS
Atmospheric mass spectrometer-P	H. A. Taylor, Jr./GSFC
Various micrometeoroid detectors-A	W. M. Alexander/GSFC
VLF noise receiver-I	R. A. Helliwell/Stanford U.
Cosmic radio noise receiver-A	F. T. Haddock/U. Michigan
Lyman-alpha ion chambers-P	P. M. Mange/NRL
Gegenschein photometer-A	C. L. Wolff/GSFC K. Hallam/GSFC S. P. Wyatt/U. Illinois
Cosmic-ray scintillator-E	K. A. Anderson/U. California
Electrostatic plasma analyzer-E	J. H. Wolfe/ARC
Faraday cup-E	H. Bridge/MIT
Positron detector-ES	T. L. Cline/GSFC E. W. Hones, Jr./Inst.Def.Anal.
Trapped radiation scintillation counter-E	A. Konradi/GSFC
Cosmic-ray isotopic abundance detector-E	G. H. Ludwig/GSFC F. B. McDonald/GSFC
Cosmic-ray telescope-E	J. A. Simpson/U. Chicago
Trapped radiation omnidirectional counters-E	J. A. Van Allen/State U. Iowa
Ion chamber, Geiger counter, and electron spectrometer-E	J. R. Winckler/U. Minnesota R. L. Arnoldy

ORBITING GEOPHYSICAL OBSERVATORY I (continued)

Remarks: Performance of the Atlas-Agena launch rocket was normal. However, shortly after separation from the Agena second stage, it appeared that the mission might be in jeopardy because of nondeployment of two booms. This resulted in abnormal operation of the automatic control system. The inability to lock on the Earth was later attributed to the fact that the satellite's Earth-seeking sensor was obscured by one of the undeployed booms.

About 4 1/2 hours after launch, OGO-I was commanded into a "hold" condition while project officials evaluated telemetry data. OGO-I was finally put in a spin-stabilized mode and returned considerable data.

Selected References:

Anonymous: OGO, First U.S. Orbiting Geophysical Observatory, *IG Bull.*, no. 92, Feb. 1965.

Arnoldy, R.L., Kane, S.R., and Winckler, J.R.: The Observation of 10-50 Kev Solar Flare X-Rays by the OGO Satellites and Their Correlation with Solar Radio and Energetic Particle Emission, *NASA CR-91950*, 1967.

Arnoldy, R.L., Kane, S.R., and Winckler, J.R.: An Atlas of 10-50 Kev Solar Flare X-Rays Observed by the OGO Satellites, 5 September 1964 to 31 December 1966, *NASA CR-94429*, 1968.

Cline, T.L. and Serlemitsos, P.: A Double Gamma-Ray Spectrometer to Search for Positrons in Space, *NASA TN D-1464*, 1962.

Comstock, G.M., Simpson, J.A., and Fan, C.Y.: Abundances and Energy Spectra of Galactic Cosmic-Ray Nuclei above 20 Mev per Nucleon in the Nuclear Charge Range $2 \leq Z \leq 26$, *Astrophys. J.*, *146*, 51, Oct. 1966.

Fenton, K.B.: A Search for Particles Trapped in the Geomagnetic Field, *J. Geophys. Res.*, *72*, 3889, Aug. 1, 1967.

Gleghorn, G.F.: The Engineering Design of the Orbiting Geophysical Observatories, in *NASA SP-30*, 1963.

ORBITING GEOPHYSICAL OBSERVATORY I (Continued)

Heppner, J.P. et al: OGO-A Magnetic Field Observations, *J. Geophys. Res., 72,* 5417, Nov. 1, 1967.

Ludwig, G.H.: The Orbiting Geophysical Observatories, *Space Sci. Rev., 2,* 175, Aug. 1963.

Ludwig, G.H. and Schull, W.E.: The Orbiting Geophysical Observatory---New Tool for Space Research, *Astronautics, 7,* 24, May 1962.

Ludwig, G.H., ed.: OGO Program---Bibliography, *NASA CR-81210,* 1966.

Nilsson, C.S. and Alexander, W.M.: Measured Velocities of Interplanetary Dust from OGO-1, in *NASA SP-135,* 1967.

Scull, W.E.: The Mission of the Orbiting Geophysical Observatories, in *The Observatory Generation of Satellites, NASA SP-30,* 1963.

Stambler, I.: The OGO, *Space/Aero., 39,* 70, Feb. 1963.

Taylor, H.A., Brinton, H.C., and Smith, C.R.: Positive Ion Composition in the Magnetoionosphere Obtained from the OGO-A Satellite, *J. Geophys, Rev., 70,* 5769, Dec. 1, 1965.

Frandsen, A.M.A., Smith, E.J., and Holzer, R.E.: OGO Search Coil Magnetometer Experiments, *IEEE Trans., GE-7,* 61, April 1969.

Pfitzer, K.A.: An Experimental Study of Electron Fluxes from 50 kev to 4 Mev in the Inner Radiation Belt, *NASA CR-123,* 1968.

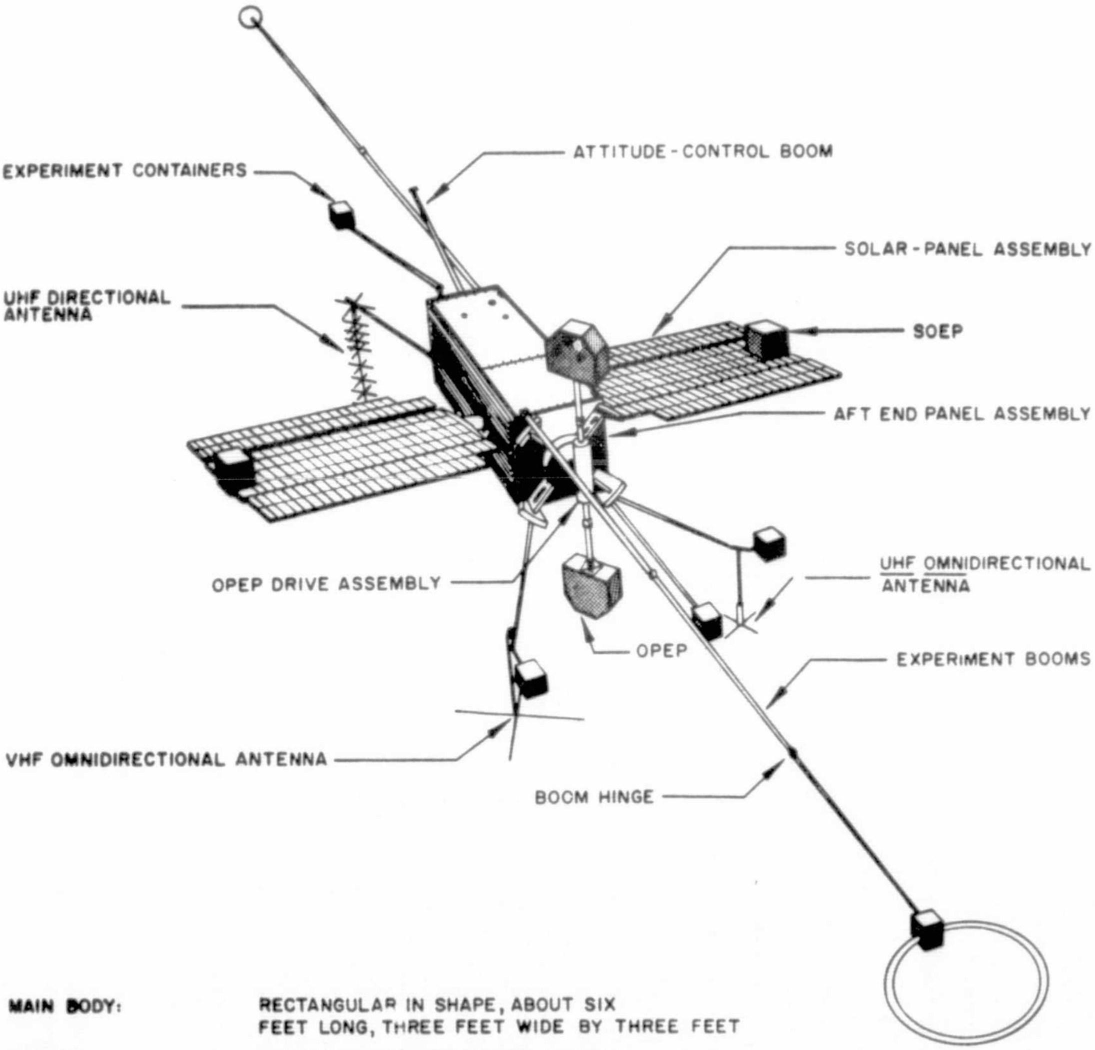
Scull, W.E.: The Orbiting Geophysical Observatories, *IEEE Trans., GE-7,* 55, April 1969.

Scull, W.E., and Beard, T.W.: Deployable Elements of the Orbiting Geophysical Observatories, *Proceedings 18th International Astronautical Congress,* M. Lunc, ed., Pergamon Press, Oxford, 1968, pp. 199-208.

Vasylivnas, V.M.: Low-Energy Electrons in the Magnetosphere As Observed by OGO-1 and OGO-3, *Physics of the Magnetosphere,* R.L. Carovillano, J.F. McClay, and H.R. Radoski, eds., D. Reidel Publishing Co., Dordrecht, 1968, pp. 622-640.

ORBITING GEOPHYSICAL OBSERVATORY I (Continued)

OGO FULLY DEPLOYED IN ORBIT



MAIN BODY:	RECTANGULAR IN SHAPE, ABOUT SIX FEET LONG, THREE FEET WIDE BY THREE FEET
LENGTH:	OVERALL, BOOMS EXTENDED, 54 FEET
WIDTH:	OVERALL, SOLAR PANELS UNFOLD, 20 FEET

EXPLORER XXI 1964 60A

Oct. 4, 1964	Delta/ETR	35 hr.
Oct. 10, 1965	136 lb	120/59,400 mi.
Jan. 1966	P. Butler	F.B. McDonald

Objectives: To study the radiation environment of cislunar space over a significant portion of a solar cycle. To study the quiescent properties of the interplanetary magnetic field and its dynamical relationships with the sun. To develop a solar flare prediction capability for Apollo. To extend the knowledge of solar-terrestrial relationships. To further the development of simple, inexpensive, spin-stabilized spacecraft for interplanetary investigations. An Interplanetary Monitoring Platform (IMP)

Instrument/Discipline	Experimenter/Affiliation
Same as Explorer XVIII	

Remarks: The satellite failed to achieve the required orbit of 161,000 mile apogee, but considerable useful data were obtained nevertheless.

Selected References:

Binsack, J.H.: Shock and Magnetopause Boundary Observations with IMP-2, *NASA CR-91901*, 1967.

Carr, F.A.: Flight Report, IMP II, *NASA TN-D-3353*, 1966.

Fairfield, D.H. and Ness, N.F.: Magnetic Field Measurements with the IMP-II Satellite, *NASA TM-X-55632*, 1966.

Rothwell, P.: Energetic Particle Observations from IMB-B Satellite, *Space Sci. Rev.*, *7*, 278, Oct. 1967.

Serbu, G.P. and Maier, E.J.R.: Low Energy Electrons Measured on IMP-II, *NASA GSFC X-615-66-92*, 1966.

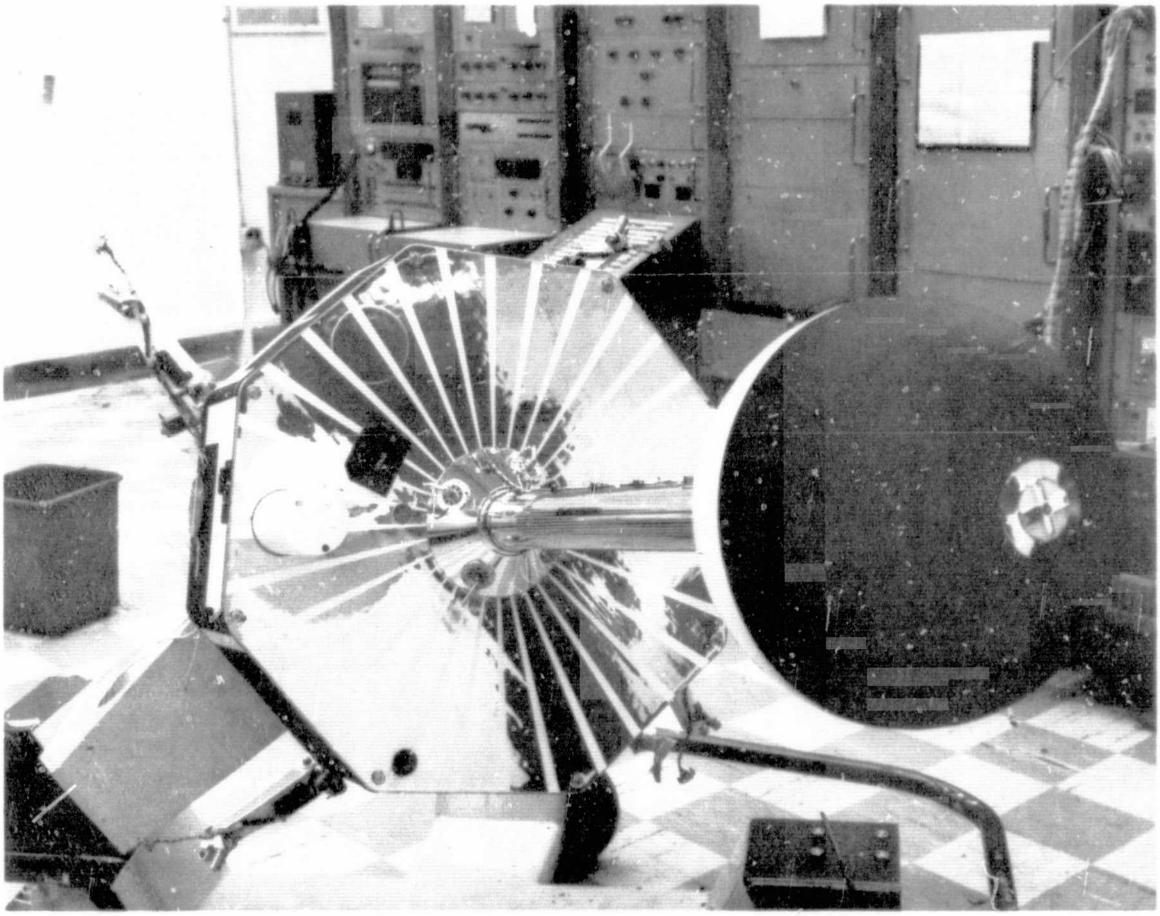
Wolfe, J.H., Silva, R.W., and Myers, M.A.: Preliminary Results from the Ames Research Center Plasma Probe Observations of the Solar-Wind-Geomagnetic Field Interaction Region on IMP-II and OGO-I, in *Space Research VI*, R.L. Smith-Rose, ed., Spartan Books, Washington, 1966, p. 680.

See also: References under Explorer XVIII.

EXPLORER XXI (Continued)

Donley, J.L., et al: Comparison of Results of Explorer 21 Direct Measurement Probe, *NASA TM-X-63442*, 1968.

Rao, N.N.: Acoustic Waves in the Ionosphere, *J. Atm. Terr. Phys.*, *31*, 539, April 1969.



EXPLORER XXII | 1964 64A

Oct. 10, 1964	Scout/WTR	104 min.
Active	115 lb.	549/669 miles
In orbit	F. T. Martin	R. E. Bourdeau

Objectives: To study for a minimum period of 1 year the variations of electron content distribution as a function of latitude, seasonal and diurnal time under varying magnetic and solar conditions. To support the beacon experiment by determining the electron density in the vicinity of the spacecraft. To test the feasibility of laser tracking.

Instrument/Discipline	Experimenter/Affiliation
Ionosphere beacon-I	G. W. Swenson/U. Illinois
	W. J. Ross/Pennsylvania State U.
	U. K. Garriott/Stanford U.
	R. S. Lawrence/NBS
	L. J. Blumle/GSFC
Electron density-I	L. Brace/GSFC
Laser tracking	H. Plotkin/GSFC

Remarks: Stations operated by prime experimenters:

a. University of Illinois: Urbana, Illinois; Houghton, Michigan; Baker Lake, Canada; Adak, Alaska

b. Pennsylvania State University: University Park, Pennsylvania; Huancayo, Peru

c. Stanford University: Stanford, California; Honolulu, Hawaii; Macapa, Brazil; S. J. dos Compos, Brazil; Santiago, Chile; Ushuaia, Argentina

d. Central Radio Propagation Laboratory (NBS): Boulder, Colorado: 2 mobile stations within 100-mile radius of Boulder, Colorado

e. Goddard Space Flight Center (GSFC): Blossom Point, Maryland

International Participation: More than 80 international observing ground stations are participating in the program. Laser stations located at Wallops Island and GSFC.

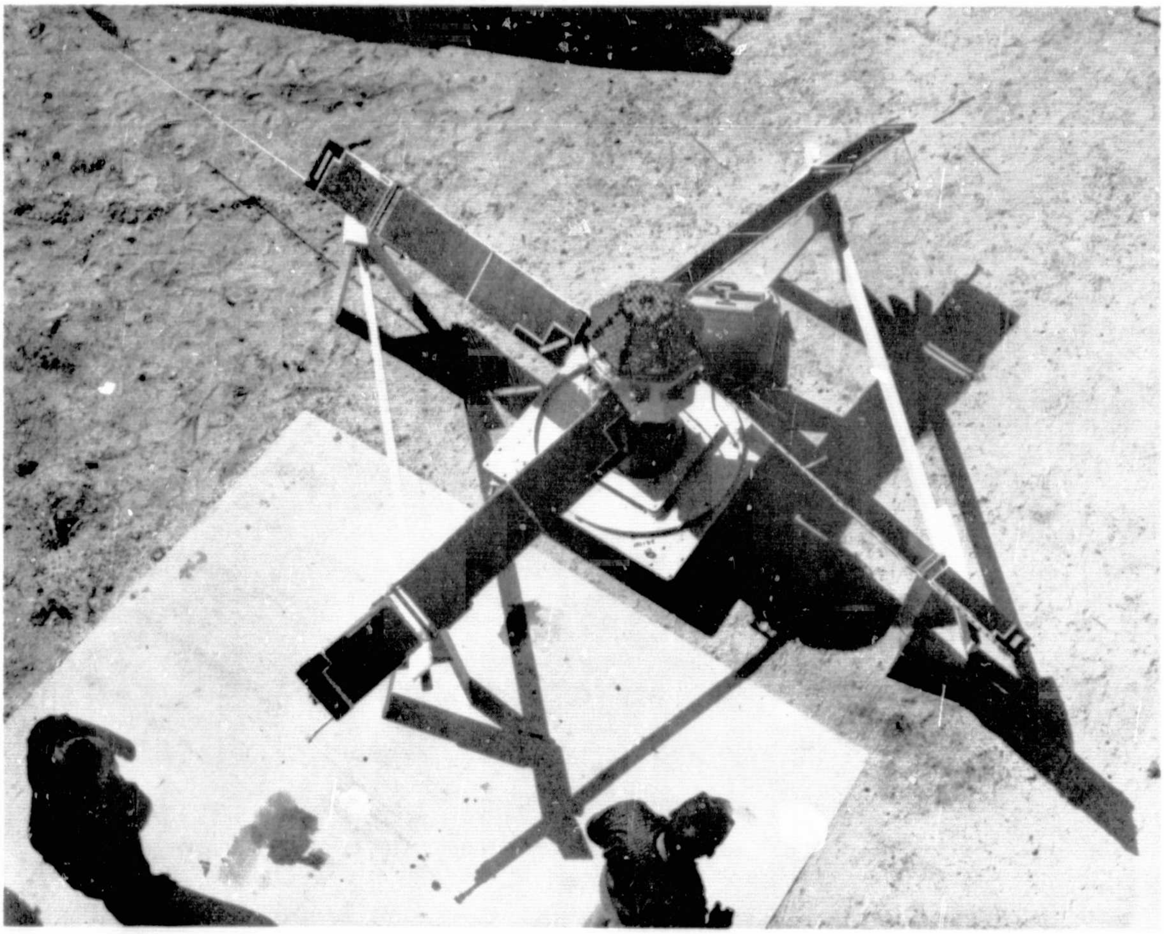
EXPLORER XXII (Continued)

Selected References:
Bourdeau, R.E.: Description of the S-66 Spacecraft, *COSPAR Info. Bull.*, no. 15, May 1963.

Brace, L.H. and Reddy, B.M.: Early Electrostatic Probe Results from Explorer 22, *J. Geophys. Res.*, *70*, 5783, Dec. 1, 1965.

NASA: Polar Ionosphere Beacon Satellite (S-55), *NASA TM-X-55009*, 1963.

Plotkin, H.H.: Laser Reflections from the Beacon Explorer Satellites, *NASA TM-X-57166*, 1965.



SAN MARCO I 1964 84A

Dec. 15, 1964	Scout/Wallops Island	95 min.
Feb. 16, 1965	250 lb.	128/510 mi.
Sept. 13, 1965	A. J. Caporale	---

Objectives: To measure air and electron density of the upper atmosphere. To study radio wave propagation phenomenon known as "ducting".

Instrument/Discipline	Experimenter/Affiliation
Satellite accelerometer-P	L. Broglio/U. Rome, Italy
Faraday rotation experiment-I	N. Carrara/U. Florence, Italy

Remarks: An Italian satellite project. First satellite to be built and instrumented in Western Europe; first satellite launched in U. S. by a non-U. S. crew.

Selected References:

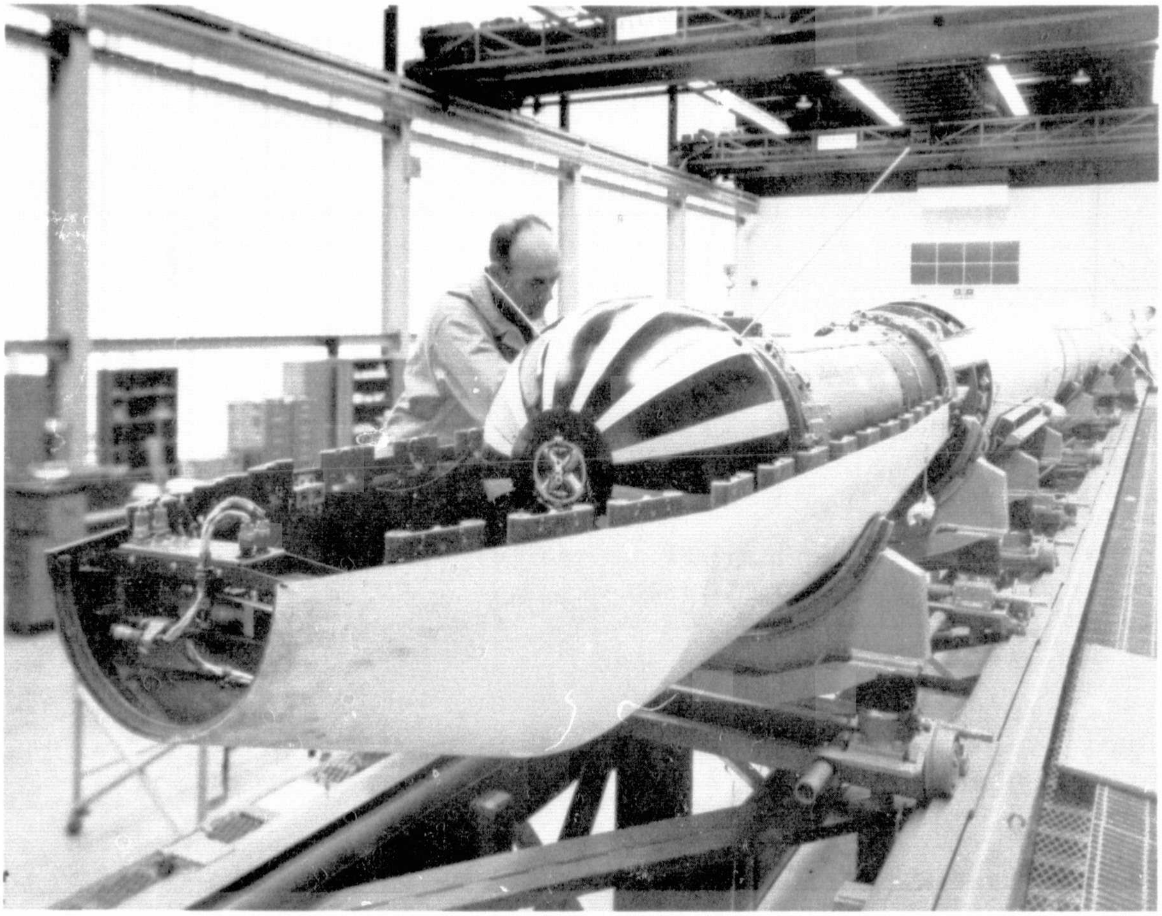
Broglio, L.: The San Marco 1-A Scientific Satellite, in *Spacecraft Systems*, M. Lunc, ed., Gordon and Breach, New York, 1966, p. 407.

Broglio, L.: First Density Experiment with the San Marco Instrumentation, in *Space Research V*, D.G. King-Hele, P. Muller, and G. Righini, eds., Interscience Publishers, New York, 1965, p. 1124.

Broglio, L.: Air Density Between 200 and 300 km Obtained by San Marco 1 Satellite, in *Space Research VII*, R.L. Smith-Rose, ed., Interscience Publishers, New York, 1967, p. 1135.

Broglio, L.: The San Marco Project - A Program of International Cooperation, *UN Paper 68-95862*, 1968.

SAN MARCO I (Continued)



C 2

EXPLORER XXVI 1964 86A

Dec. 21, 1964	Delta/ETR	456 min.
May 26, 1967	101 lb	190/16,250 mi.
In orbit	G.W. Longanecker	L. Davis

Objectives: To study the injection, trapping, and behavior of the trapped radiation belt (natural and artificial). The particle measurements will be correlated with data from the magnetic field experiment. (An Energetic Particles Explorer).

Instrument/Discipline Experimenter/Affiliation

Same as Explorer XV.

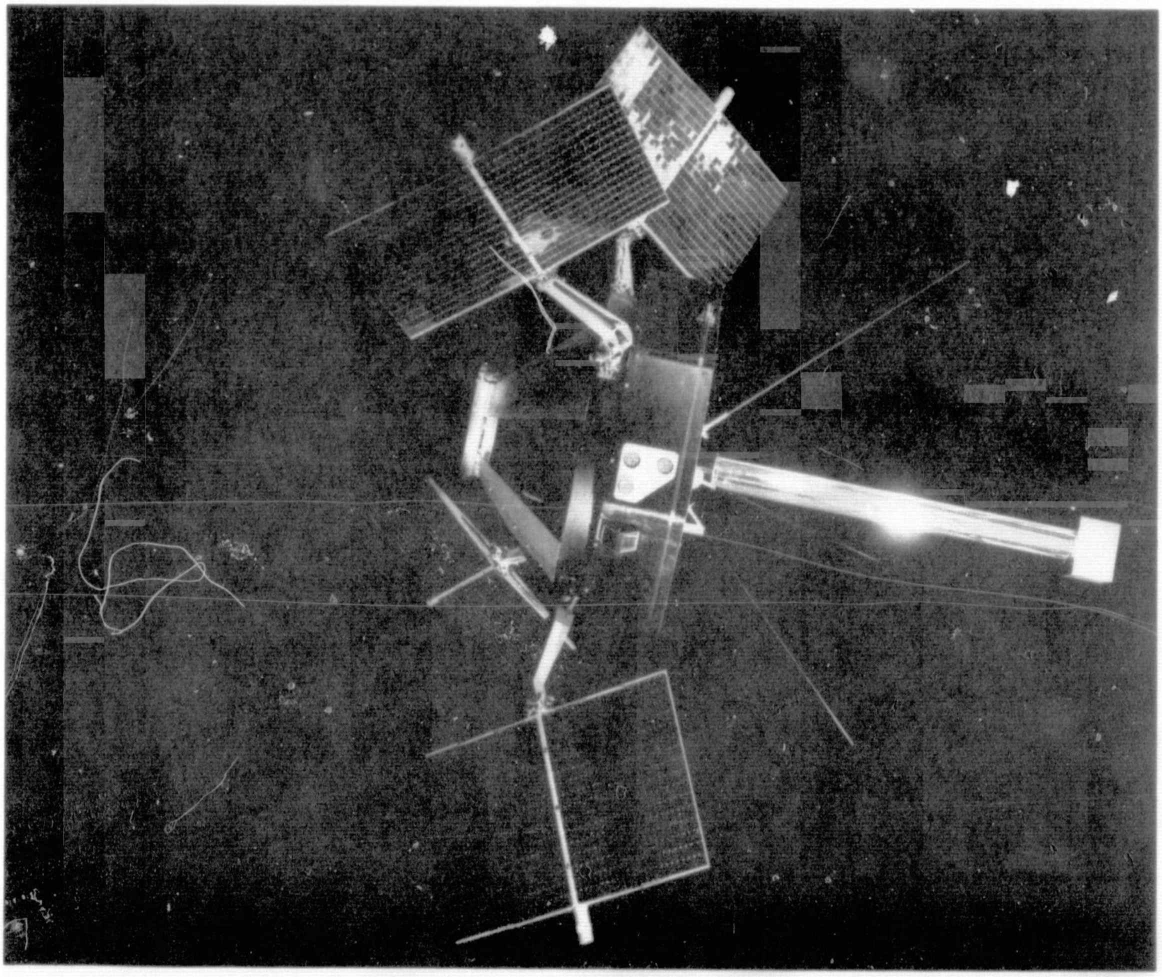
Remarks: The satellite continued the work of earlier satellites in the Energetic Particles Explorer series, which measured the Van Allen belts and the artificial radiation belt (produced by the "Starfish" nuclear explosion in the Pacific.)

Selected References:

Williams, D.J., Arens, J.F., and Lanzerotti, L.J.: Observations of Trapped Electrons at Low and High Altitudes, *NASA TM-X-63121*, 1968.

See also: References under Explorer XII.

EXPLORER XXVI (Continued)



TIROS IX 1965 4A

Jan. 22, 1965	Delta/ETR	119 min.
Retired	305 lb	436/1602 miles
In orbit	R. Rados	-----

Objectives: To launch a wheel-mode TIROS spacecraft that will contribute to the development of a global meteorological observation system. To explore the use of Sun-synchronous orbits.

Instrument/Discipline | Experimenter/Affiliation

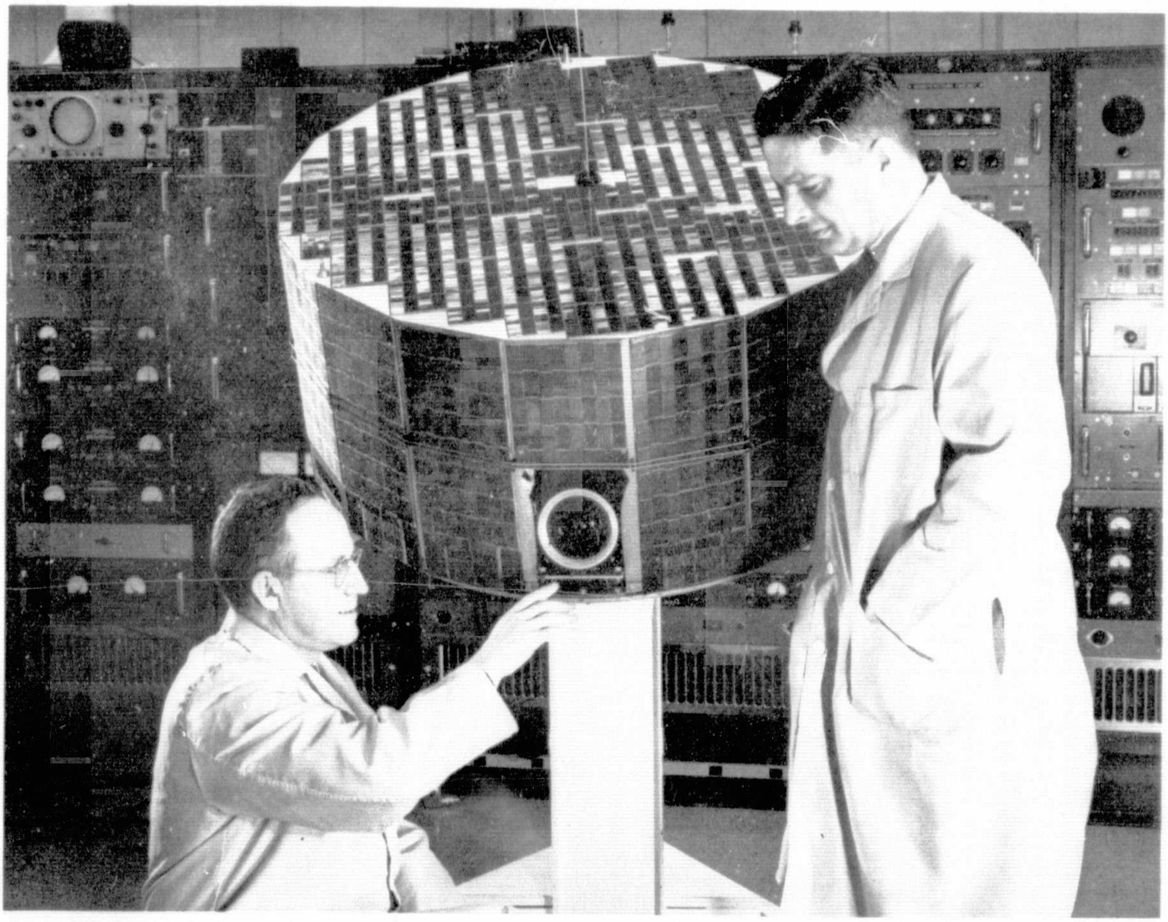
Two TV camera systems

Remarks: Proved out the wheel-mode TIROS design. Daily world-wide photography of cloud cover accomplished.

Selected References:

See: References under Tiros I.

TIROS IX (Continued)



ORBITING SOLAR OBSERVATORY II 1965 7A

Feb. 3, 1965	Delta/ETR	97 min.
Nov. 6, 1965	545 lb	343/393 miles
In orbit	L. T. Hogarth	J.C. Lindsay

Objectives: To conduct solar physics experiments above the Earth's atmosphere, where the short-wave-length portion of the solar spectrum can be viewed.

Instrument/Discipline	Experimenter/Affiliation
Pointed Experiments	
Ultraviolet spectrometer-spectroheliograph 300-1400A-S	L. Goldberg/Harvard U. E.M. Reeves W.H. Parkinson W. Liller
X-ray telescope and spectroheliograph-S	T.A. Chubb/NRL
White light coronograph-spectroheliograph-S	R. Tousey/NRL
Wheel Experiments	
Zodiacal light experiment-A	E.P. Ney/U. Minnesota
Gamma-ray Cerenkov telescope-A	C.P. Leavitt/U. New Mexico
Gamma-ray scintillator-S	K.J. Frost/GSFC
Ultraviolet spectrophotometer 1500-3200A-A	K.L. Hallam/GSFC
Measurement of thermal-radiation characteristics of surfaces to determine emissivity stability of spacecraft temperature-control coatings.	C.B. Neel/ARC

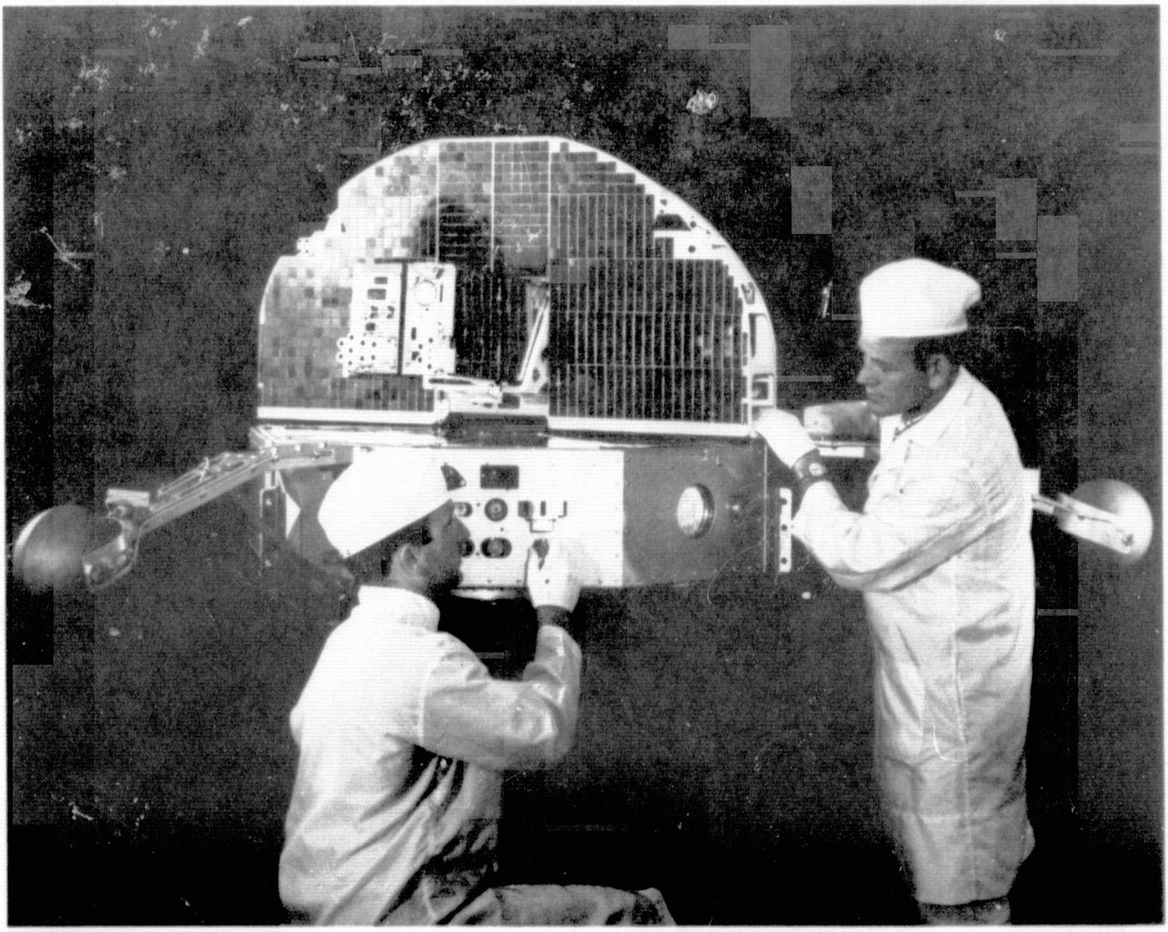
Remarks: Due to diminishing pitch gas supply, terminal maneuver was begun on September 24, 1965. Expanded analysis of solar radiation begun by OSO I.

ORBITING SOLAR OBSERVATORY II (Continued)

Selected References:
Pearson, B.D., Jr., and Neel, C.B.: Albedo and Earth-Radiation Measurements from OSO-II, *AIAA Paper 67-330*, 1967.

NASA: History of the Orbiting Solar Observatory OSO-2, *NASA TM-X-55590*, 1966.

See also: References under OSO I.



EARLY BIRD		1965 28A
April 6, 1965	TAD/ETR	24 hr.
Retired	87 lb	21,748/22,733 mi.
In orbit	C.P. Smith	----

Objectives: Commercial communications. (Project of Comsat Corp.)

Remarks: GSFC provided launching and associated services on a reimbursible basis. Satellite operation was the responsibility of the Communications Satellite Corp.

Selected References:

Barstow, J.M.: Satellite Communication Systems, *Microwave J.*, *9*, 100, Nov. 1966.

Bentley, R.M.: Early Bird, *Astronautics & Aeronautics*, *3*, 26, March 1965.

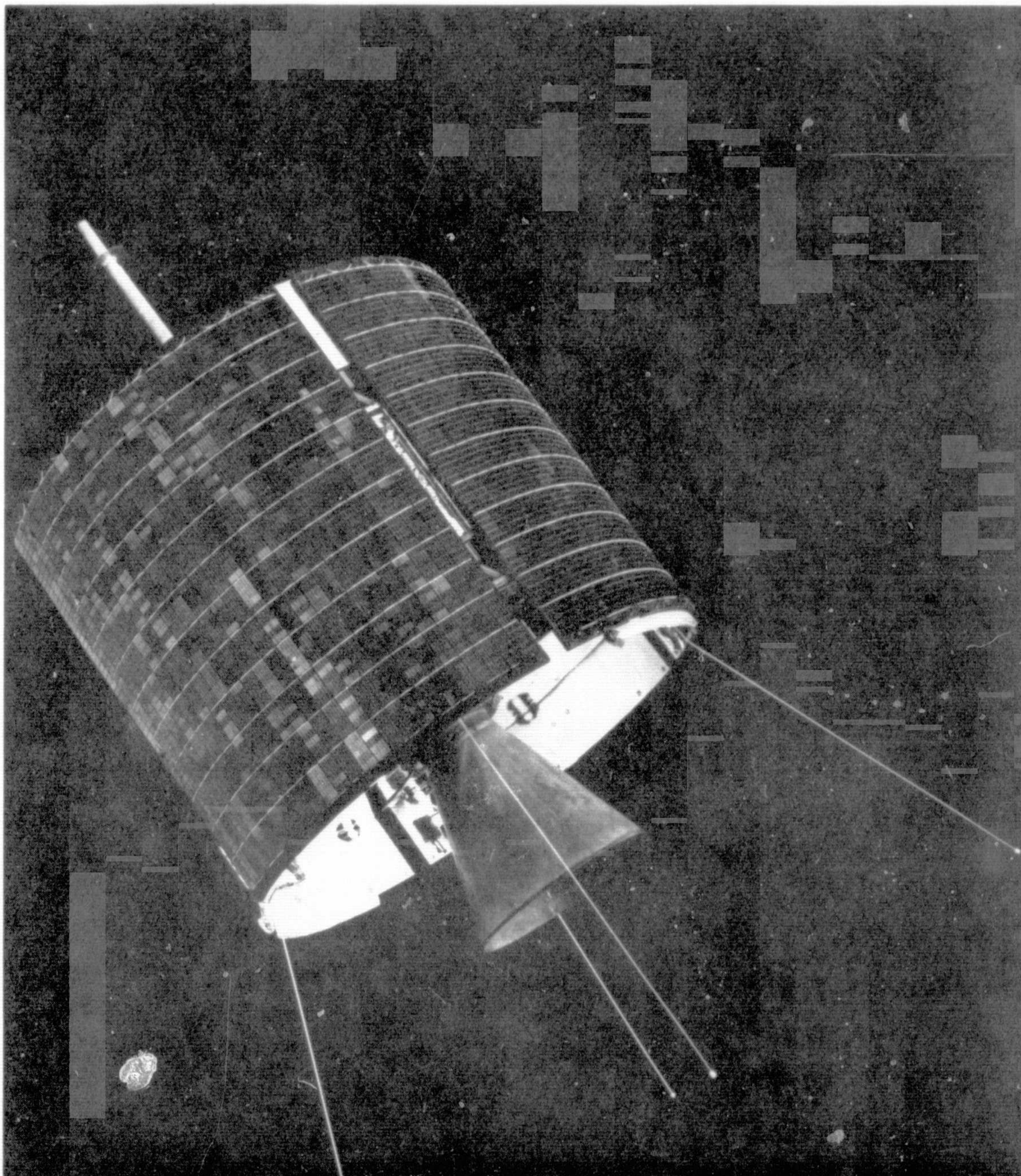
Bentley, R.M.: Early Bird Experimental Results, in *Meteorological and Communication Satellites*, M. Lunc, ed., Gordon and Breach, New York, 1966, p. 91.

Gray, L.F.: Experimental Performance of the Early Bird Communication System, in *Communication Satellite Systems Technology*, R.B. Marsten, ed., Academic Press, 1966.

Spaulding, S.W.: Commercial Satellite Communications, in *Practical Space Applications*, L.L. Kavanau, ed., American Astronautical Society, Sun Valley, 1967, p. 17.

Votaw, M.J.: The Early Bird Project, in *Meteorological and Communication Satellites*, M. Lunc, ed., Gordon and Breach, New York, 1966, p. 103.

EARLY BIRD (Continued)



EXPLORER XXVII 1965 32A

April 29, 1965	Scout/Wallops Island	108 min.
Active	134 lb	584/819 miles
In orbit	F.T. Martin	R.E. Bourdeau and R. Newton

Objectives: Ionosphere: To study for a minimum period of 1 year, the variations of electron density as a function of latitude, and seasonal and diurnal time, under varying magnetic and solar conditions. To support the beacon experiment by determining the electron density in the vicinity of the spacecraft. To test the feasibility of laser tracking.

Geodesy: To study orbital perturbations in order to deduce the size and shape of the Earth and the nature of its gravitational field.

Instrument/Discipline Experimenter/Affiliation

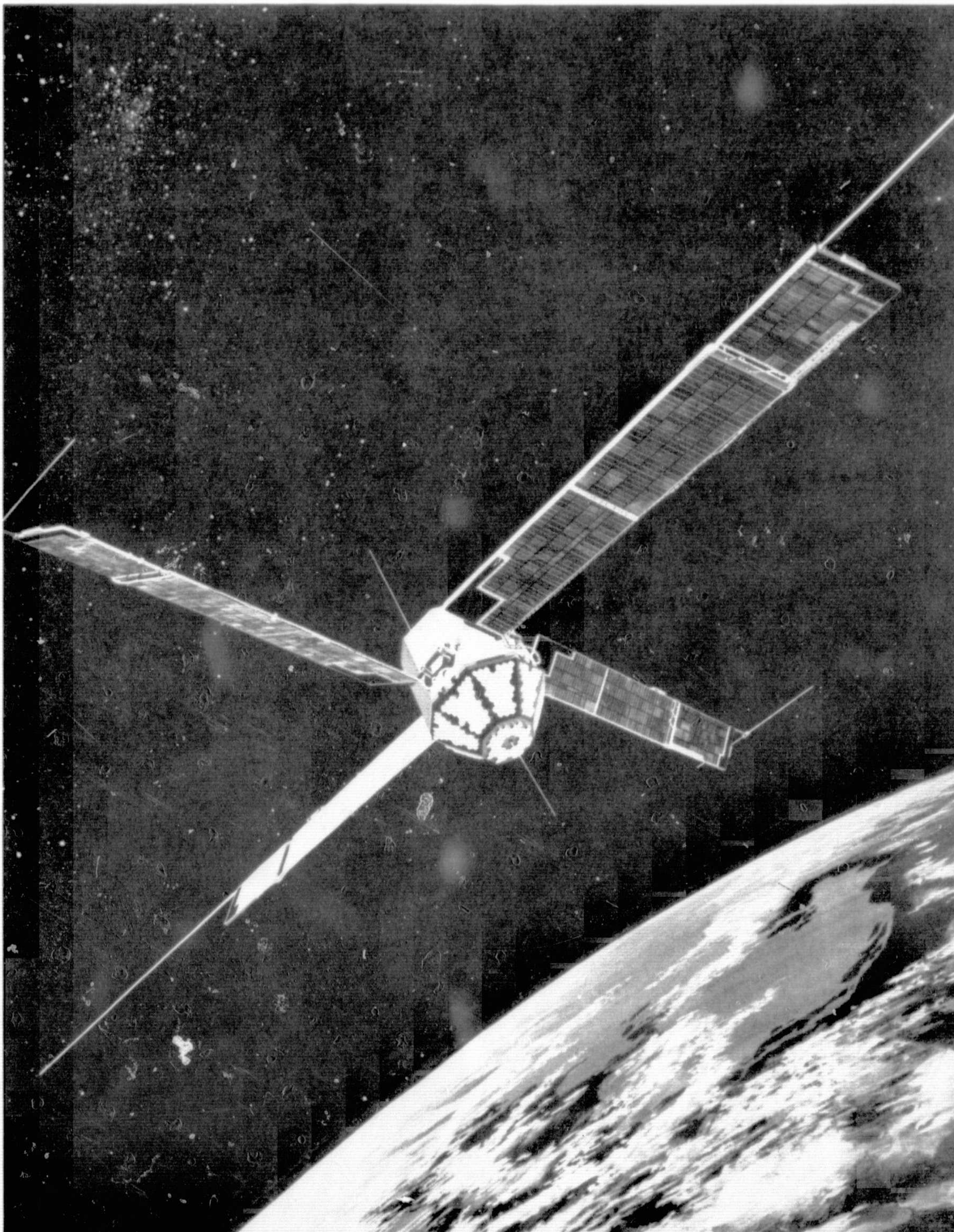
Same as Explorer XXII

Remarks: Many stations operated by prime experimenters. See list under Explorer XXII.

Selected References:

See: References under Explorer XXII.

EXPLORER XXVII (Continued)



EXPLORER XXVIII 1965 42A

May 29, 1965	Delta/ETR	142 hr.
May 1967	150 lb	120/164,000 mi.
July 4, 1968	P. Butler	F.B. McDonald

Objectives: To study the radiation environment of cislunar space over a significant portion of a solar cycle. To study the quiescent properties of the interplanetary magnetic field and its dynamical relationships with the sun. To develop a solar flare prediction capability for Apollo. To extend the knowledge of solar-terrestrial relationships. To further the development of simple, inexpensive, spin-stabilized spacecraft for interplanetary investigations. An Interplanetary Monitoring Platform (IMP).

Instrument/Discipline Experimenter/Affiliation

Same as Explorer XVIII

Remarks: Successfully placed in highly eccentric orbit. Returning data on Earth's magnetosphere and "magnetic tail."

Selected References:

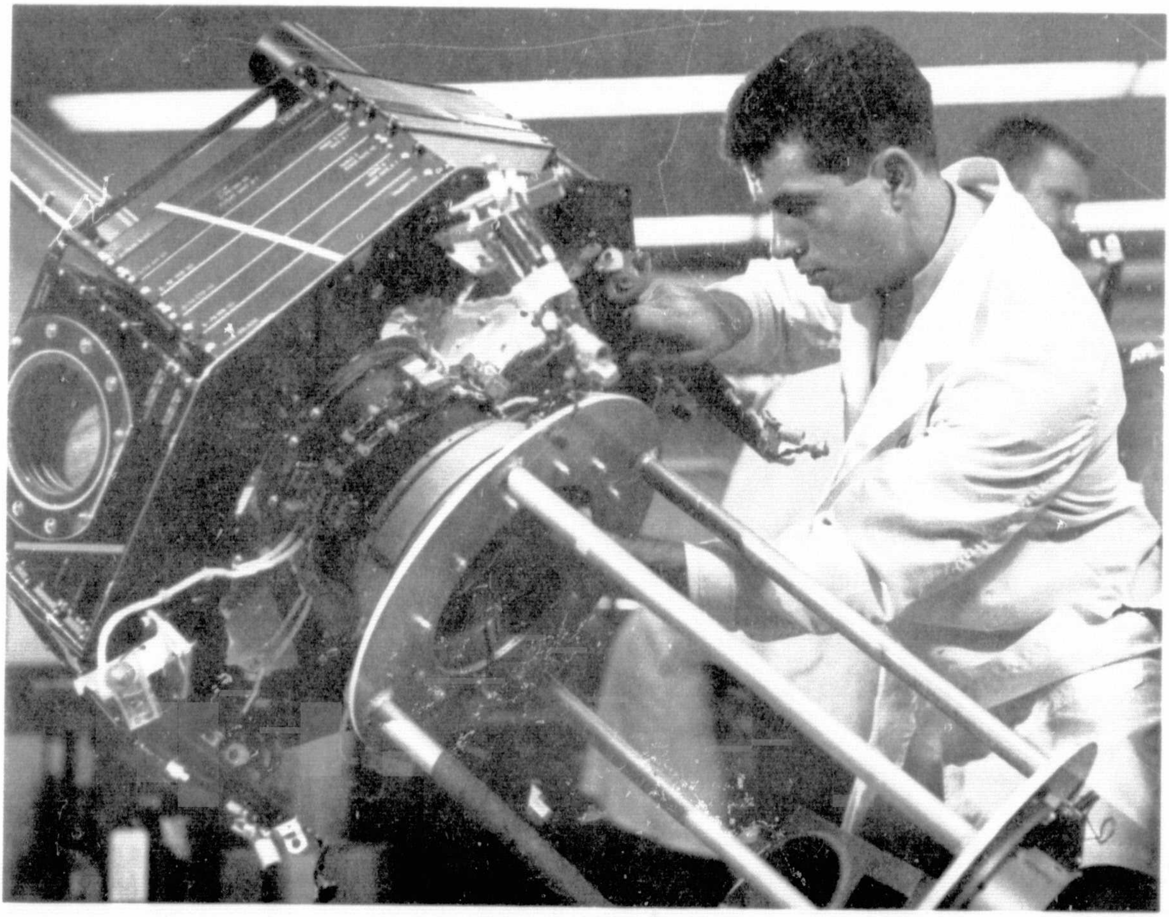
Ness, N.F. and Taylor, H.E.: Observations of the Interplanetary Magnetic Field, July 4-12, 1966, *NASA TM-X-55842*, 1967.

Taylor, H.E.: Sudden Commencement Associated Discontinuities in the Interplanetary Magnetic Field Observed by IMP 3, *NASA TM-X-63246*, 1968.

Balasubrahmanyan, V.K. et al: Co-Rotating Modulations of Cosmic Ray Intensity Detected by Spacecrafts Separated in Solar Azimuth, *NASA TM-X-63654*, 1969.

See also: References under Explorers XVIII and XXI.

EXPLORER XXVIII (Continued)



TIROS X 1965 51A

July 2, 1965	Delta/ETR	100 min.
Retired	280 lb.	458/518 miles
In orbit	R. Rados	---

Objectives: To provide additional operational data for WB requirements.

Instrument/Discipline	Experimenter/Affiliation	
Two TV camera systems	---	ESSA

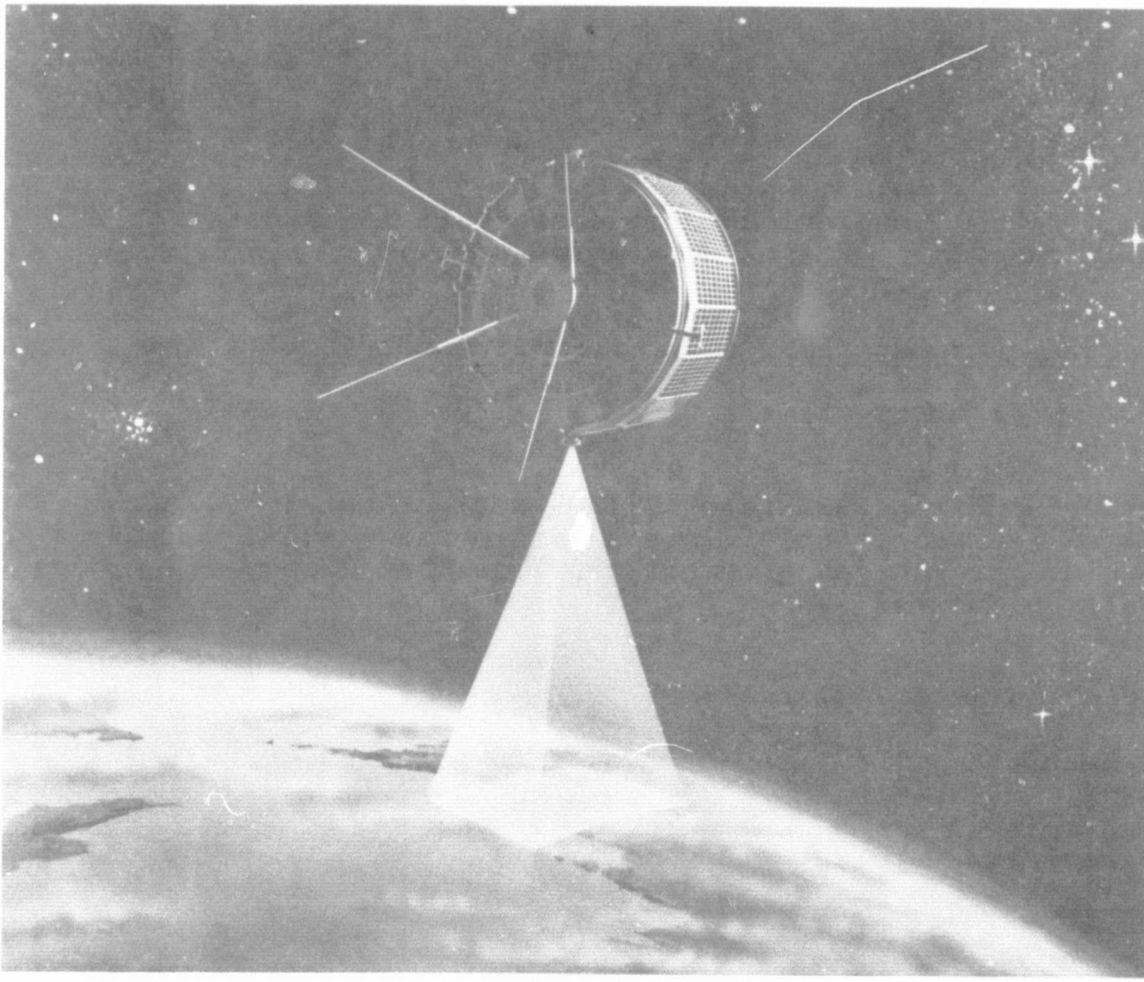
Remarks: First ESSA-funded TIROS weather satellite. The satellite was launched into a near-perfect Sun-synchronous orbit. Precession of orbit was less than 2 degrees per year. Retired June 1967.

Selected References:

Schnapf, A.: The Tiros Decade, *IEEE Spectrum*, *6*, 53, July 1969.

See also: References under Tiros I.

TIROS X (Continued)



ORBITING SOLAR OBSERVATORY C		None
Aug. 25, 1965	Delta/ETR	---
----	619 lb	---
Suborbital	L.T. Hogarth	J.C. Lindsay

Objectives: To conduct solar physics experiments above the Earth's atmosphere, where the short-wave-length portion of the solar spectrum can be viewed.

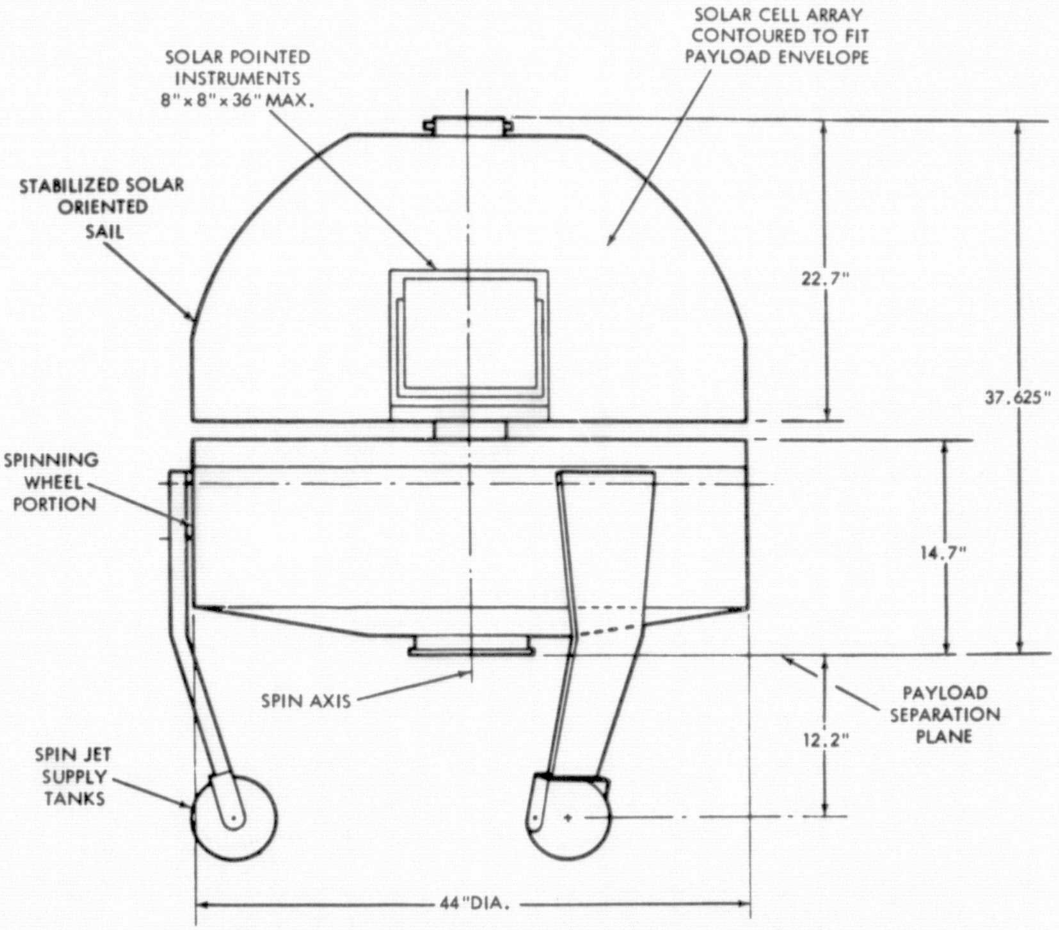
Instrument/Discipline	Experimenter/Affiliation
Same as OSO III (March 8, 1967).	

Remarks: The Delta's third stage failed; the satellite is believed to have impacted in the South Atlantic Ocean.

Selected References:

See: References under OSO III.

ORBITING SOLAR OBSERVATORY C (Continued)



ORIENTED AND SPINNING WHEEL PORTION OF SPACECRAFT

ORBITING GEOPHYSICAL OBSERVATORY II 1965 81A

Oct. 14, 1965	TAT-Agena/WTR	104 min.
Retired Feb. 1968	1148 lb.	256/938 miles
In orbit	W. E. Scull	N. W. Spencer

Objectives: To launch and operate an orbital spacecraft carrying experiments to make geophysical measurements about the Earth.

Instrument/Discipline	Experimenter/Affiliation
Radio noise receiver-A	F. T. Haddock/U. Michigan
VLF receiver-I	R. A. Helliwell/Stanford U. M. G. Morgan/Dartmouth College T. Laaspere
Triaxial search-coil magnetometer-E	R. E. Holzer/UCLA E. J. Smith/JPL
Rubidium-vapor magnetometer-E	J. P. Heppner J. C. Cain/GSFC
Ionization chamber-E	H. R. Anderson/Rice Inst. H. V. Neher/Calif.Inst.Tech.
Scintillator telescope-E	J. A. Simpson/U. Chicago
Cosmic-ray telescope-E	W. R. Webber/U. Minnesota
Geiger counters-E	J. A. Van Allen/State U. of Iowa
Trapped-radiation scintillation detectors-E	R. A. Hoffman/GSFC
Air-glow photometer-R	J. Blamont/U. Paris E. Reed/GSFC
Airglow ion chambers-R	P. M. Mange/NRL
Ultra-violet spectrometer-R	C. A. Barth/JPL L. Wallace/Kitt Peak Nat. Obs.
Quadrupole spectrometer-R	R. J. Leite/U. Michigan
RF mass spectrometer-R	H. A. Taylor, Jr./GSFC
Ion gauge-R	G. P. Newton/GSFC
Micrometeoroids-P	W. M. Alexander/GSFC
Plasma analyzer-I	R. E. Bourdeau/GSFC
X-ray ion chamber-S	R. W. Kreplin/NRL
Solar ultraviolet spectrometer-S	H. E. Hinteregger/AFCRL

Remarks: Due to difficulties encountered in the attitude control system and the abnormal consumption of control gas, the satellite exhausted its supply of control gas and entered a random tumbling mode. In a polar orbit.

ORBITING GEOPHYSICAL OBSERVATORY II (Continued)

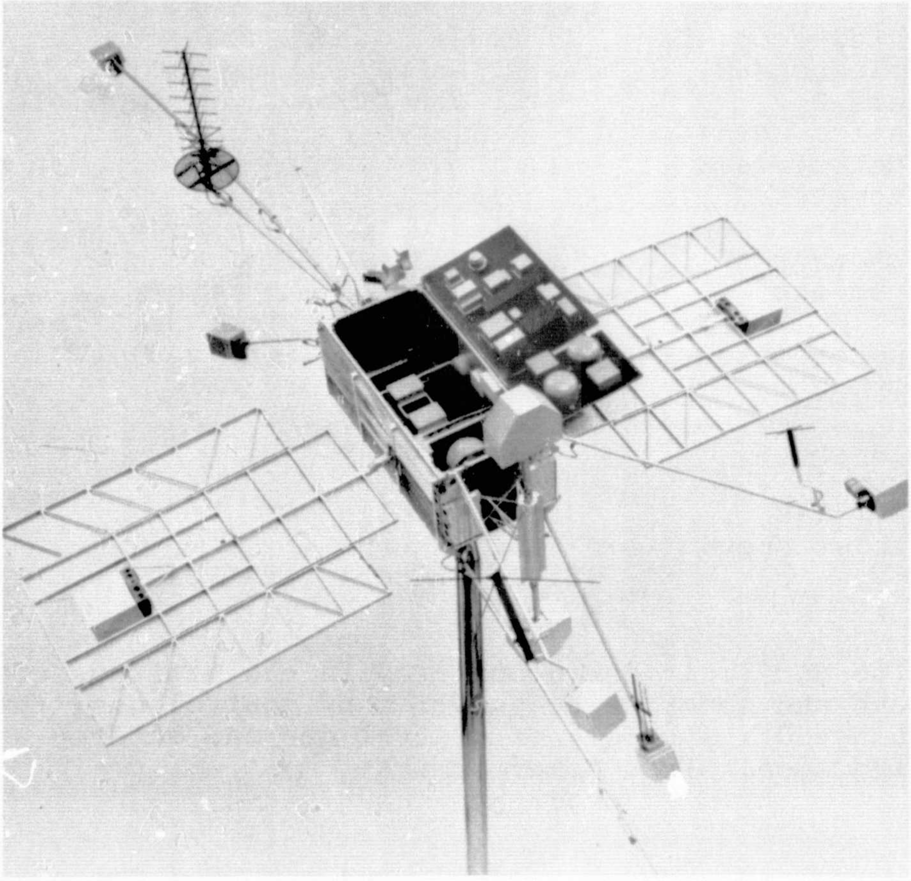
Selected References:
Cain, J.C., Langel, R.A., and Hendricks, S.J.: First Magnetic Field Results from the OGO-2 Satellite, in *Space Research VII*, R.L. Smith-Rose, ed., Interscience Publishers, New York, 1967, p. 1466.

Frank, L.A.: Low-Energy Proton and Electron Experiment for the Orbiting Geophysical Observatories B and E, *AD-466738*, 1965.

Nilsson, C.S. and Southworth, R.B.: The Flux of Meteors and Micrometeoroids in the Neighborhood of the Earth, *NASA CR-95692*, 1967.

Reed, E.I. and Blamont, J.E.: Some Results Concerning the Principle Airglow Lines as Measured from the OGO-II Satellite, in *Space Research VII*, R.L. Smith-Rose, ed., Interscience Publishers, New York, 1967, p. 337.

See also: References under OGO I.



EXPLORER XXIX 1965 89A

Nov. 6, 1965	TAD/ETR	120.3 min
Active	385 lb	693/1414 miles
In orbit	J.D. Rosenberg	N. Roman

Objectives: To intercompare tracking system accuracies; to study the fine structure of the Earth's gravitational field; to improve worldwide geodetic datum accuracies; to improve coordinates of satellite tracking stations.

Experiment/Instrument	Experimenter/Affiliation
Geodetic aids, including optical and radio beacons, radio transponders, laser corner reflectors	----/NASA

Remarks: Explorer XXIX (also called Geos I) was launched for NASA Headquarters by GSFC

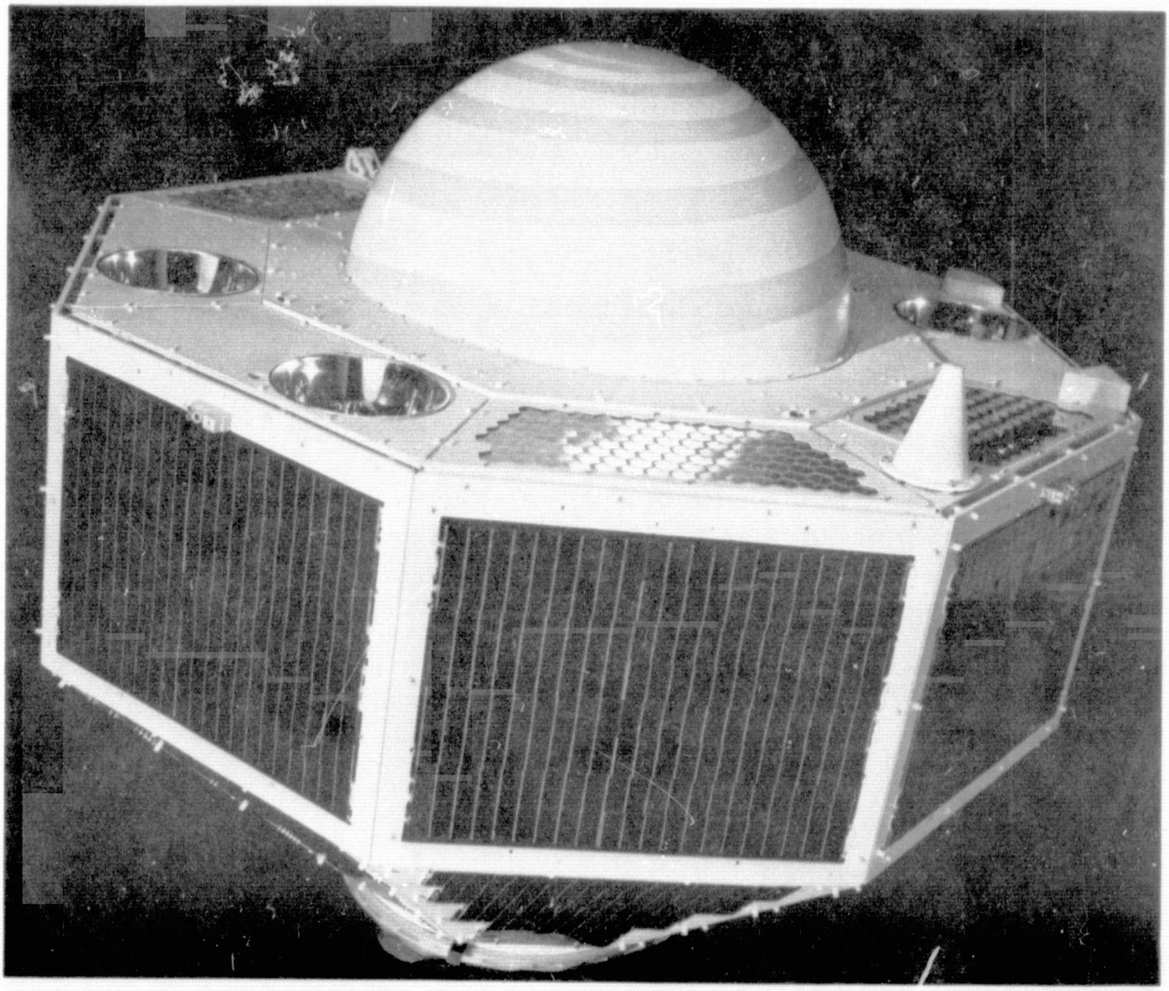
Selected References:

Newton, R.R.: Characteristics of the Geos A Spacecraft, *AD-463141*, 1964.

Communications and Systems, Inc.: Proceedings of the Geos Program Review Meeting. Volume 1: Geos-I Operations and Plans for Geos-B. Volume 2: Geometric and Gravimetric Investigations with Geos-I. *NASA CR-100679* and *NASA CR-100675*, 1968.

Lynn, J.J.: Short Arc Optical Survey of the Geos North American Network, *COSPAR Paper*, Prague, 1969.

EXPLORER XXIX (Continued)



EXPLORER XXX 1965 93A

Nov. 19, 1965	Scout/Wallops	103 min
Active	125 lb	440/548 miles
In orbit	M.J. Aucremanne	R.W.Kreplin

Objectives: To monitor solar X-rays during the IQSY.

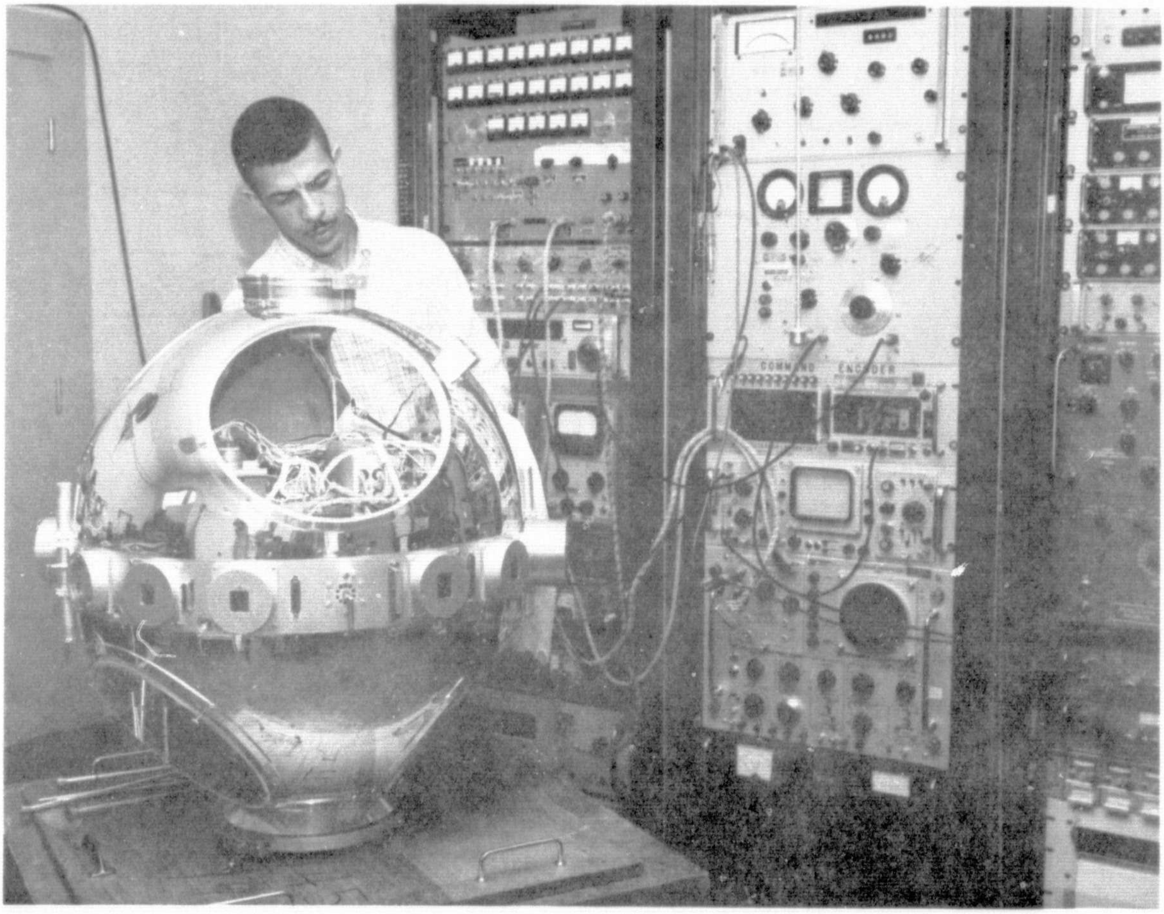
Experiment/Instrument	Experiment/Affiliation
X-ray ion-chamber photometer-S	----/NRL
X-ray Geiger counters - S	----/NRL
Lyman-alpha ion chamber - S	----/NRL

Remarks: Explorer XXX (also called a Solar Explorer) was launched by NASA for NRL.

Selected References:
Corliss, W.R.: Scientific Satellites, *NASA SP-133*,1967.

Friedman, H., and Kreplin, R.W.: The Slowly Varying Component of Solar X-Ray Emission in the Period 1-15 July 1966, *The Proton Flare Project*, A.C. Stickland, ed., M.I.T. Press, Cambridge 1969, pp. 78-81.

EXPLORER XXX (Continued)



EXPLORER XXXI	1965 98A
ALOUETTE II	1965 98B

Nov. 29, 1965	Thor-Agena/WTR	121 min.
Dec. 1966	218 lb (Explorer)	314/1856 mi.
(Alouette still active)	323 lb (Alouette)	314/1850 mi.
Both in orbit	E.D. Nelson	J.E. Jackson

Objectives: To sound the topside of the ionosphere using topside sounder and measurement techniques. (ISIS-X)

Instrument/Discipline	Experimenter/Affiliation
ALOUETTE II	
Topside sounding of the ionosphere-I	E.S. Warren/DRTE
Galactic and solar radio noise receiver-A	T.R. Hartz/DRTE
VLF receiver-I	R. Barrington/DRTE
Energetic particle detectors-E	I. McDiarmid/NRC
Electrostatic probes-I	L. Brace/GSFC
EXPLORER XXXI	
Thermal ion and electron probes-I	J. Donley/GSFC
Electrostatic probe-I	L. Brace/GSFC
Electron probe-I	A. Willmore/UCL
Spherical ion-mass spectrometer-I	A. Willmore/UCL
Magnetic ion-mass spectrometer-I	J. Hoffman/SCAS
Energetic current monitor-I	E. Maier/GSFC

Remarks: A second Canadian Alouette satellite and another U.S. Explorer satellite were launched simultaneously. This double-launch project, known as ISIS-X, was the first in a new cooperative NASA/Canadian Defense Board program for International Satellites for Ionospheric Studies (ISIS). Alouette II was designed and built by Canada's DRB; Explorer was designed and built for GSFC by APL.

EXPLORER XXXI
ALOUETTE II (Continued)

Selected References:

Barrington, R.E. and Hartz, T.R.: Satellite Ionosonde Records---Resonances Below the Cyclotron Frequency, *Science, 160*, 181, April 12, 1968.

Brace, L.H. and Findlay, J.A.: Comparisons of Cylindrical Electrostatic Probe Measurements on Alouette 2 and Explorer 31, *NASA TM-X-63292*, 1968.

Donley, J.L.: Observations of the Polar Ionosphere in the Altitude Range 2000 to 3000 km by Means of Satellite Borne Electron Traps, *NASA TM-X-55851*, 1967.

Hoffman, J.H.: Composition Measurements of the Topside Ionosphere, *Science, 155*, 322, Jan. 20, 1967.

Nelms, G.L. et al: The Alouette II Satellite, *NASA TM-X-57352*, 1965.

Nelms, G.L. and Lockwood, G.E.K.: Early Results from the Topside Sounder in the Alouette II Satellite, in *Space Research VII*, R.L. Smith-Rose, ed., Interscience Publishers, New York, 1967, p. 604.

Jackson, J.E., and Warren, E.S.: Objectives, History, and Principal Achievements of the Topside Sounder and ISIS Programs, *IEEE Proc., 57*, 861, June 1969.

Mar, J., and Garrett, T.: Mechanical Design and Dynamics of the Alouette Spacecraft, *IEEE Proc., 57*, 882, June 1969.

Thomas, J.O., and Andrews, M.K.: Transpolar Exospheric Plasma I, *J. Geophys. Res., 73*, 7407, Dec. 1, 1968.

Dyson, P.L.: Direct Measurements of the Size and Amplitude of Irregularities in the Topside Ionosphere, *NASA TM-X-63512*, 1969.

Findlay, J.A., and Brace, L.H.: Cylindrical Electrostatic Probes Employed on Alouette II and Explorer XXXI Satellites, *IEEE Proc., 57*, 1054, June 1969.

Franklin, C.A., and Maclean, M.A.: The Design of Swept-Frequency Topside Sounders, *IEEE Proc., 57*, 897, June 1969.

EXPLORER XXXI
ALOUETTE II (Continued)

Harvey, R.W.: Evidence of Electrostatic Proton Cyclotron Harmonic Waves from Alouette 2 Satellite Data, *J. Geophys. Res., 74*, 3969, Aug. 1, 1969.

Ramasastry, J., Walsh, E.J., and Herman, J.R.: Conjugate Echoes in Alouette-2 Topside-Sounder Data, *IEEE Trans., AP-16*, 771, Nov. 1968.

Rao, B.C.N., and Maier, E.J.R.: Photoelectron Flux and Protonospheric Heating during the Conjugate Point Sunrise, *NASA TM-X-63655*, 1969.

Wrenn, G.L.: The Langmuir Plate and Spherical Ion Probe Experiments Aboard Explorer XXXI, *IEEE Proc. 57*, 1072, June 1969.

FRENCH-1A 1965 101A

Dec. 6, 1965	Scout/WTR	99.8 min.
Active	135 lb.	458/484 mi.
In orbit	S. R. Stevens	R. W. Rochelle

Objectives: To study the properties of the VLF wave field in the magnetosphere; to study the irregularities and the distribution of ionization in the magnetosphere.

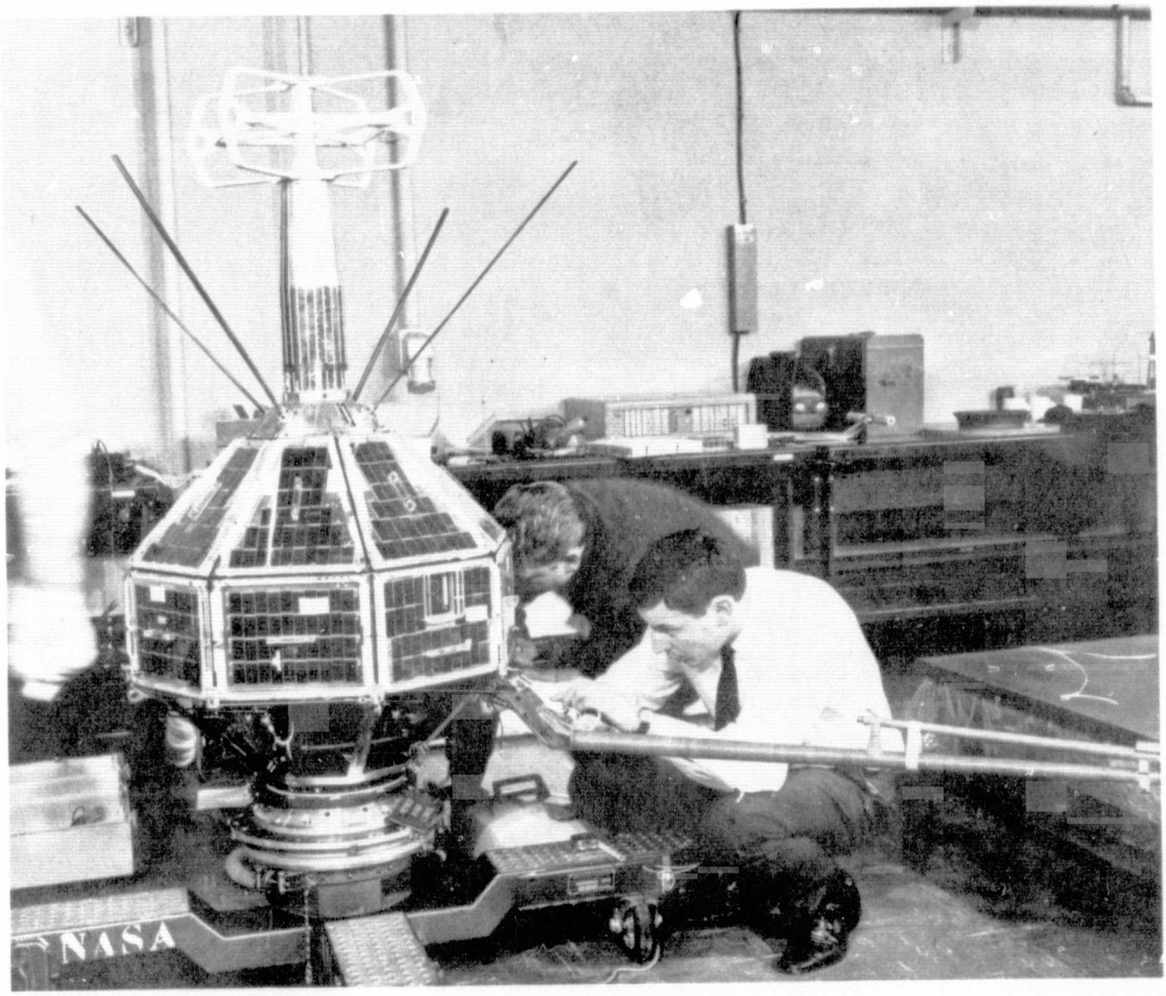
Instrument/Discipline	Experimenter/Affiliation
VLF experiment-I	L. R. O. Storey/CNET
Electron probe-I	J. Sayers/U. Birmingham

Remarks: Spacecraft was designed, constructed, and tested by the Centre National d'Etudes, in France (CNET).

Selected References:

Causse, J.-P.: FR-1 Satellite, in *Spacecraft Systems*, M. Lunc, ed., Gordon and Breach, New York, 1966, p. 395.

FRENCH-1A (Continued)



ESSA I 1966 08A

Feb. 3, 1966	Delta/ETR	100 min.
Retired	305 lb.	432.9/522.6 mi.
In orbit	R. Rados	---

Objectives: To launch a wheel-mode TIROS spacecraft that will contribute to the development of a global meteorological observation system.

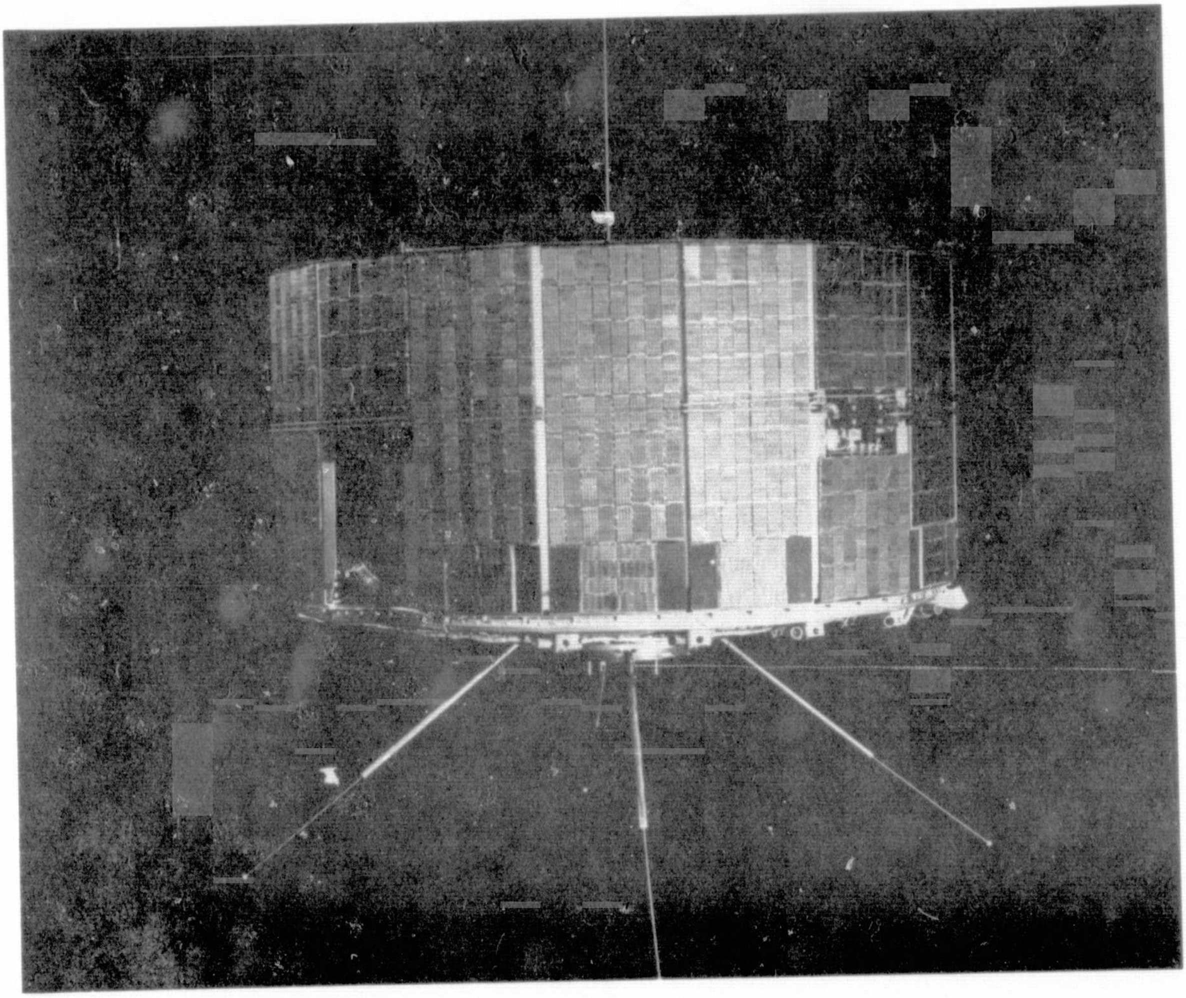
Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: First of the ESSA operational satellite systems.

Selected References:

Krawitz, L. and Hoedemaker, R.W.: The ESSA Satellite---A New Role for Tiros, *SMPTE Preprint 101-56*, 1967.

ESSA I (Continued)



ESSA II 1966 16A

Feb. 28, 1966	TAID/ETR	113.4 min.
Active	290 lb.	839/876 miles
In orbit	W. W. Jones	---

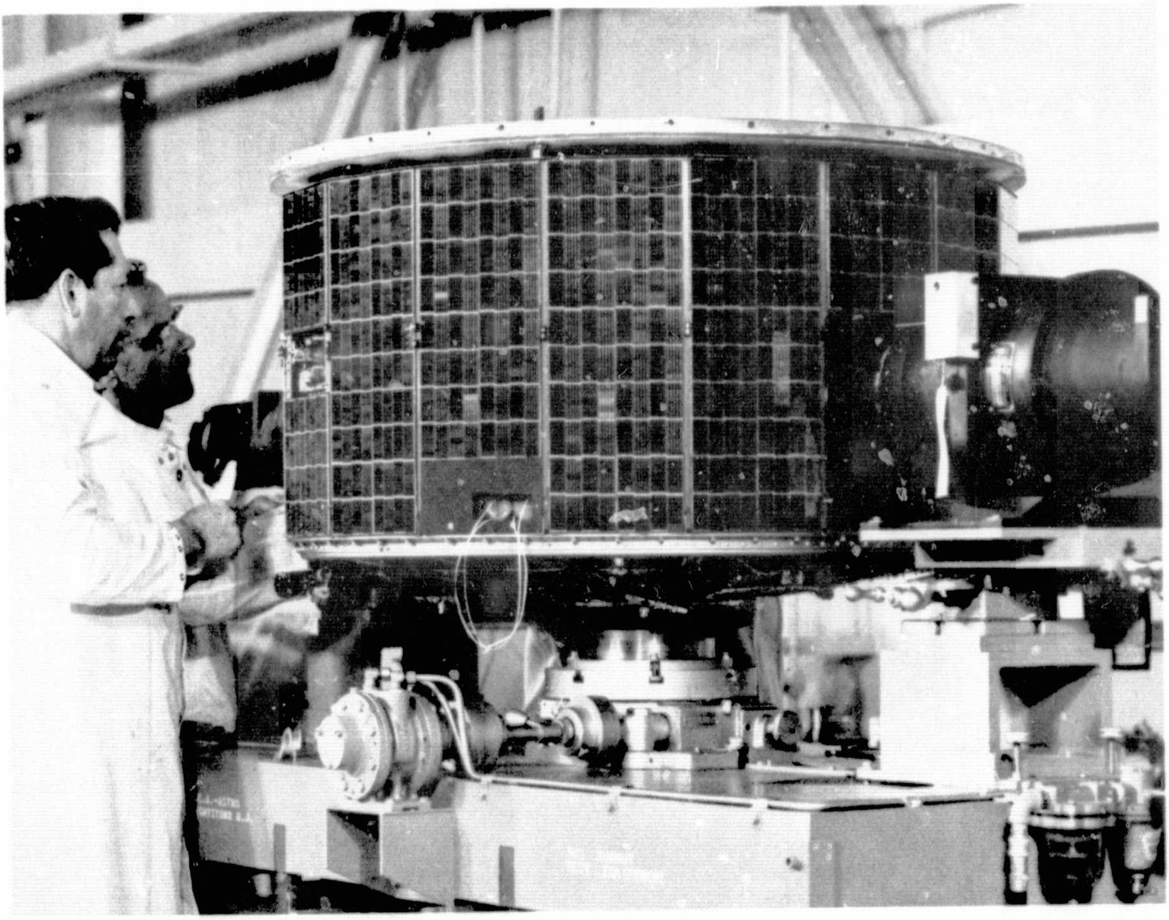
Objectives: To provide continuous observation of the Earth's cloud-cover with direct readout TV data on a global basis.

Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: An operational weather satellite system developed by NASA for the U. S. Weather Bureau. Cartwheel configuration, Sun-synchronous orbit permits complete coverage of world's weather. Carries APT.

Selected References:
See: References under ESSA I.

ESSA II (Continued)



ORBITING ASTRONOMICAL OBSERVATORY I 1966 31A

April 8, 1966	Atlas-Agena/ETR	101 min.
April 10, 1966	3900 lb.	492/500 miles
In orbit	R. R. Ziemer	J. E. Kupperian, Jr.

Objectives: To develop a basic spacecraft having the pointing capability, power, and data-handling equipment to make precise telescope observations from above the Earth's atmosphere. Of interest are the emission and absorption characteristics of the Sun, stars, planets, nebulae, and interplanetary and interstellar media in the relatively unexplored infrared, ultraviolet, X-ray, and gamma-ray regions of the spectrum.

Instrument/Discipline	Experimenter/Affiliation
Broadband photometric studies in the ultraviolet-A	A. D. Code/U. Wisconsin
X-ray proportional counter-A	P. C. Fisher/Lockheed
Gamma/X-ray telescope-A	W. Kraushaar/MIT
Gamma-ray telescope-A	K. J. Frost/GSFC

Remarks: Shortly after orbiting, OAO-I began having battery heating problems and other electrical malfunctions. After 1.5 days in orbit, the last battery failed.

Selected References:

Imgram, D.A.: Design and Development of the Orbiting Astronomical Observatory, *Annals N.Y. Acad. Sci., 134*, 183, Nov. 22, 1965.

Rogerson, J.B.: The Orbiting Astronomical Observatories, *Space Sci. Rev., 2*, 621, Nov. 1963.

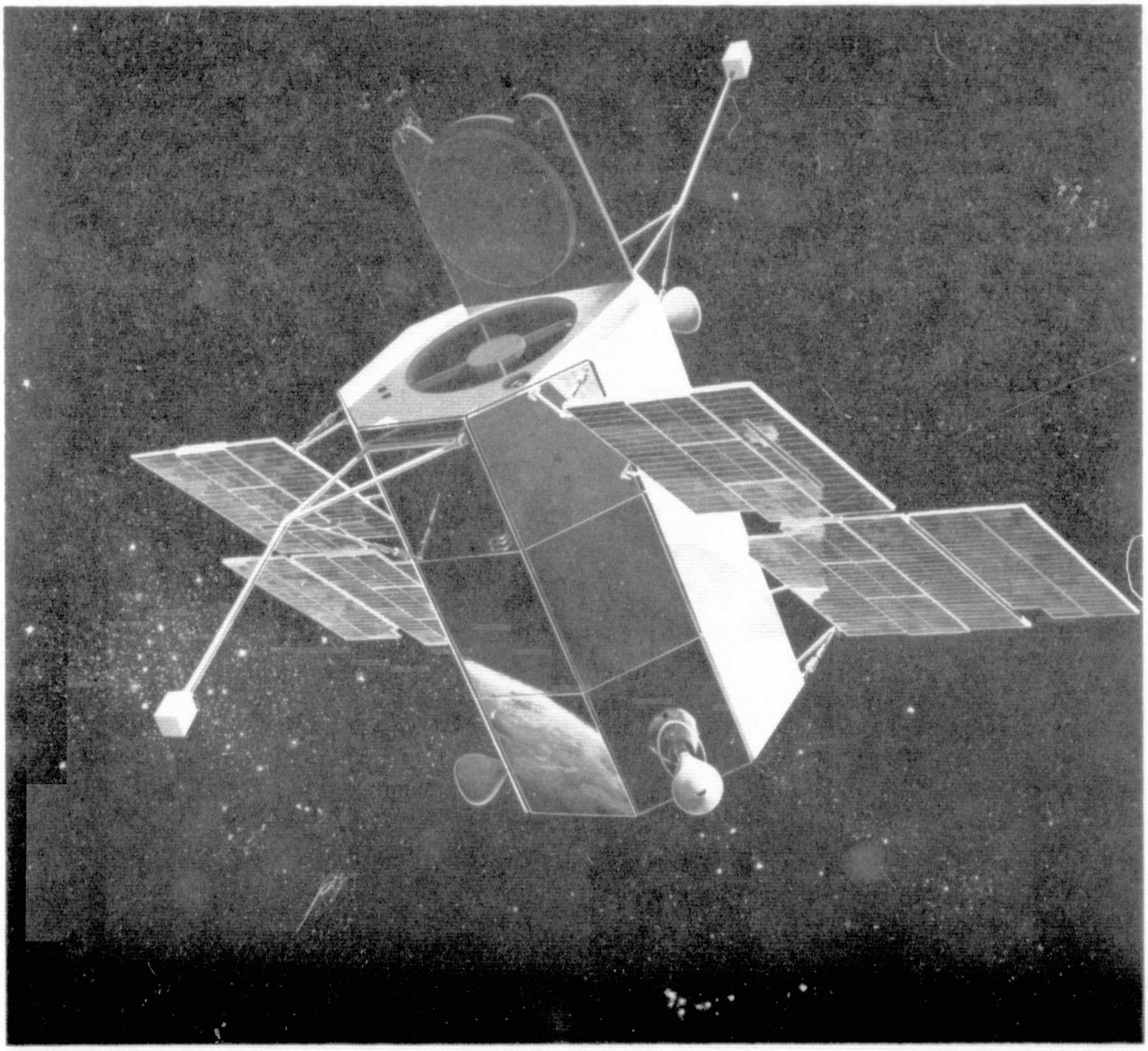
Scott, W.H.: The Engineering Design of the Orbiting Astronomical Observatory, *The Observatory Generation of Satellites, NASA SP-30*, 1963.

Stambler, I.: The Orbiting Observatories, *Space/Aero., 42*, 34, Sept. 1964.

ORBITING ASTRONOMICAL OBSERVATORY I (Continued)

Ziemer, R.R.: Orbiting Astronomical Observatories, *Astronautics*, *6*, 36, May 1961.

Ziemer, R.R. and Kupperian, J.E.: The Mission of the Orbiting Astronomical Observatory, in *The Observatory Generation of Satellites, NASA SP-30*, 1963.



NIMBUS II 1966 40A

May 15, 1966	TAT-Agena/WTR	108 min.
Active	935 lb.	681/733 miles
In orbit	H. Press	W. Nordberg

Objectives: To extend the meteorological data obtained from Nimbus I to a broad range of seasonal and hemispheric variations in weather systems, and to test new sensors in the infrared radiation region.

Instrument/Discipline	Experimenter/Affiliation
Advanced vidicon camera system	J. R. Schulman/GSFC
Automatic picture transmission system (APT)	J. R. Schulman/GSFC
High-resolution infrared radiometer	L. L. Foshee/GSFC
Medium-resolution infrared radiometer	A. W. McCulloch/GSFC

Remarks: Direct readout of infrared pictures of APT stations. All sensors returned good data for both R & D and operational purposes.

Selected References:

Allied Research Associates: Interpretation of Baroclinic Systems and Wind Fields as Observed by Nimbus 2 MRIR, Final Report, *NASA CR-94688*, 1968.

Allied Research Associates: The Nimbus II Data Catalog, Vol. 1. 15 May-30 June 1966, *NASA CR-80342*, 1966.

Howe, J.B. et al: Nimbus II Users Guide, *NASA CR-80361*, 1966.

McNaney, J.J., Palmer, B.A., and Shapiro, R.: Nimbus II Flight Evaluation, Launch through Orbit 5275, *NASA TN-D-4881*, 1969.

NIMBUS II (Continued)

Bowley, C.J.: Use of Nimbus 2 APT to Determine the Rate of Ice Disintegration and Dispersion in Hudson Bay, *NASA CR-106478*, 1969.

Davis, P.A.: Study of Medium-Resolution Radiometric Data from Nimbus 2, *NASA CR-73953*, 1968.

Nordberg, W. et al: Preliminary Results from Nimbus II, *Bull, Amer. Met. Soc., 47*, 857, Nov. 1966.

Nordberg, W.: Summary Report on the Nimbus II Satellite, in *Space Research VIII*, A.P. Mitra et al, eds., Interscience Publishers, New York, 1968, p. 1002.

Pallmann, A.J.: The Synoptics, Dynamics and Energetics of the Temporal Using Satellite Radiation Data. The Temporal of June 1966 as Enhanced by the Nimbus 2 HRIR, MRIR, AVCS, and Maritime Observations, *PB-180287*, 1969.

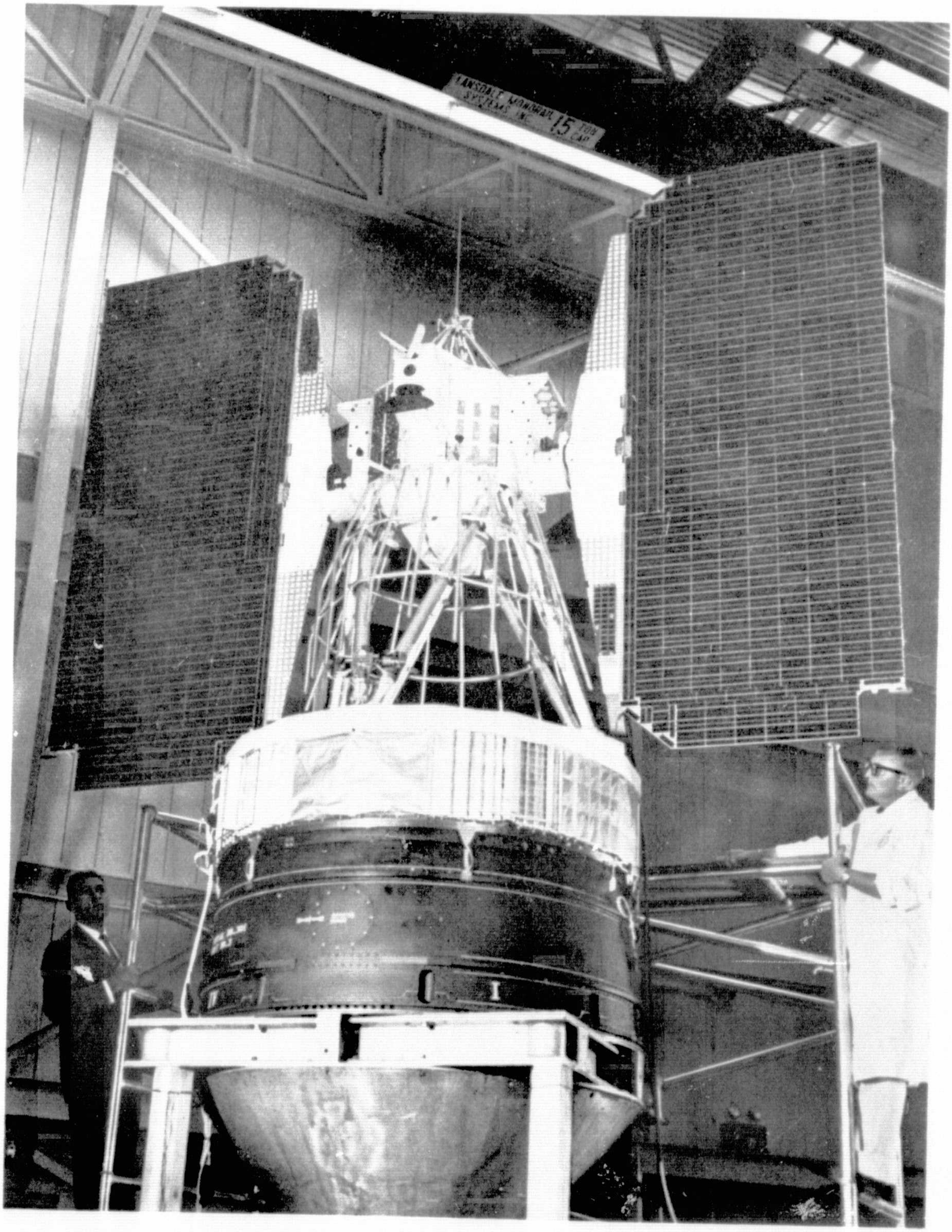
Pouquet, J., and Raschke, E.: A Preliminary Study of the Detection of the Geomorphological Features over Northeast Africa by Satellite Radiation Measurements in the Visible and Infrared, *NASA TN-D-4648*, 1968.

Pouquet, J.: An Approach to the Remote Detection of Earth Resources in Sub-Arid Lands, *NASA TN-D-4647*, 1968.

Raschke, E.: The Radiation Balance of the Earth-Atmosphere System from Radiation Measurements of the Nimbus 2 Meteorological Satellite, *NASA TN-D-4589*, 1968.

Warnecke, G. and McCulloch, A.W.: Stratospheric Temperature Patterns Derived from Nimbus II Measurements, in *Space Research VIII*, A.P. Mitra et al, eds., Interscience Publishers, New York, 1968, p. 1024.

NIMBUS II (Continued)



EXPLORER XXXII 1966 44A

May 25, 1966	Delta/ETR	116 min.
March 22, 1967	485 lb.	173/1629 mi.
In orbit	N. W. Spencer	L. H. Brace

Objectives: To study the structure and physics of the upper atmosphere between 135 and 650 statute miles.

Instrument/Discipline	Experimenter/Affiliation
Redhead ion gauges-RP	C. Reber/GSFC
	J. Cooley/GSFC
Ion gauges-RP	G. P. Newton/GSFC
Electrostatic probes-RPI	L. Brace/GSFC
Ion-mass spectrometer-RPI	H. Brinton/GSFC
	R. A. Pickett/GSFC
	H. A. Taylor/GSFC

Remarks: Second stage burned too long, giving higher apogee than planned. Experiments performed well. The higher altitude enhanced the altitudinal resolution of the measured atmospheric parameters.

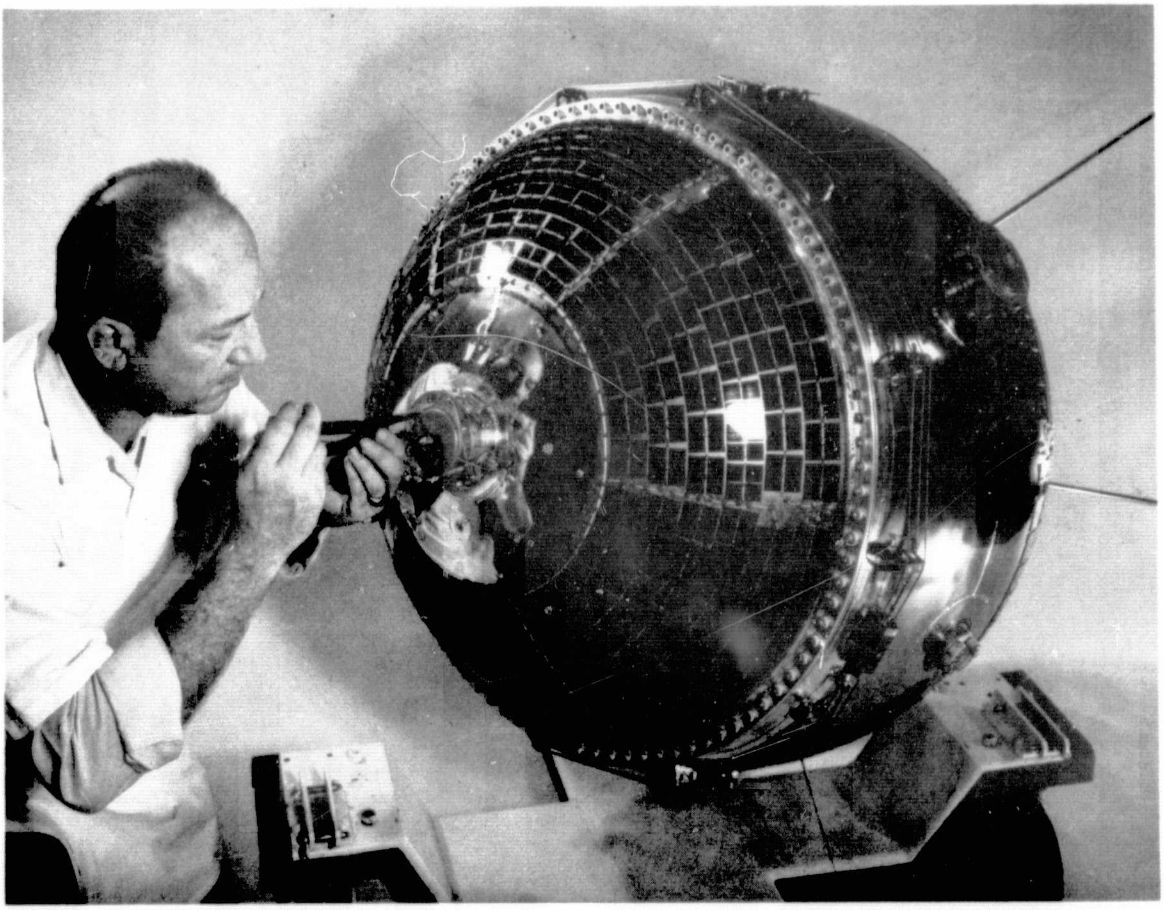
Selected References:

Newton, G.P. and Peiz, D.T.: Latitudinal Variations in the Neutral Atmospheric Density, *NASA TM-X-63264*, 1968.

Reber, C.A., Cooley, J.E., and Harpold, D.N.: Upper Atmosphere Hydrogen and Helium Measurements from the Explorer 32 Satellite, in *Space Research VIII*, A.P. Mitra et al, eds., Interscience Publishers, New York, 1968, p. 993.

Brinton, H.C., Pickett, R.A., and Taylor, H.A., Jr.: Diurnal and Seasonal Variation of Atmospheric Ion Composition: Correlation with Solar Zenith Angle, *NASA TM-X-63443*, 1968.

EXPLORER XXXII (Continued)



ORBITING GEOPHYSICAL OBSERVATORY III 1966 49A

June 7, 1966	Atlas-Agena/ETR	48.6 hr.
Active	1133 lb.	170/75,769 mi.
In orbit	W. E. Scull	G. H. Ludwig

Objectives: To launch and operate an orbital spacecraft carrying experiments to make geophysical measurements about the Earth.

Instrument/Discipline	Experimenter/Affiliation
Essentially the same as OGO-I except for changes noted below.	
Low-energy proton detector-E	D. S. Evans/GSFC
Radio propagation-I	J. K. Hargreaves/ESSA
Interplanetary dust particles-P	J. L. Bohn/Temple U.

Remarks: The satellite lost its capability to be Earth anchored on July 23, 1966, and became spin-stabilized. First highly elliptical orbit satellite to be three-axis stabilized. All experiments operated; returned good data.

Selected References:

Arnoldy, R.L., Kane, S.R., and Winckler, J.R.: A Study of Energetic Solar Flare X-Rays, *Solar Physics, 2*, 171, Sept. 1967.

Cline, T.L., Holt, S.S., and Jones, E.W.: High-Energy Solar X-Rays of 7 July 1966, *NASA TM-X-55846*, 1967.

Frank, L.A.: Several Observations of Low-Energy Protons and Electrons in the Earth's Magnetosphere with OGO 3, *J. Geophys. Res., 72*, 1905, April 1, 1967.

Frank, L.A.: On the Extraterrestrial Ring Current During Geomagnetic Storms, *J. Geophys. Res., 72*, 3753, Aug. 1, 1967.

ORBITING GEOPHYSICAL OBSERVATORY III (Continued)

Frank, L.A. and Swisher, R.L.: Energy Fluxes of Low-Energy Protons and Positive Ions in the Earth's Inner Radiation Zone, *J. Geophys. Res.*, *73*, 442, Jan. 1, 1968.

Russell, C.T. et al: OGO 3 Search Coil Magnetometer Data Correlated with the Reported Crossing of the Magnetopause at 6.6 R_E by ATS 1, *J. Geophys Res.*, *73*, 5759, Sept. 1, 1968.

Vasyliunas, V.M.: Low Energy Electrons in the Magnetosphere as Observed by OGO 1 and OGO 3, *NASA CR-89092*, 1967.

Wolff, C.: Optical Environment about the OGO-III Satellite, *Science*, *158*, 1045, Nov. 24, 1967.

Fichtel, C.E.: Gamma Ray Astronomy, *Significant Accomplishments in Science 1968*, Goddard Space Flight Center, Greenbelt, 1969, pp. 172-187.

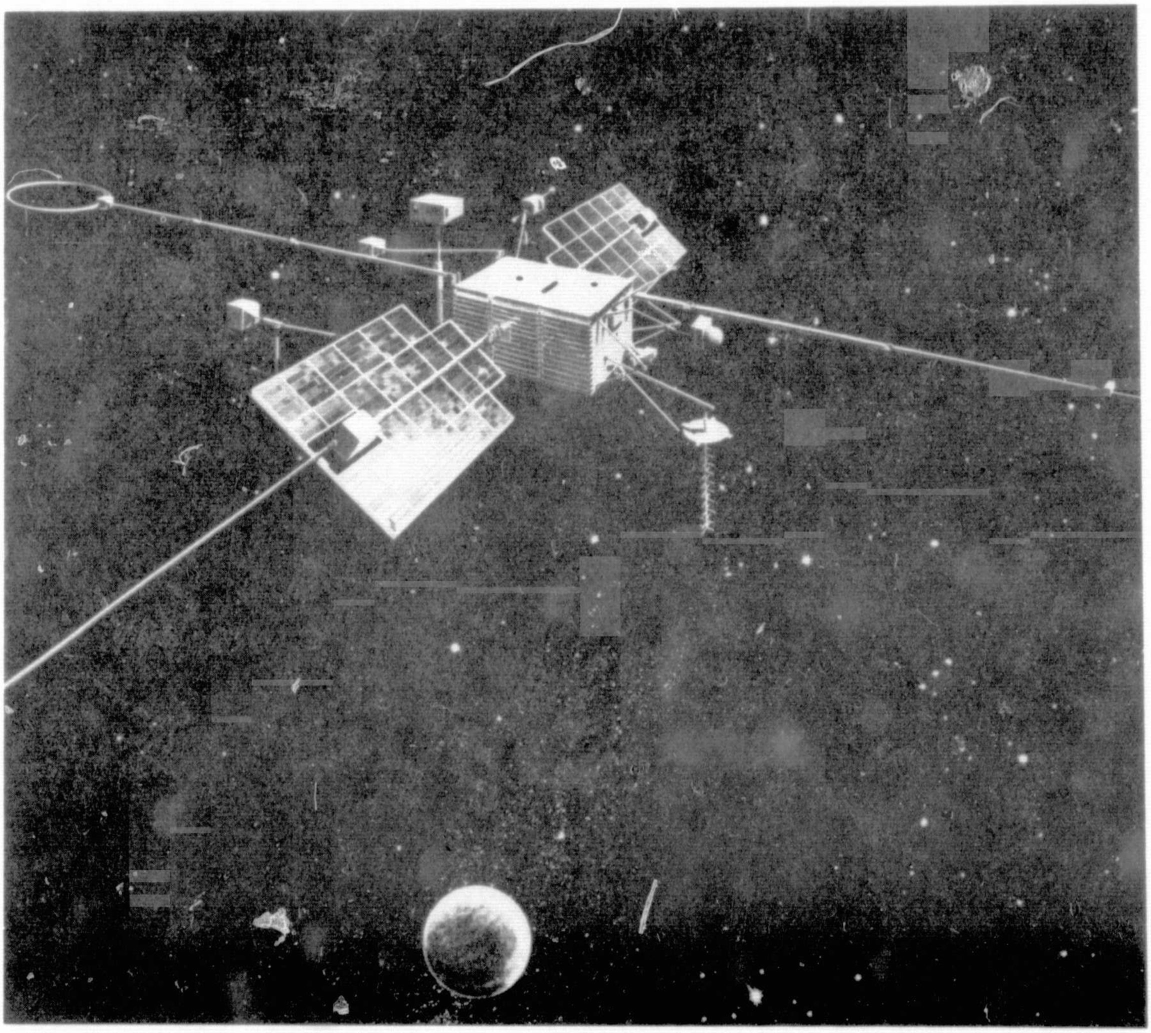
Heppner, J.E. et al: A Preliminary Survey of the Distribution of Micropulsations in the Magnetosphere from OGO's 3 and 5, *NASA TM-X-63682*, 1969.

Pfitzer, K.A., and Winckler, J.R.: Intensity Correlations and Substorm Drift Effects in the Outer Radiation Belt Measured with the OGO-III and ATS-I Satellites, *NASA CR-101640*, 1969.

Pfitzer, K.A., Lezniak, T.W., and Winckler, J.R.: Experimental Verification of Drift Sheel Splitting in the Distorted Magnetosphere, *NASA CR-101641*, 1969.

Russell, C.T., Holzer, R.E., and Smith, E.J.: OGO 3 Observations of ELF Noise in the Magnetosphere, *J. Geophys. Rev.*, *74*, 755, Feb. 1, 1969.

ORBITING GEOPHYSICAL OBSERVATORY III (Continued)



EXPLORER XXXIII 1966 58A

July 1, 1966	TAID/ETR	13.9 days to 20.0 days (fluctuating)
Active	206 lb	
In orbit	P.G.Marcotte	18,000/284,000 miles (fluctuating)
		N.F. Ness

Objectives: To anchor a satellite in orbit about the Moon, to measure in detail the solar plasma flux, energetic-particle population, magnetic fields, and cosmic dust in this orbit,and to explore the variations of the Moon's gravitational field and search for a possible lunar ionosphere. (An Anchored IMP).

Instrument/Discipline	Experimenter/Affiliation
Fluxgate magnetometer-E	N.F. Ness/GSFC
Thermal ion probe-I	G.P. Serbu/GSFC E.J. Maier
Fluxgate magnetometers-E	C.P. Sonett/Ames
Ion chamber and two GM tubes-E	K.A. Anderson/UCLA
Tubes and p-on-n junction-E	J.A. Van Allen/State U. Iowa
Faraday-cup probe-E	H.S. Bridge/MIT

Remarks: The spacecraft failed to achieve orbit around the Moon. A highly eccentric Earth orbit with the apogee point beyond lunar orbit permitted the study of solar plasma, energetic particles, and magnetic fields.

Selected References:

Behannon, K.W.: Mapping of the Earth's Bow Shock and Magnetic Tail by Explorer 33, *NASA TM-X-55868*, 1967.

Haskell, G.P.: Energetic Particles in the Outer Magnetosphere: Explorer 33, *NASA CR-95484*, 1968.

EXPLORER XXXIII (Continued)

Lyon, E. et al: Plasma Measurements on Explorer 33, in *Space Research VIII*, A.P. Mitra et al, eds., Interscience Publishers, New York, 1968, p. 99.

Madden, J.J.: Interim Flight Report, Anchored Interplanetary Monitoring Platform AIMP I---Explorer XXXIII, *NASA TM-X-55663*, 1966.

NASA: AIMP (IMP-D) Technical Summary Description, *TM-X-55770*, 1967.

Sonett, C.P.: The Geomagnetic Tail: Topology, Reconnection and Interaction with the Moon, *NASA TM-X-60238*, 1968.

Van Allen, J.A.: The Solar X-Ray Flare of 7 July 1966, *NASA CR-89262*, 1967.

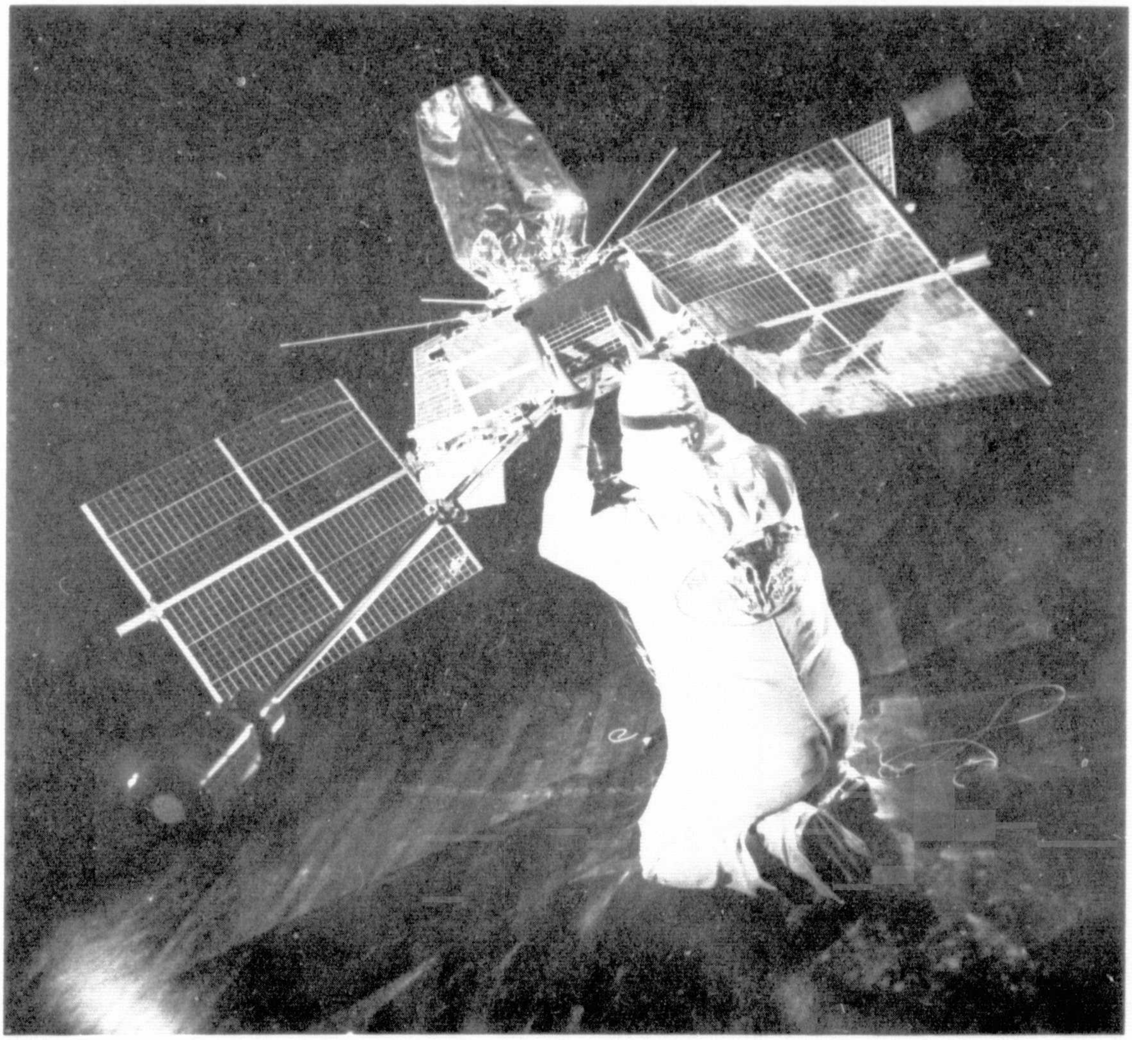
Behannon, K.W.: Geometry of the Geomagnetic Tail, *NASA TM-X-63516*, 1969.

Haskell, G.P.: Anisotropic Fluxes of Energetic Particles in the Outer Magnetosphere, *J. Geophys. Res.*, *74*, 1740, April 1, 1969.

Ogilvie, K.W., and Burlaga, L.F.: Hydromagnetic Shocks in the Solar Wind, *NASA TM-X-63449*, 1969.

Wende, C.D.: The Correlation of Solar Microwave and Soft X-Ray Radiation, *NASA CR-100730*, 1969.

EXPLORER XXXIII (Continued)



ESSA III 1966 87A

Oct. 2, 1966	TAID/WTR	114.5 min.
Active	325 lb.	859/920 miles
In orbit	W. W. Jones	---

Objectives: To provide continuous observations of the Earth's cloud-cover on a global basis. TV data stored on tape recorder and read out at CDA stations.

Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: Advanced cartwheel design. In polar Sun-synchronous orbit.

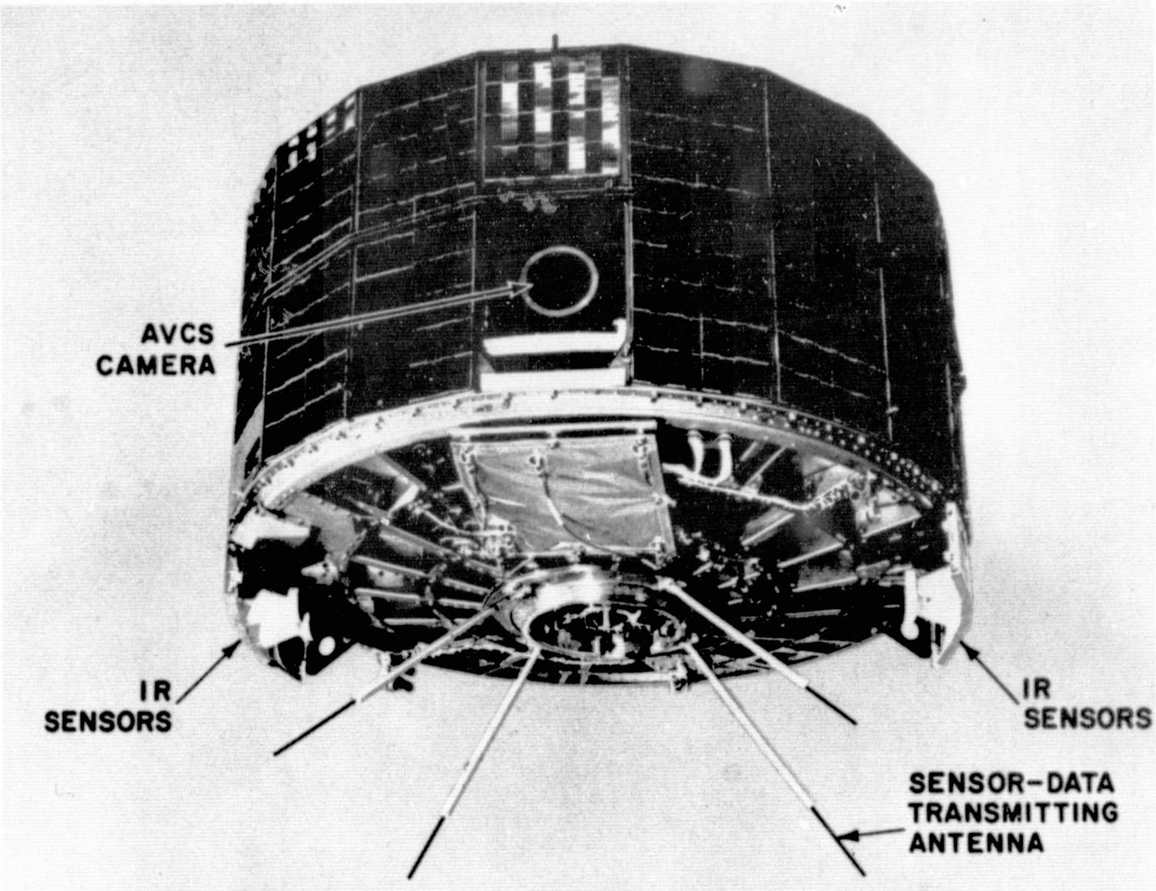
Selected References:

Kornfield, J. et al: Photographic Cloud Climatology from ESSA III and V Computer Produced Mosaics, *Bull. Amer. Met. Soc.*, *48*, 878, Dec. 1967.

Warnecke, G. et al: A Satellite View of Typhoon Marie 1966 Development, *NASA TN D-4757*, 1967.

See also: References under ESSA I.

ESSA III (Continued)



INTELSAT II-A 1966 96A

Oct. 26, 1966	TAID/ETR	1440 min.
Active	192 lb.	2,122/23,271 mi.
In orbit	C. P. Smith	---

Objectives: Commercial communications.

Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: Second COMSAT Corp. commercial satellite; NASA provided reimbursable launch support. Capable of handling TV data transmissions or up to 240 voice channels; part of capacity was purchased by NASA for Apollo support. Satellite failed to achieve synchronous orbit due to a malfunction of the apogee kick motor which limited satellite use to approximately 8 hr. for U. S./Pacific communications.

Selected References:

Taylor, F.J.D.: Intelsat II Systems---The Result of Practical Experience, *AIAA Paper 68-427*, 1968.

INTELSAT II-A (Continued)

APPLICATIONS TECHNOLOGY SATELLITE I 1966 110A

Dec. 7, 1966	Atlas-Agena/ETR	1440 min.
Active	790 lb	22,277/22,920 mi.
In orbit	R.J. Darcey	

Objectives: To test a spacecraft in a stationary orbit with R & D experiments common to spin-stabilized satellite applications. Experiments to include communications, meteorology, and control systems.

Instrument/Discipline	Experimenter/Affiliation
2 SHF repeaters for multiple access and wideband data, including color TV relay. Downlink used to transmit cloudcover pictures.	P. Corrigan/GSFC
1 VHF repeater for ground-to-aircraft relay communications and relay of WEFAX data.	P. Corrigan/GSFC
Electronically despun phased-array antenna used with SHF repeaters.	B. Pickard/GSFC
Nutation sensor to measure spin axis wobble from 5 degrees to one thousandth of a degree.	P. Corrigan/GSFC
Resisto-jet evaluation as low thruster for despin and orbital maneuver use.	D. Suddeth/GSFC
Suprathermal ion detector-I	J. Freeman/Rice U.
Magnetometer-E	P. Coleman/UCLA
Omnidirectional electron-proton detector-I	G. Paulikas/Aerospace Corp.
Electron magnetic spectrometer-I	J. Winckler/U. Minnesota
Multielement particle telescope-E	W. Brown/BTL
Solar radiation damage test-S	R. Waddel/GSFC
Thermal coatings tests	J. Triolo/GSFC
Spin-scan cloud camera	V. Suomi/U. Wisc.
Weather facsimile	B. Drummon/GSFC

Remarks: Circular orbit with zero inclination.

APPLICATIONS TECHNOLOGY SATELLITE I (Continued)

Selected References:

Allied Research Associates: Meteorological Data Catalog for the Applications Technology Satellites, vol. 1, *NASA TM-X-61290*, 1967.

Anon.: Applications Satellites---An Introductory Bibliography, *TRW Space Log, 8*, 23, Fall 1968.

Corrigan, J.P.: The ATS VHF Experiment for Aircraft Communication. *Paper, Canaveral Space Congress on the Challenge of the 1970's*, 1967.

Freeman, J.W., Jr., and Maguire, J.J.: On the Variety of Particle Phenomena Discernible at the Geostationary Orbit via the ATS-1 Satellite, *NASA CR-95215*, 1967.

Hughes Aircraft Co.: Applications Technology Satellites, *NASA CR-100329*, 1968.

McQuain, R.H.: ATS-I Camera Experiment Successful, *Bull. Amer. Met. Soc., 48*, 74, Feb. 1967.

Miller, G.L., and Lie, H.P.: Design of VLF and Particle Experiments for the ATS-A Satellite with Special Reference to Electromagnetic Interference, *Proceedings of the Spacecraft Electromagnetic Interference Workshop*, Jet Propulsion Laboratory, Pasadena, 1968, pp. 111-138.

NASA: Applications Technology Satellite, Technical Data Report, *NASA TM-X-61130*, 1968.

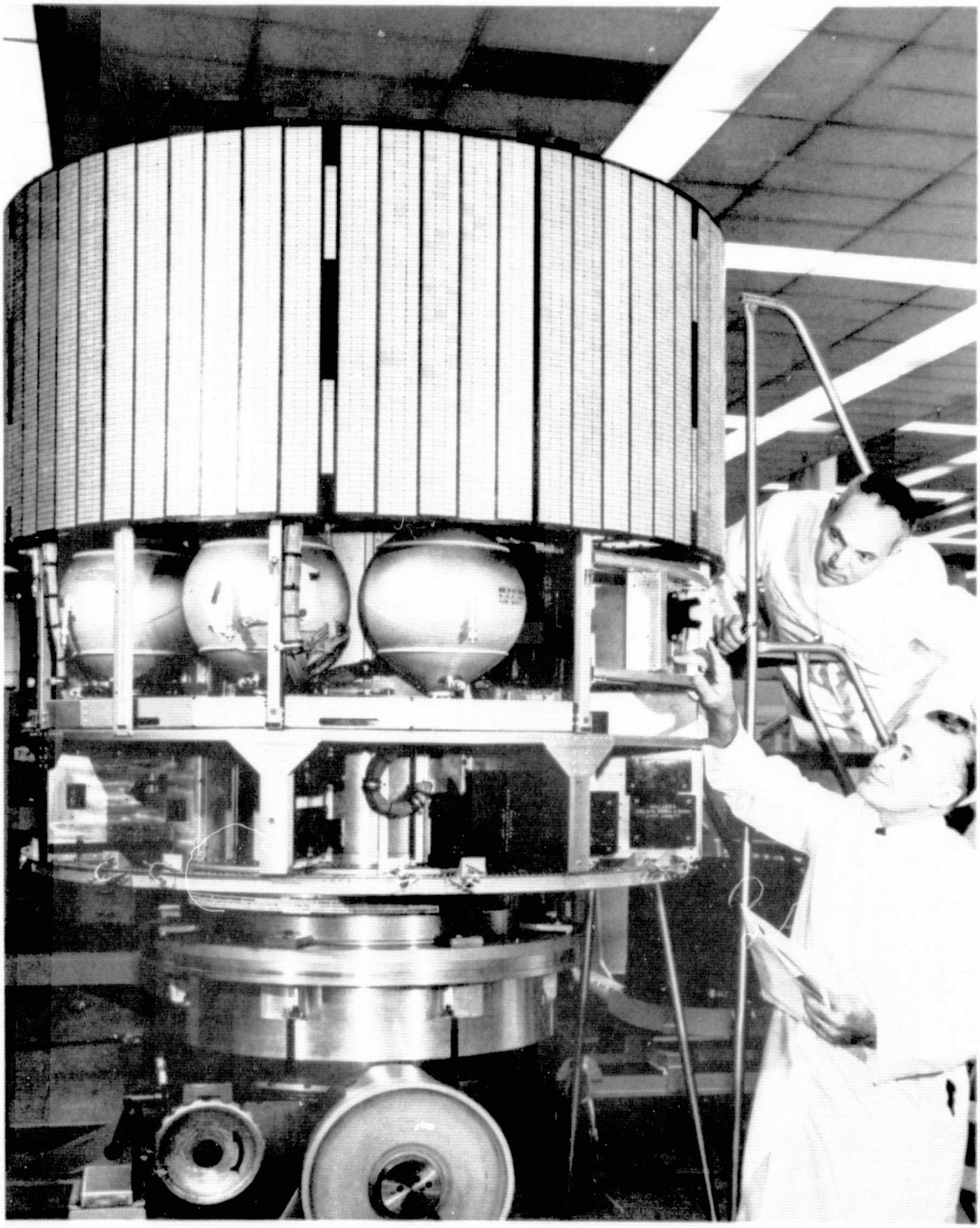
Paulikas, G.A., and Blake, J.B.: Penetrations of Solar Protons to Synchronous Altitude, *AD-682943*, 1968.

Pickard, R.H.: The Applications Technology Satellite, in *Meteorological and Communication Satellites*, M. Lunc, ed., Gordon and Breach, New York, 1966, p. 123.

Sunderlin, W.S.: The ATS-1 Spin-Scan Camera Experiment, *Paper, Canaveral Space Congress on the Challenge of the 1970's*, 1967.

Suomi, V.E.: Studies in Atmospheric Energetics Based on Aerospace Probings, *PB-180267*, 1968.

APPLICATIONS TECHNOLOGY SATELLITE I (Continued)



INTELSAT II-B 1967 01A

Jan. 11, 1967	Delta/ETR	24 hr.
Active	192 lb.	22,244/22,257 mi.
In orbit	C. P. Smith	---

Objectives: Commercial communications

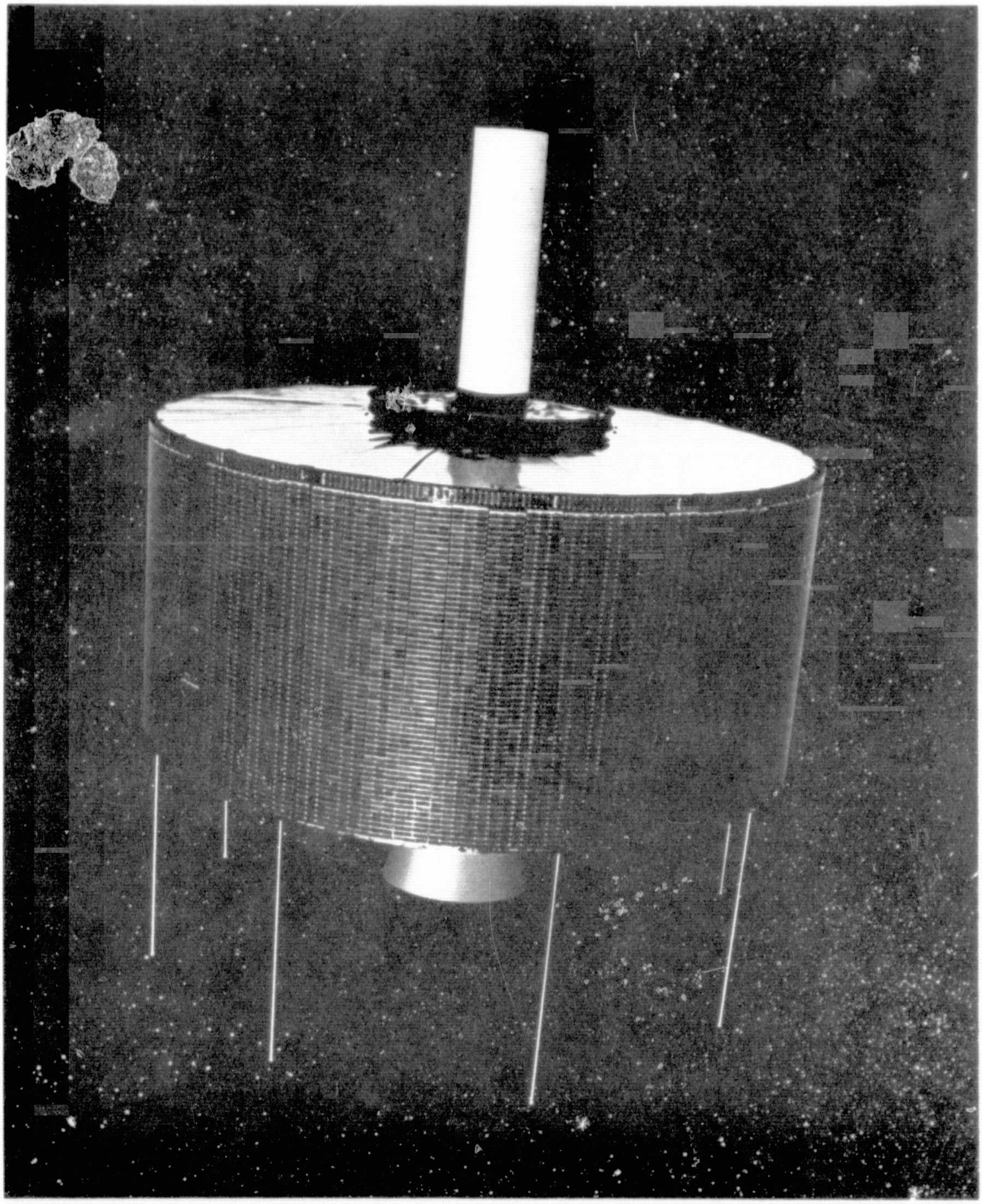
Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: Placed in stationary orbit over Pacific. Handles TV and 240 voice channels. NASA used for Apollo support.

Selected References:

See: References under Intelsat II-A.

INTELSAT II-B (Continued)



ESSA-IV 1967 06A

Jan. 26, 1967	TAID/WTR	113 min.
Active	290 lb.	822.51/894.40 mi.
In orbit	W. W. Jones	---

Objectives: To provide continuous observation of the Earth's cloudcover with direct APT readout of TV data on a global basis.

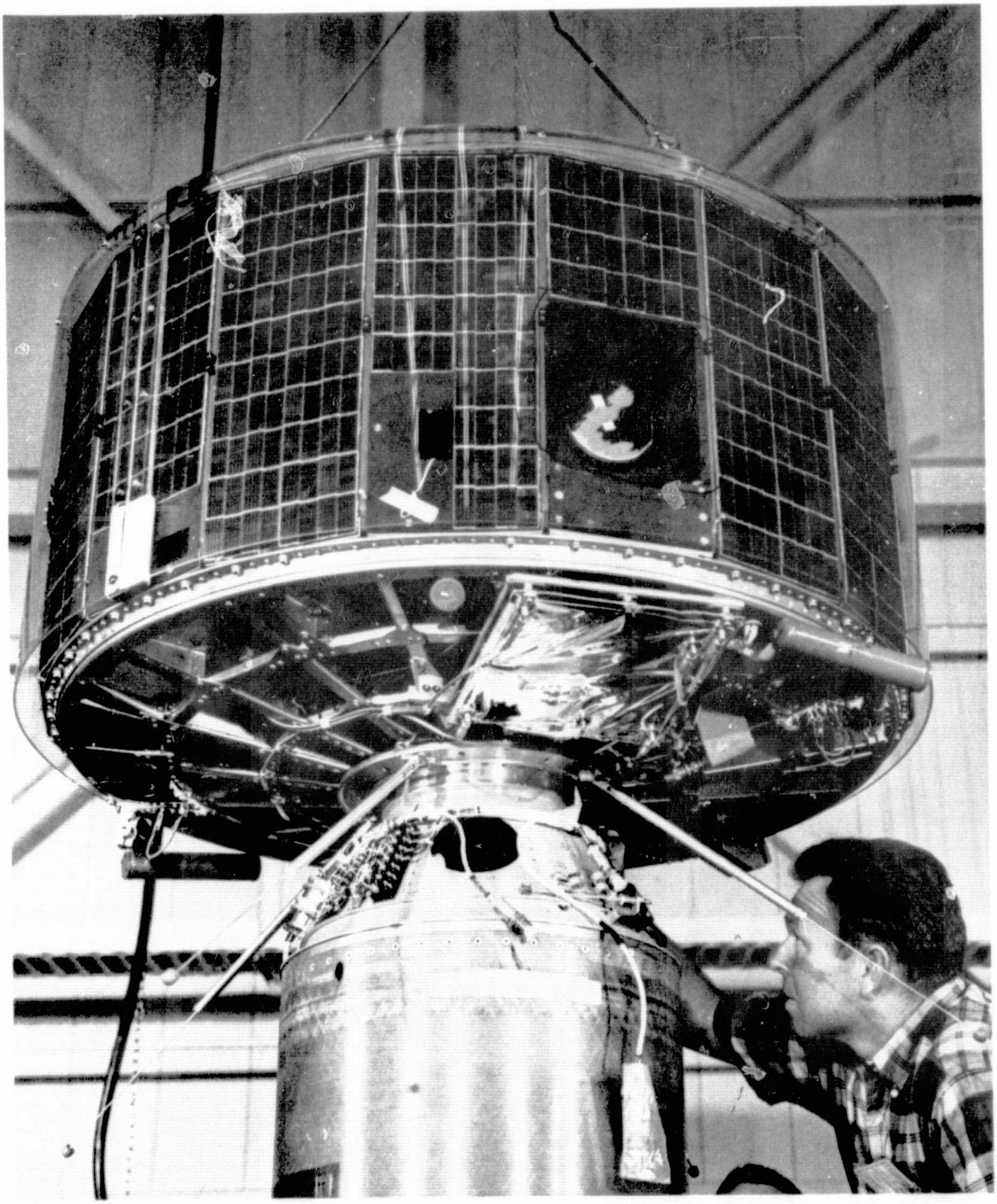
Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: Advanced version of cartwheel configuration.

Selected References:

See: References under ESSA I.

ESSA IV (Continued)



ORBITING SOLAR OBSERVATORY III 1967 20A

March 8, 1967	Delta/ETR	95.7 min.
Active	619 lb	336/354 mi.
In orbit	L.T. Hogarth	W.E. Behring

Objectives: To conduct solar physics experiments above the Earth's atmosphere. Experiments will detect and measure electromagnetic radiation from the Sun and the celestial sphere in the short-wave-length region of the spectrum.

Instrument/Discipline	Experimenter/Affiliation
Pointed Experiments	
Ultraviolet monochromator-S	H.E. Hinteregger/AFCRL L.A. Hall
Solar spectrometer-S	W.M. Neupert/GSFC W.A. White
Wheel Experiments	
Earth's albedo photometer-A	C.B. Neel/ARC
Emissivity stability of low-temperature coatings	C.B. Neel/ARC
Directional radiometers to measure intensity of total sunlight reflected from Earth-A	C.B. Neel/ARC
Celestial gamma-ray telescope-A	W.L. Kraushaar/MIT G.W. Clark G. Garmire
Solar X-ray ion chambers-S	R. Teske/U. Michigan
Cosmic-ray telescope-S	M.F. Kaplan/U. Rochester C.L. Deney B. Dennis

Remarks: OSO-III carried experiments almost identical to those on OSO-C which was launched unsuccessfully on Aug. 25, 1965.

ORBITING SOLAR OBSERVATORY III (Continued)

Selected References:
Brandt, J.C.: OSO-III---Preliminary Scientific Results, *Solar Physics, 6,* 171, Feb. 1969. See pp. 175-234 for additional OSO-III papers.

Clark, G.W., Garmire, G.P., and Kraushaar, W.L.: Review of Observational Results on Gamma Ray Background, *NASA CR-105310,* 1969.

Hudson, H.S., Peterson, L.E., and Schwartz, P.A.: The Hard Solar X-Ray Spectrum Observed from the Third Orbiting Solar Observatory, *Astrophys, J., 157,* 389, July 1969.

Kraushaar, W.L. and Garmire, G.: Preliminary Results of Gamma-Ray Observations from OSO-3, *Can. J. Phys., 46,* S414, May 15, 1968.

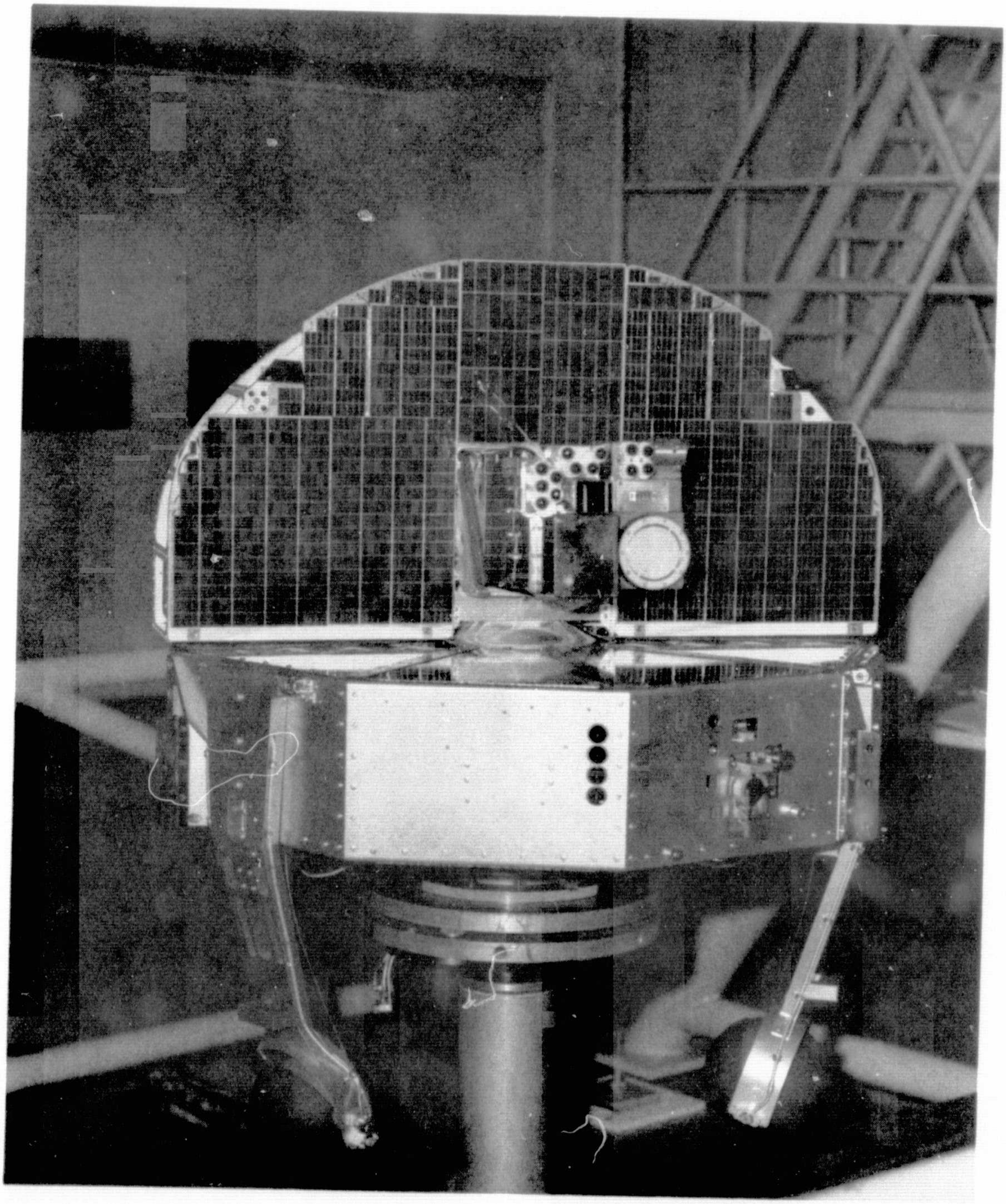
Neupert, W.M. et al: Observation of the Solar Flare X-Ray Emission Line Spectrum from Iron from 1.3 to 20 A, *Astrophys. J., 149,* L79, Aug. 1967.

Oertel, G.K., and Teske, R.G.: Solar Physics, *Significant Achievements in Space Science 1967,* Michigan University, 1968, pp. 439-558.

Peterson, L.E., Hudson, H.S., and Schwartz, D.A.: Preliminary Results of the University of California X-Ray Experiment on the OSO-3, *NASA CR-96950,* 1967.

See also: References under OSO I.

ORBITING SOLAR OBSERVATORY III (Continued)



INTELSAT II-C 1967 26A

March 23, 1967	Delta/ETR	24 hr.
Active	192 lb.	22,246/22,254 mi.
In orbit	C. P. Smith	---

Objectives: Commercial communications.

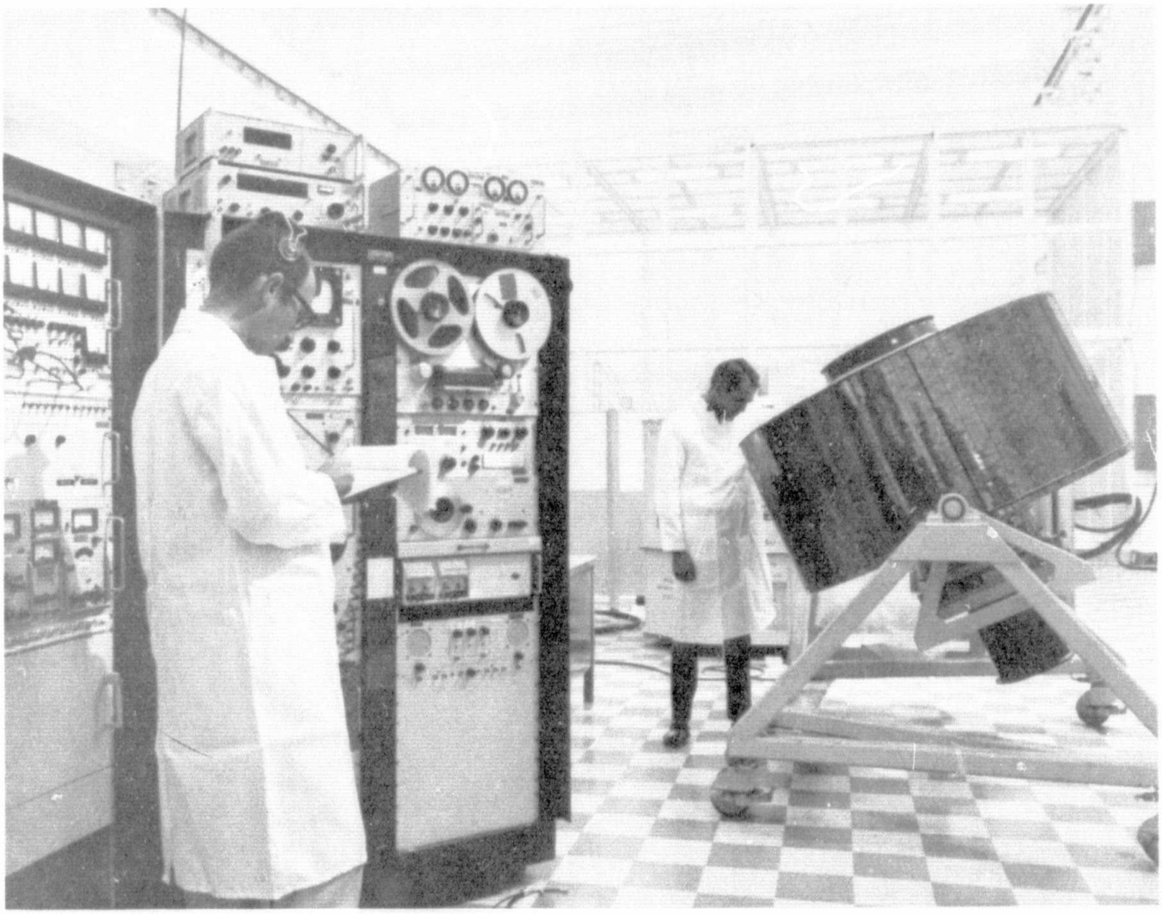
Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: Spacecraft placed in orbit over Atlantic Ocean. Launched by NASA for Comsat Corp. on a reimbursible basis.

Selected References:

See: References under Intelsat II-A.

INTELSAT II-C (Continued)



APPLICATIONS TECHNOLOGY SATELLITE II 1967 31A

April 6, 1967	Atlas-Agena/ETR	219 min.
Retired	702 lb.	115/6947 miles
Sept. 2, 1969	R. J. Darcey	---

Objectives: To obtain engineering data on Earth-oriented gravity-gradient stabilization at medium altitudes; to extend techniques to synchronous altitudes; to investigate gravity-gradient stabilization for use on communications and meteorological satellite systems; and to measure orbital environment.

Instrument/Discipline	Experimenter/Affiliation
2 microwave (SHF) repeaters	
2 AVCS cameras-one wide angle, one narrow angle	
Gravity-gradient stabilization system to provide performance data using attitude data and cameras to observe boom deflections	---
Omnidirectional particle detectors-E	C. E. McIlwain/U. California
Silicon-junction particle detector-E	W. L. Brown/BTL
VLF whistler receiver-I	W. L. Brown/BTL
Electron magnetic spectrometer-E	J. Winckler/U. Minnesota
Solar-cell radiation damage experiment	R. Waddel/GSFC
Thermal coating experiment	J. J. Triolo/GSFC
Cosmic radio noise receiver-A	R. G. Stone/GSFC
Electric field meter-I	T. Aggson/GSFC

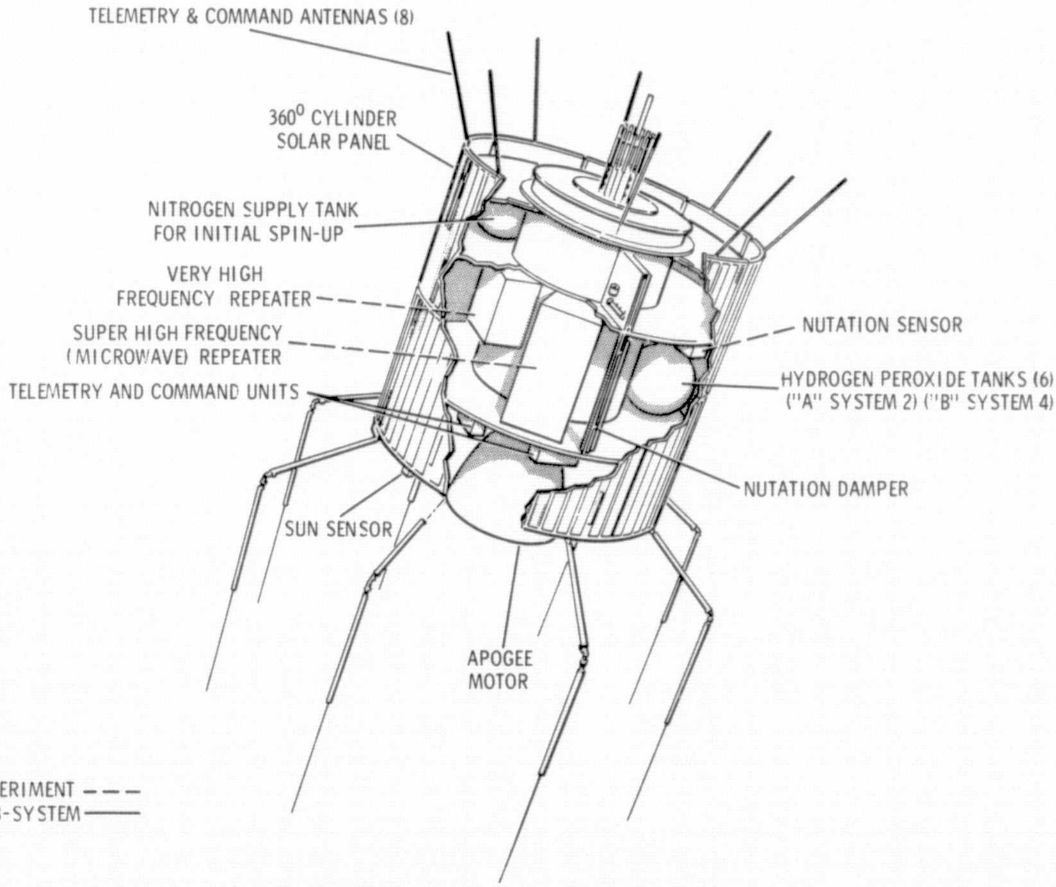
Remarks: Because of a malfunction in the second ignition of the Agena rocket, the ATS-II spacecraft was placed in a highly elliptical orbit. Only limited data received.

APPLICATIONS TECHNOLOGY SATELLITE II (Continued)

Selected References:
Alexander, J.K., Malitson, H.H., and Stone, R.G.: Type 3 Radio Bursts in the Outer Corona, *NASA TM-X-63403*, 1968.

Weber, R.R., Stone, R.G., and Somerlock, C.R.: Cosmic Radio Noise Intensity from 0.45 to 3.0 MHz Observed by the ATS II Satellite, *Astronomy and Astrophysics, 1*, 44, Jan. 1969.

See also: References under ATS I.



ATS - B SYSTEMS AND INTERIOR EXPERIMENTS

NASA G-67-2884

ESSA V 1967 36A

April 20, 1967	TAID/WTR	113 min.
Active	325 lb.	838/881 miles
In orbit	W. W. Jones	---

Objectives: To provide continuing observation of the Earth's cloudcover and heat budget on a global basis.

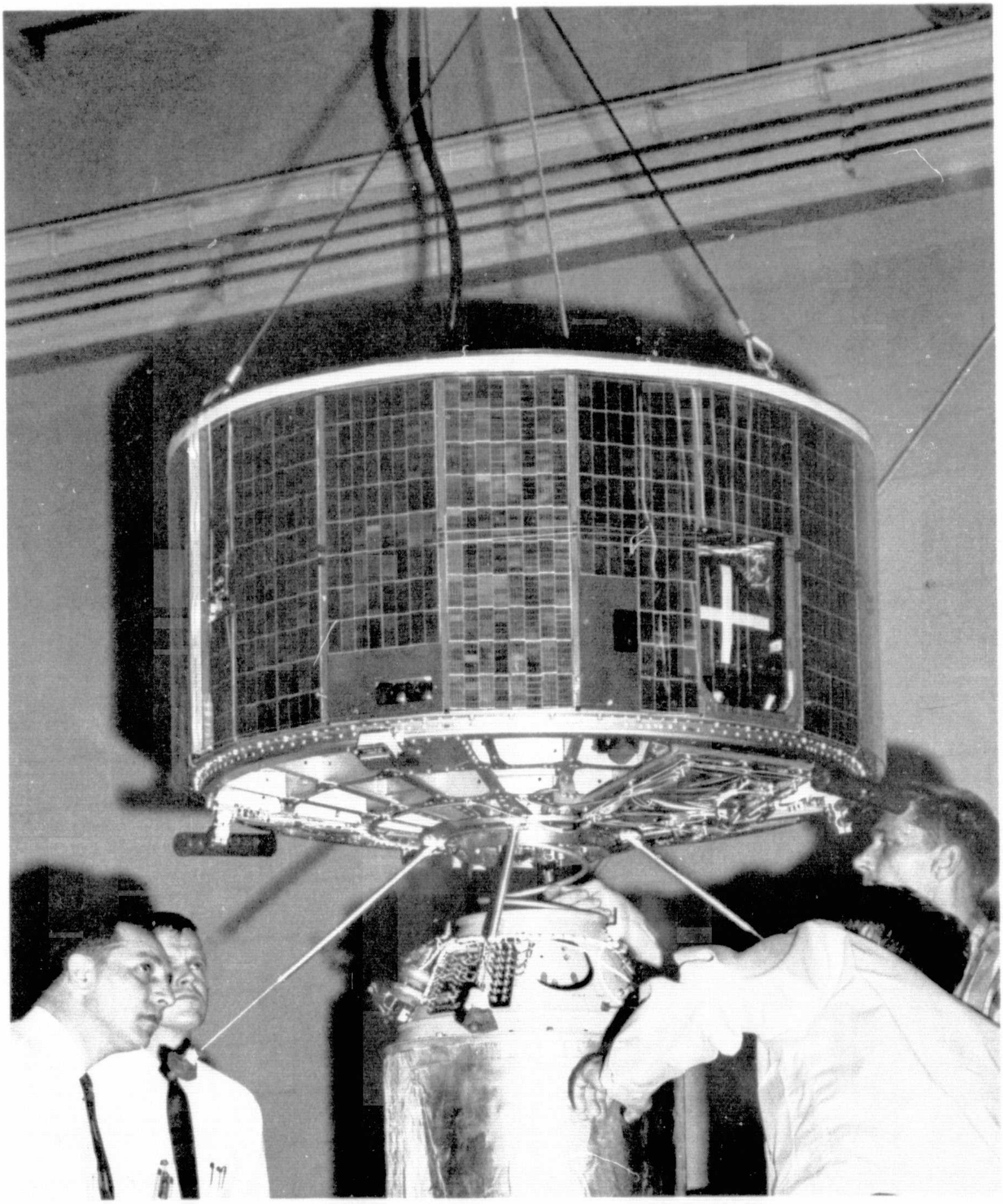
Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: Carrying advanced Vidicon camera system. In Sun-synchronous orbit.

Selected References:

See: References under ESSA I.

ESSA V (Continued)



SAN MARCO II 1967 38A

April 26, 1967	TAID/Indian Ocean	94 min.
Aug. 14, 1967	285 lb.	130/500 miles
Oct. 14, 1967	A. J. Caporale	---

Objectives: To measure upper atmosphere air density. To measure electron density and to study the radio-wave propagation effect known as "ducting."

Instrument/Discipline	Experimenter/Affiliation
Air density triaxial balance-R	L. Broglio/U. Rome
Electron content and wave propagation experiment-I	N. Carrara/U. Florence

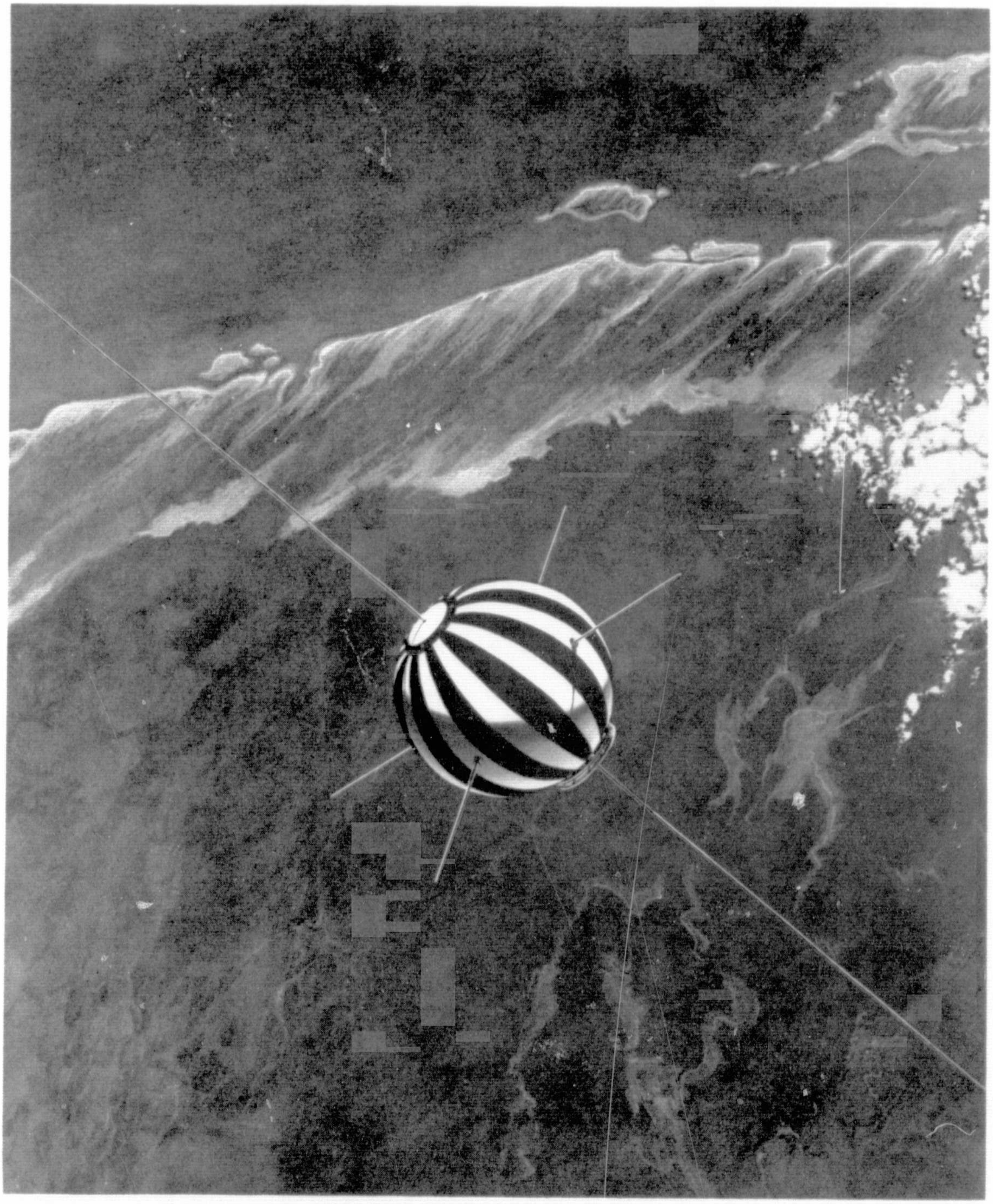
Remarks: World's first satellite to be launched from a sea platform (Indian Ocean off Kenya). Italian project.

Selected References:
Broglio, L.: Main Features of the San Marco II Satellite Equatorial Experiment, in *Space Research VIII*, A.P. Mitra et al, eds., Interscience Publishers, New York, 1968, p. 90.

NASA: Project San Marco-B, *NASA News Release 67-93*, 1967.

Broglio, L.: Equatorial Atmospheric Density Obtained from San Marco II Satellite Between 200 and 350 km, *Space Research IX*, K.S.W., Champion, P.A. Smith, and R.L. Smith-Rose, eds., North Holland Publishing Co., Amsterdam, 1969, pp. 547-554.

SAN MARCO II (Continued)



ARIEL III 1967 42A

May 5, 1967	Scout/WTR	95.6 min.
Active	179 lb.	306/373 mi.
In orbit	E. Hymowitz	---

Objectives: To measure vertical distribution of molecular oxygen in Earth's atmosphere. To map large-scale RF-noise sources in the galaxy. To investigate VLF radiation, both natural and man-made. To measure ionization density and temperature above the F_2 maximum. To investigate terrestrial radio noise.

Instrument/Discipline	Experimenter/Affiliation
Ion chamber-E	R. Frith/Meteorological Office
Three radio receivers-AP	F. G. Smith/U. Manchester
Radio receivers-AP	T. R. Kaiser/U. Sheffield
RF plasma probe-I	J. Sayers/U. Birmingham
Radio receiver-AP	J. A. Ratcliffe/Radio Research Station

Remarks: First all British payload.

Selected References:

Blonstein, J.L.: The UK3 International Ionospheric Satellite---Britain's First Spacecraft, in *Proceedings of the 14th International Astronautical Congress*, E. Brun and I. Hersey, eds., Gauthier-Villars, Paris, 1965, p. 405.

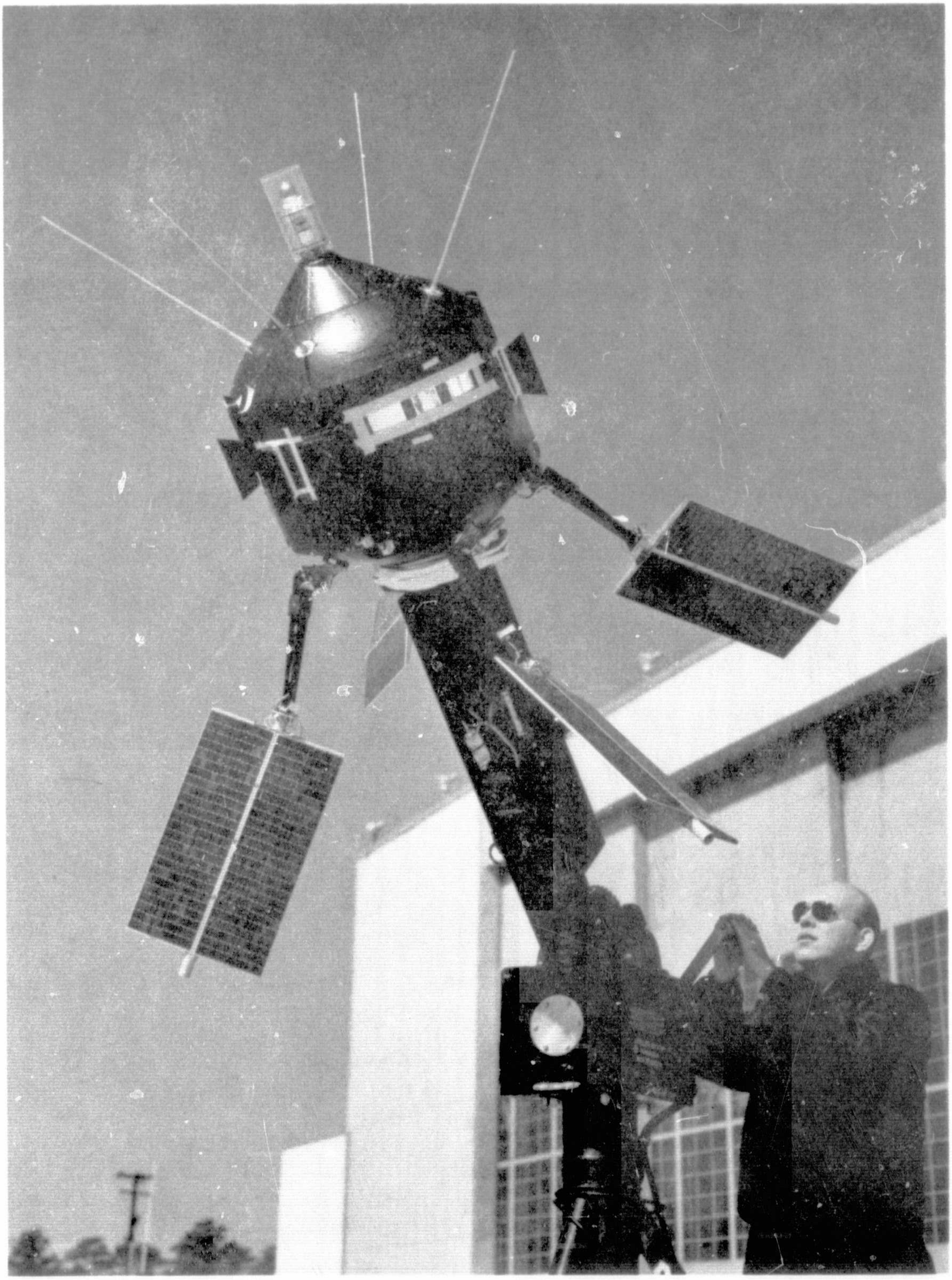
Smith, F.G. et al: Experiments in the U.K. Satellite Ariel III, in *Space Research VIII*, A.P. Mitra et al, eds., Interscience Publishers, New York, 1968, p. 728.

Stockwell, B.: Britain's First Spacecraft, *Spaceflight, 7*, 2, Jan. 1965.

Wildman, P.J.L.: The Ariel 3 Vehicle, *Met. Mag., 96*, 289, Oct. 1967.

Various: Proceedings, British National Committee on Space Research, Discussion on Scientific Results Obtained by the Ariel III Satellite, London, England, April 24, 1968, *Proc. Roy. Soc., Series A, 311*, No. 1507, Aug. 12, 1969.

ARIEL III (Continued)



EXPLORER XXXIV 1967 51A

May 24, 1967	TAID/WTR	6231 min.
May 3, 1969	163 lb.	154/131,187 mi.
May 3, 1969	P. Butler	F. B. McDonald

Objectives: To study solar and galactic cosmic radiation, the solar plasma, energetic particles within the magnetosphere and its boundary layer, and the interplanetary magnetic field. The experiments and instrumentation of Explorer XXXIV permit more detailed and precise measurements than possible with previous IMPs.

Instrument/Discipline	Experimenter/Affiliation
Low-energy telescope-E	W. L. Brown/BTL
Neher-type ion chamber-E	K. A. Anderson/U. California
Scintillator telescope-E	J. A. Simpson/U. Chicago
Cosmic-ray telescope-E	K. G. McCracken/Southwest Center for Advanced Studies
Solar proton detectors-S	C. Bostrom/APL/GSFC F. B. McDonald
Cosmic-ray telescope-E	F. B. McDonald/GSFC
Low-energy proton and alpha detector-E	D. E. Hagge/GSFC
Electrostatic analyzer-E	K. W. Ogilvie/GSFC T. D. Wilkerson/U. Maryland
Electrostatic analyzer-E	L. A. Frank/State U. Iowa J. A. Van Allen
Spherical electrostatic analyzer-E	F. B. Harrison/TRW
Fluxgate and rubidium-vapor magnetometers-E	N. F. Ness/GSFC

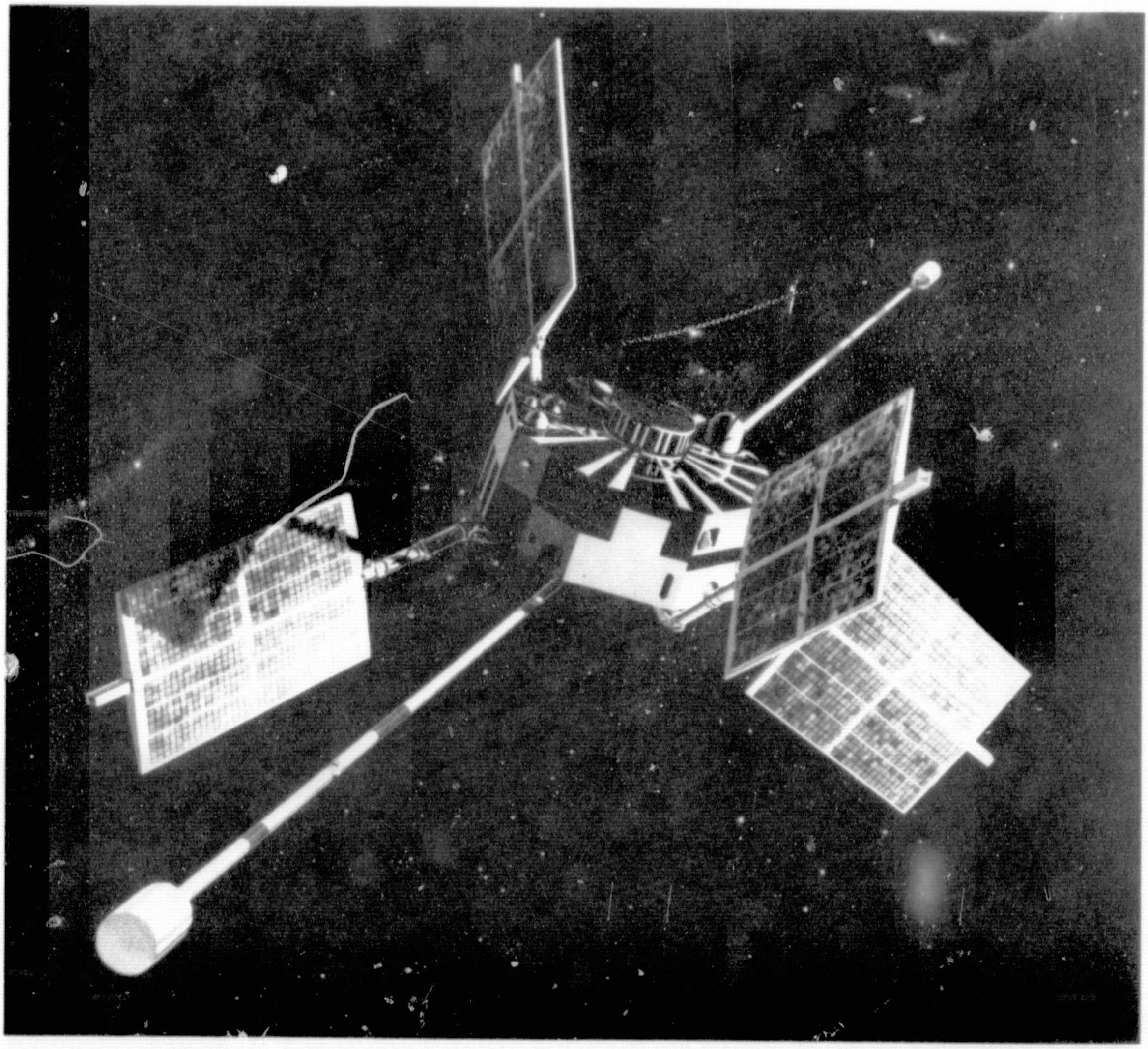
Remarks: Launched during class III bright solar flare. Explorer XXXIV skipped off the atmosphere into a new orbit on April 28, 1969.

EXPLORER XXXIV (Continued)

Selected References:
Burlaga, L.F. and Ogilvie, K.W.: Observations of the Magnetosheath-Solar Wind Boundary, *NASA TM-X-63155*, 1968.

Burlaga, L.F.: Large Velocity Discontinuities in the Solar Wind, *NASA TM-X-63287*, 1968.

Simnett, G.M. and McDonald, F.B.: Observations of Cosmic Rays between 2.7 and 21.5 Mev, *NASA TM-X-63393*, 1968.



ESRO IIA None

May 29, 1967	Scout/WTR	---
---	153 lb	---
Suborbital	H. L. Eaker	L. H. Meredith

Objective: To measure solar and cosmic radiation.

Experiment/Instrument	Experimenter/Affiliation
See ESRO IIB (May 17, 1968)	

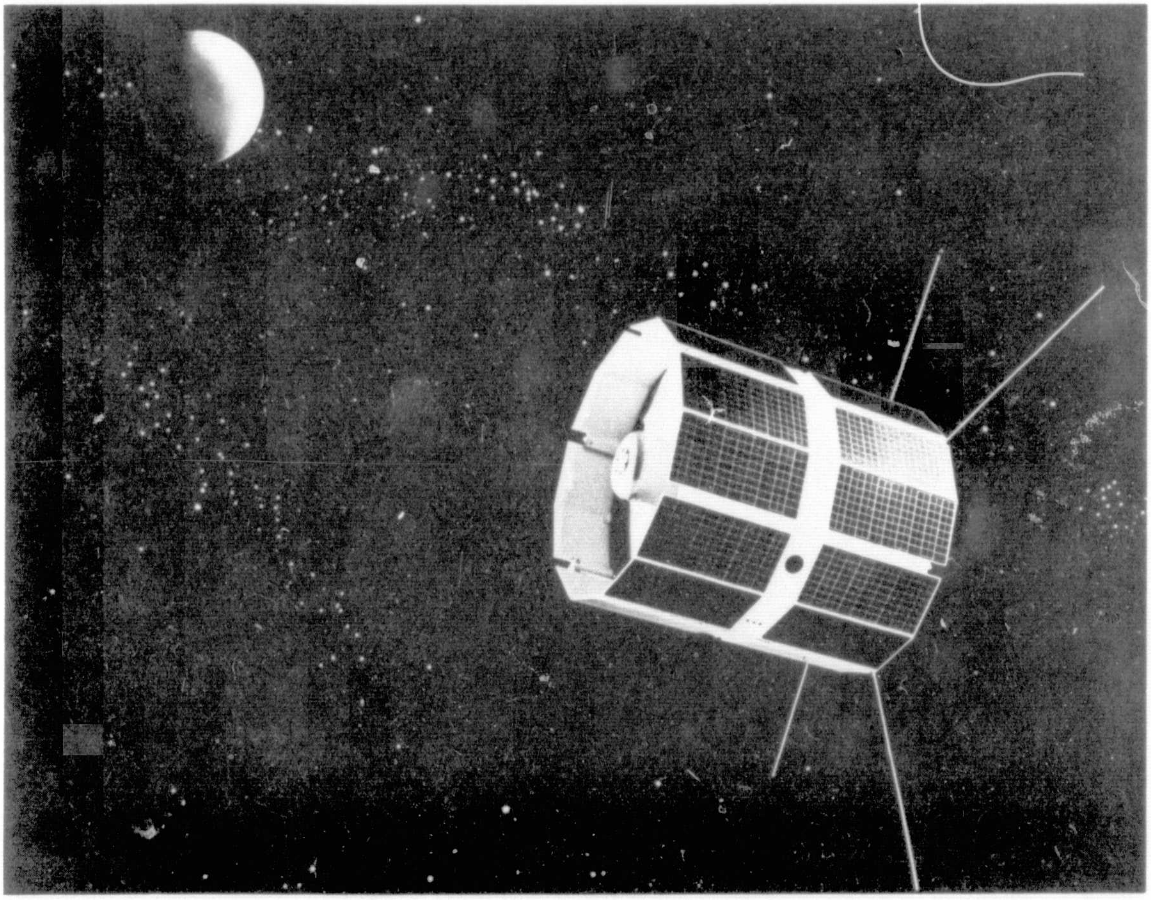
Remarks: Third stage failed; satellite landed in South Pacific.

Selected References:

Blassel, P. et al: Introduction to the International Scientific Satellite ESRO 2/IRIS, *NASA CR-99125*, 1968.

Hume, C.R.: The ESRO II Satellite Project, *Spaceflight*, *9*, 20, Jan. 1967.

ESRO IIA (Continued)



EXPLORER XXXV 1967 70A

July 19, 1967	TAID/ETR	690 min.
Active	230 lb.	465/4797 miles
In lunar orbit	P. G. Marcotte	N. F. Ness

Objectives: To anchor a satellite in orbit about the Moon. To measure the solar-plasma flux, energetic-particle population, magnetic fields, and cosmic dust in this orbit. To explore the variations of the Moon's gravitational field and search for a possible lunar ionosphere. (An Anchored IMP).

Instrument/Discipline	Experimenter/Affiliation
Magnetometer-E	N. F. Ness/GSFC
Thermal ion detector-I	G. P. Serbu/GSFC E. J. Maier
Magnetometer-E	C. P. Sonett/ARC
Ion chamber and two Geiger tubes-E	K. A. Anderson/UCLA
Three Geiger tubes and one p-on-n junction-E	J. A. Van Allen/State U. Iowa
Micrometeoroid detector-A	J. L. Bohn/Temple U.
MIT Faraday cup-E	H. S. Bridge/MIT

Remarks: Inserted into lunar orbit on July 22, 1967. Passes through Earth's "tail" every 29.5 days. No detectable lunar magnetic field found.

Selected References:

Behannon, K.W.: Intrinsic Magnetic Properties of the Lunar Body, *J. Geophys. Rev.*, *73*, 7257, Dec. 1, 1968.

Ness, N.F. et al: Early Results from the Magnetic Field Experiment on Lunar Explorer 35, *J. Geophys. Res.*, *72*, 5769, Dec. 1, 1967.

Ness, N.F.: Recent Results from Lunar Explorer 35, *NASA TM-X-63327*, 1968.

Ness, N.F.: Lunar Explorer 35, *NASA TM-X-63225*, 1968.

EXPLORER XXXV (Continued)

Serbu, G.P.: Explorer 35 Measurements of Low Energy Plasma in Lunar Orbit, *NASA TM-X-63267*, 1968.

Taylor, H.E., Behannon, K.W., and Ness, N.F.: Measurements of the Perturbed Interplanetary Field in the Lunar Wake, *NASA TM-X-63231*, 1968.

Whang, Y.C.: Interaction of the Magnetized Solar Wind with the Moon, *NASA GSFC X-612-67-580*, 1967.

Alexander, W.M. et al: Lunar Explorer 35---1967-1968 Measurements of Picogram Dust Particle Flux in Selenocentric Space, *COSPAR Paper*, Prague, 1969.

Broadhurst, R.H.: Explorer 33 and 35---Reliability Achievement by Design, *Eascon '68*, IEEE, New York, 1968, pp. 422-430.

Ness, N.F.: Lunar Explorer 35, *Space Research IX*, K.S.W. Champion, P.A. Smith, and R.L. Smith-Rose, eds., North Holland Publishing Co., Amsterdam, 1969, pp. 678-703.

Ness, N.F.: The Electrical Conductivity and Internal Composition of the Moon, *NASA TM-X-63545*, 1969.

Ogilvie, K.W., and Ness, N.F.: Dependence of the Lunar Wake on Solar Wind Plasma Characteristics, *NASA TM-X-63513*, 1969.

Yeh, R.S., and Van Allen, J.A.: Alpha Particles Emissivity of the Moon: An Observed Upper Limit, *NASA CR-106452*, 1969.

EXPLORER XXXV (Continued)

ORBITING GEOPHYSICAL OBSERVATORY IV 1967 73A

July 28, 1967	TAT/Agena/WTR	97.9 min.
Active	1211 lb	256/564 miles
In orbit	W.E. Scull	N.W. Spencer

Objectives: To launch and operate an orbital spacecraft carrying experiments to make geophysical measurements about the Earth.

Instrument/Discipline	Experimenter/Affiliation
Radio noise receiver-A	F.T. Haddock/U. Michigan
VLF receiver-I	R.A. Helliwell/Stanford U. M.G. Morgan/Dartmouth College T. Laaspere
Triaxial search-coil magnetometer-E	R.E. Holzer/UCLA E.J. Smith/JPL
Rubidium-vapor-magnetometer-E	J.P. Heppner J.C. Cain/GSFC
Ionization chamber-E	H.R. Anderson/Rice Inst. H.V. Neher/Calif. Inst. Tech.
Scintillator telescope-E	J.A. Simpson/U. Chicago
Cosmic-ray telescope-E	W.R. Webber/U. Minnesota
Geiger counters-E	J.A. Van Allen/State U. Iowa
Trapped-radiation scintillation detectors-E	R.A. Hoffman/GSFC
Air-glow photometer-R	J. Blamont/U. Paris E. Reed/GSFC
Airglow ion chambers-R	P.M. Mange/NRL
Ultraviolet spectrometer-R	C.A. Barth/JPL L.Wallace/Kitt Peak Nat. Obs.
Quadrupole spectrometer-R	R.J. Leite/U. Michigan
RF mass spectrometer-R	H.A. Taylor,Jr./GSFC
Ion gauge-R	G.P. Newton/GSFC
Plasma analyzer-I	R.E. Bourdeau/GSFC
X-ray ion chamber-S	R.W. Kreplin/NRL
Solar ultraviolet spectrometer-S	H.E. Hinteregger/AFCRL
Micrometeoroid detector-A	C.S. Nilsson/SAO

Remarks: Successfully launched into a polar orbit. Tape recorder failed Jan. 19, 1969.

ORBITING GEOPHYSICAL OBSERVATORY IV (Continued)

Selected References:

Barth, C.A., and Mackey, E.F.: OGO-IV Ultraviolet Airglow Spectrometer, *IEEE Trans.*, *GE-7*, 114, April 1969.

Hoffman, R.A. and Evans, D.S.: Field Aligned Electron Bursts at High Latitudes Observed by OGO-4, *NASA TM-X-63093*, 1967.

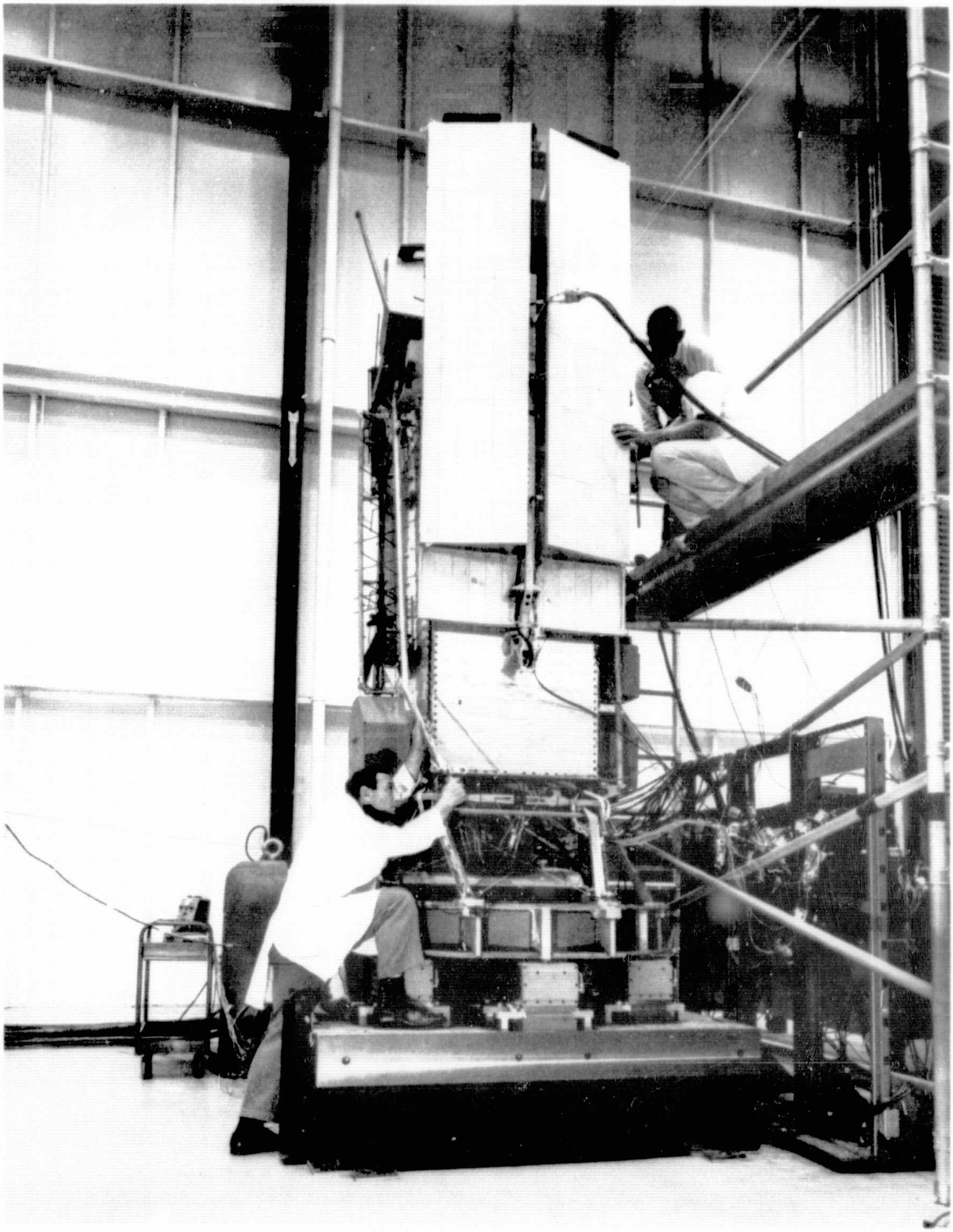
Hoffman, R.A.: OGO-4 Satellite Measurements of Low Energy, High Latitude Electron Precipitation, *NASA TM-X-63562*, 1969.

Meier, R.R.: Temporal Variations of Solar Lyman-Alpha, *COSPAR Paper*, Prague, 1969.

Thomas, G.E.: Ultraviolet Observations of Atomic Hydrogen and Oxygen from the OGO Satellites, *COSPAR Paper*, Prague, 1969.

Warnecke, G. et al: Meteorological Results from Multispectral Photometry in Airglow Bands by the OGO-4 Satellite, *NASA TM-X-63299*, 1968.

ORBITING GEOPHYSICAL OBSERVATORY IV (Continued)



INTELSAT II-D 1967 94A

Sept. 28, 1967	Delta/ETR	24 hr.
Active	192 lb.	22,220/22,245 mi.
In orbit	C. P. Smith	---

Objectives: Commercial communications.

Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: In stationary orbit over Pacific.

Selected References:

See: References under Intelsat II-A.

ORBITING SOLAR OBSERVATORY IV 1967 100A

Oct. 18, 1967	Delta/ETR	95.7 min.
Active	570 lb	334/354 mi.
In orbit	L.T. Hogarth	W.E. Behring

Objectives: To conduct experiments in solar physics above the Earth's atmosphere.

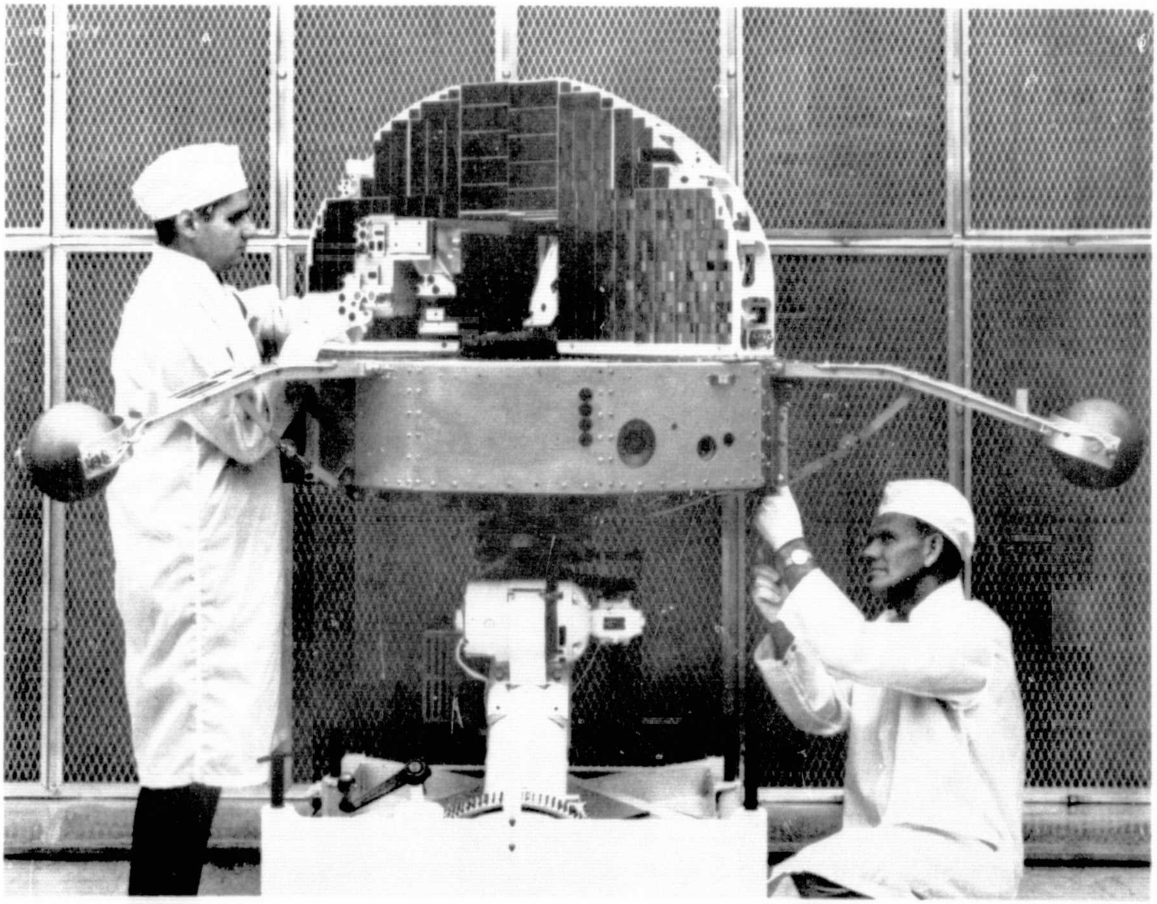
Instrument/Discipline	Experimenter/Affiliation
Pointed Experiments	
Solar X-ray telescope-S	R. Giacconi/American Science & Engineering F.R. Paolini
Bragg crystal X-ray spectrometer-S	H. Friedman/NRL T.A. Chubb R.W. Kreplin J.F. Meekins
Scanning spectrometer spectroheliograph-S	L.Goldberg/Harvard College Obs. E.M. Reeves W.H. Parkinson
Wheel Experiments	
X-ray telescope-S	R. Giacconi/American Science & Engineering H. Gursky
Proportional counter and Geiger spectrophotometer-S	R.L. F. Boyd/U. College, Leicester U. K.A. Pounds E.A. Stewardson
Grating monochromator-S	R.L.F. Boyd/U. College
Proton-electron detector-E	J. Waggoner/U. California
X-ray ion chambers-S	T.A. Chubb/NRL R.W. Kreplin H. Friedman
Lyman-alpha ion chamber-S	P.W. Mange/NRL T.A. Chubb H. Friedman

Remarks: First ultraviolet pictures of Sun.

ORBITING SOLAR OBSERVATORY IV (Continued)

Selected References:
Culhane, J.L., Sanford, P.W., and Phillips, K.J.H.: Soft X-Ray Observations from OSO-4, *Sky and Telescope, 37*, 287, May 1969.

Goldberg, L., et al: The Results and Interpretation of Some of the Harvard OSO-IV Observations, *AAS Paper 68-219*, 1968.



APPLICATIONS TECHNOLOGY SATELLITE III 1967 111A

Nov. 5, 1967	Atlas-Agena/ETR	24 hr.
Active	798 lb.	22,228/22,254 mi.
In orbit	R. J. Darcey	---

Objectives: Applications and technology involving communications, meteorology, Earth photography, navigation, stabilization, pointing, and degradation of surfaces in space and ionosphere.

Instrument/Discipline	Experimenter/Affiliation
Multicolor spin-scan camera system	V. Suomi/U. Wisconsin W. Sunderlin/GSFC
Image-dissector camera	G. Branchflower/GSFC
Omega position location equipment	H. Horiuchi/GSFC
WEFAX	--- ESSA
Super-high frequency (microwave) experiment	---/GSFC
Multiple-access mode tests	--- GSFC
Frequency translation tests	--- GSFC
Very high frequency (VHF)	--- GSFC
Self-contained navigation system	J. P. Corrigan/GSFC
Reflectometer experiment	--- Control Data Corp.
Resisto-jet experiment	--- Electro-Optical Systems, Inc.,

Selected References:

NASA: Atlas/Agena-25 Applications Technology Satellite C Operations Summary, *NASA TM-X-60905*, 1967.

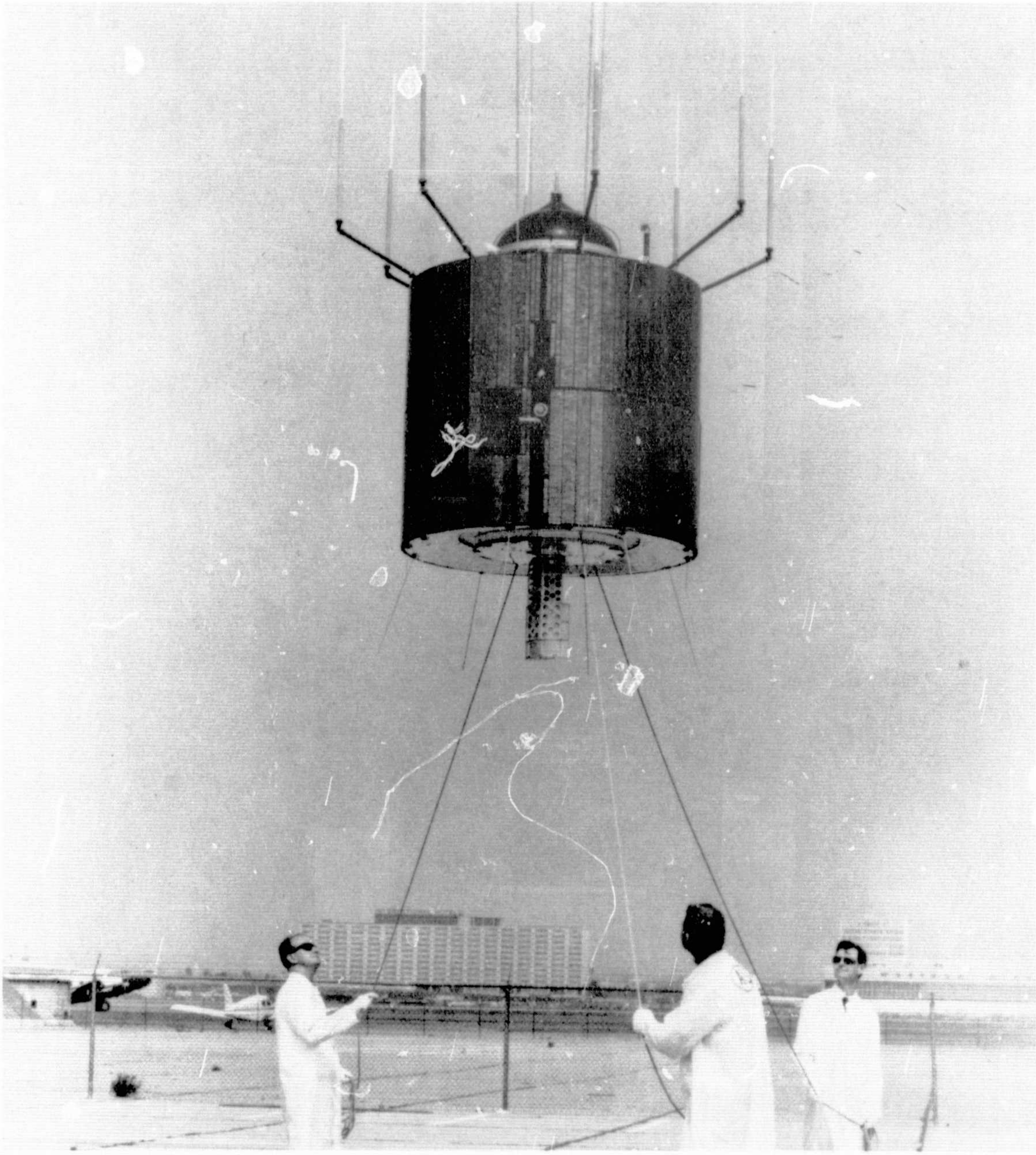
Purmire, T.K. and Lund, W.: ATS-III Resistojet Thruster System Performance, *AIAA Paper 68-553*, 1968.

Warnecke, G. and Sunderlin, W.S.: The First Color Picture of the Earth Taken from the ATS-3 Satellite, *Bull. Amer. Met. Soc.*, *49*, 75, Feb. 1968.

APPLICATIONS TECHNOLOGY SATELLITE III (Continued)

Blaisdell, L., Rubin, R., and Mahr, O.: ATS Mechanically Despun Communications Satellite Antenna, *IEEE Trans.*, *AP-17*, 415, July 1969.

Heaney, J.B.: Results from the ATS-3 Reflectometer Experiment, *AIAA Paper 69-644*, 1969.



ESSA-VI 1967 114A

Nov. 10, 1967	TAID/WTR	114.8 min.
Active	286 lb.	876/925 mi.
In orbit	W. W. Jones	---

Objectives: To provide continuous observation of the Earth's cloudcover with direct readout of TV data on a global basis.

Instrument/Discipline	Experimenter/Affiliation
---	---

Remarks: Carries two TV systems used for APT ground stations. Launched by NASA on a reimbursible basis.

Selected References:

See: References under ESSA I.

ESSA VI (Continued)

TEST AND TRAINING SATELLITE I 1967 123B

Dec. 13, 1967	Delta/ETR	92.3 min.
Apr. 28, 1968	40 lb	182/300 mi.
Apr. 28, 1968	P. Burr	----

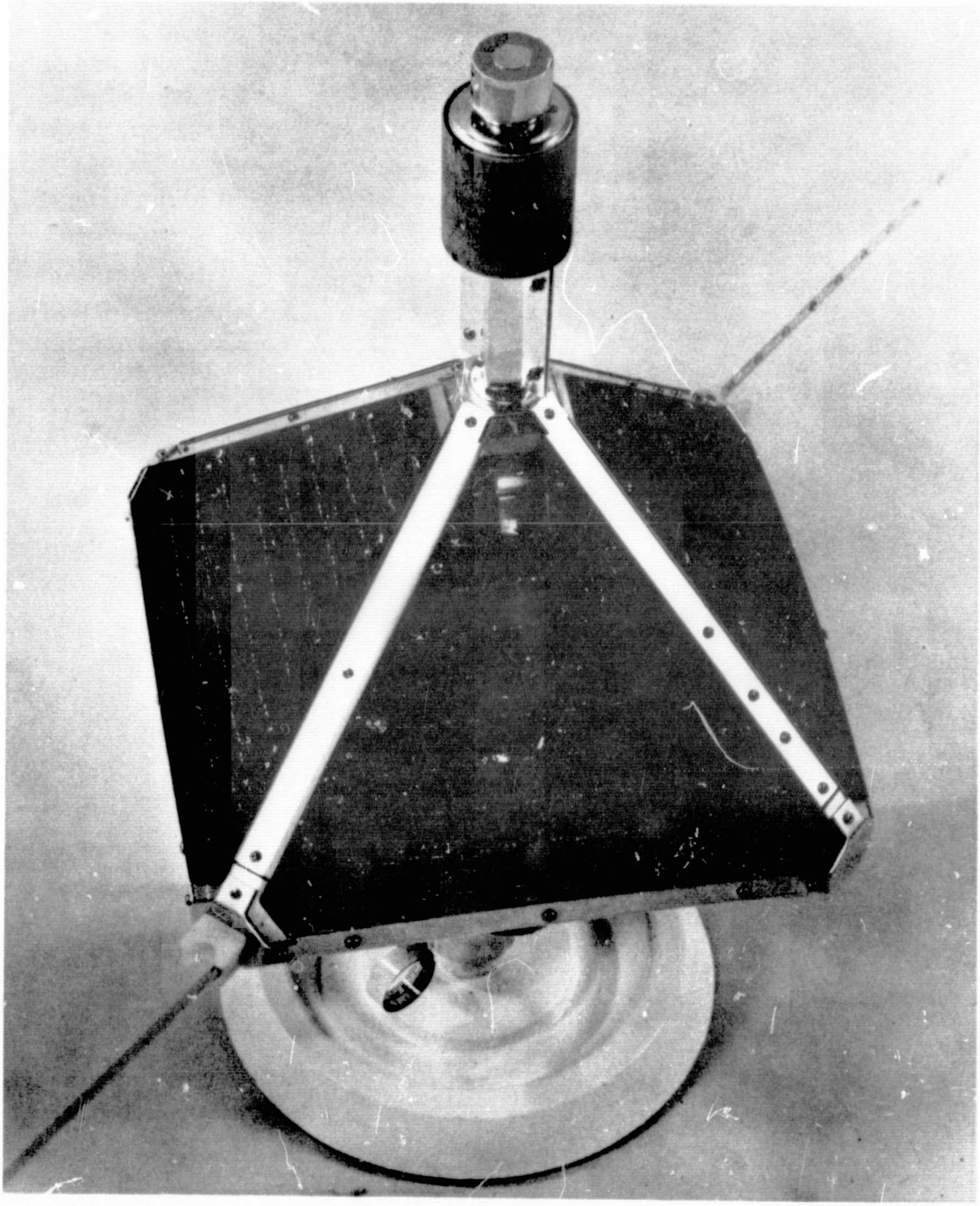
Objectives: To check out Manned Space Flight Network stations prior to manned missions; to help train ground personnel; to simulate routine, all-weather missions; and to develop and verify target acquisition and handover techniques.

Remarks: Also called TTS-I or TETR-I (an obsolete acronym). TTS-I was launched piggyback along with Pioneer VIII as a secondary-objective spacecraft. The TTS-I payload included an S-band transponder so that it could be acquired and tracked by Manned Space Flight Network stations. Routine tracking and housekeeping telemetry, however, were handled by STADAN.

Selected References:

Horn, H.J.: Test and Training Satellites for the Manned Space Flight Network, *TRW Systems Report 06834-6008-R000*, 1968.

TEST AND TRAINING SATELLITE I (Continued)



EXPLORER XXXVI 1968 02A

Jan. 11, 1968	TAID/WTR	112 min
Active	460 lb	671/976 miles
In orbit	J.D. Rosenberg	N. Roman

Objectives: To intercompare tracking system accuracies; to study the fine structure of the Earth's gravitational field; to improve worldwide geodetic datum accuracies; to improve coordinates of satellite tracking stations.

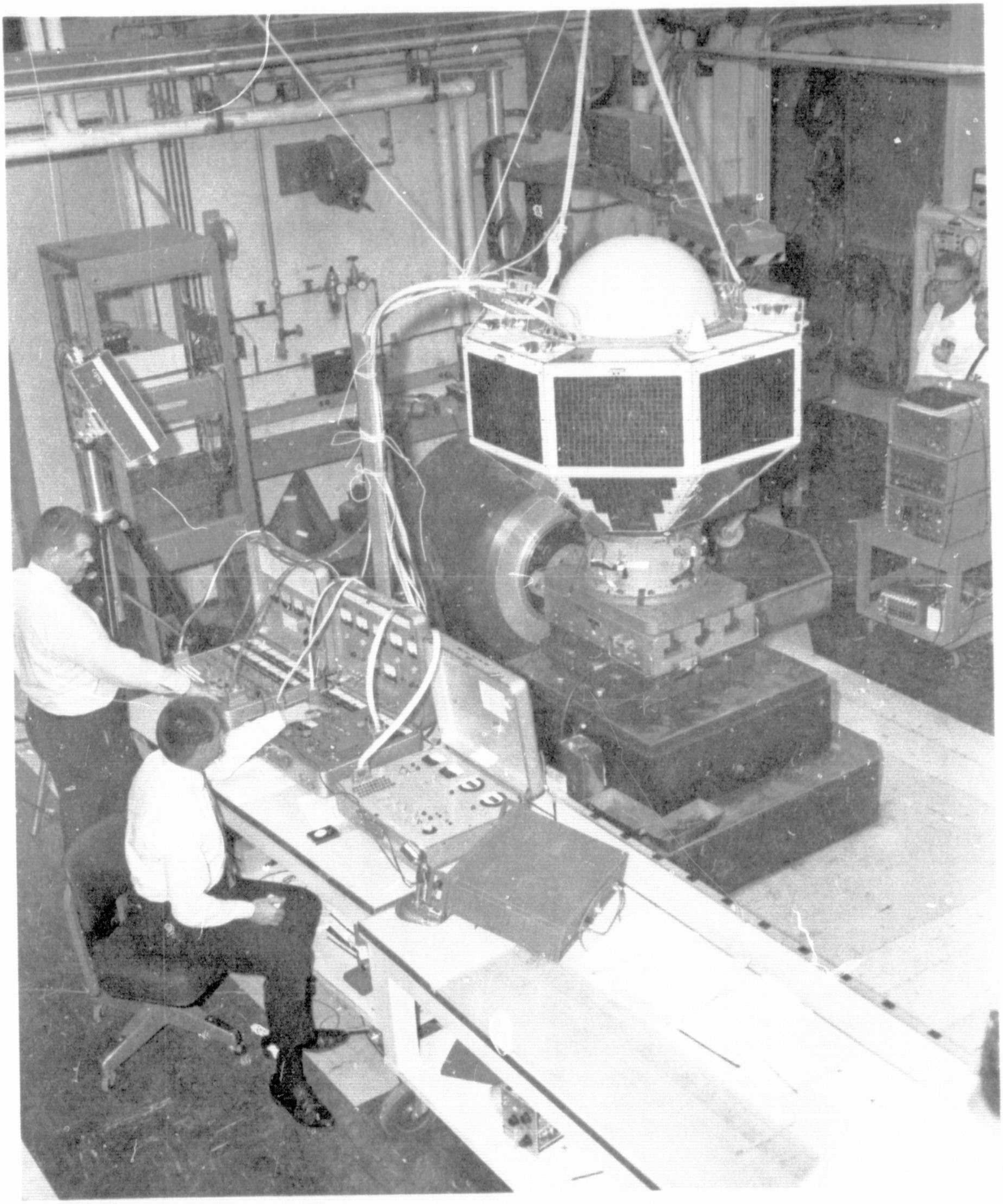
Experiment/Instrument	Experimenter/Affiliation
Geodetic aids, including optical and radio beacons, radio transponders, laser corner reflectors	----/NASA

Remarks: Explorer XXXVI (also called Geos II) was launched for NASA Headquarters by GSFC.

Selected References:

See: References under Explorer XXIX.

EXPLORER XXXVI (Continued)



ORBITING GEOPHYSICAL OBSERVATORY V 1968 14A

Mar 4, 1968	Atlas-Centaur/ETR	63.3 hr
Active	1347 lb	180/91,260 miles
In orbit	W. E. Scull	J. P. Heppner

Objectives: To launch and operate an orbital spacecraft carrying a wide variety of geophysical instruments.

Experiment/Instrument	Experimenter/Affiliation
Spherical plasma analyzer-E	R.L.F. Boyd/University College
Spherical plasma analyzer-E	R. Sagalyn/AFCRL
Planar plasma analyzer-E	G. P. Serbu/GSFC
Scintillator and proportional-countertelescope-S	K. A. Anderson/U. California
Scintillator telescope-E	T. L. Cline/GSFC
Electron-proton magnetic spectrometer-E	R. D'Arcy/Livermore Rad. Lab.
Cylindrical electrostatic analyzer-E	L. A. Frank/State U. Iowa
Spark chamber-E	G. W. Hutchinson/U. Southampton
Cerenkov-scintillator telescope-E	P. Meyer/U. Chicago
Scintillator-solid state telescope-E	F. B. McDonald/GSFC
Electron electrostatic analyzer-E	K. W. Ogilvie/GSFC
Cosmic-ray telescope-E	H. C. van de Hulst/Cosmic Ray Working Group, Netherlands
Fluxgate magnetometer and solid-state detector-E	P. J. Coleman/U. California (L.A.)
Fluxgate and rubidium-vapor magnetometers-E	J. P. Heppner/GSFC
Search-coil magnetometer-E	E. J. Smith/JPL
Electrostatic analyzer and Faraday cup-E	C. Snyder/JPL
Magnetic mass spectrometer-E	G. W. Sharp/Lockheed
Cosmic radio-noise receiver	F. T. Haddock/U. Michigan
Ultraviolet airglow photometer-P	C. A. Barth/U. Colorado
Lyman-alpha H-D cell-P	J. E. Blamont/U. Paris
Proportional-counter spectrometer-S	R. W. Kreplin/NRL
Plasma-wave experiment-E	G. M. Crook/TRW Systems

ORBITING GEOPHYSICAL OBSERVATORY V (Continued)

Electric-field experiment-E	T. L. Aggson/GSFC
High-Z, Low-E particle experiment-E	J. A. Simpson/U. Chicago

Remarks: 23 experiments returning good data.

Selected References:

Bertaux, J.L., and Blamont, J.E.: OGO-V Measurements of Lyman-Alpha Intensity Distribution and Linewidth up to 6 Earth Radii, *COSPAR Paper*, Prague, 1969.

Crook, G.M., et al: The OGO-V Plasma Wave Detector---Instrumentation and In-Flight Operation, *IEEE Trans.*, *GE-7*, 120, April 1969.

Harris, K.K., and Sharp, G.W.: Structure of the Topside Ionosphere from Early Orbits of OGO-V, *COSPAR Paper*, Prague, 1969.

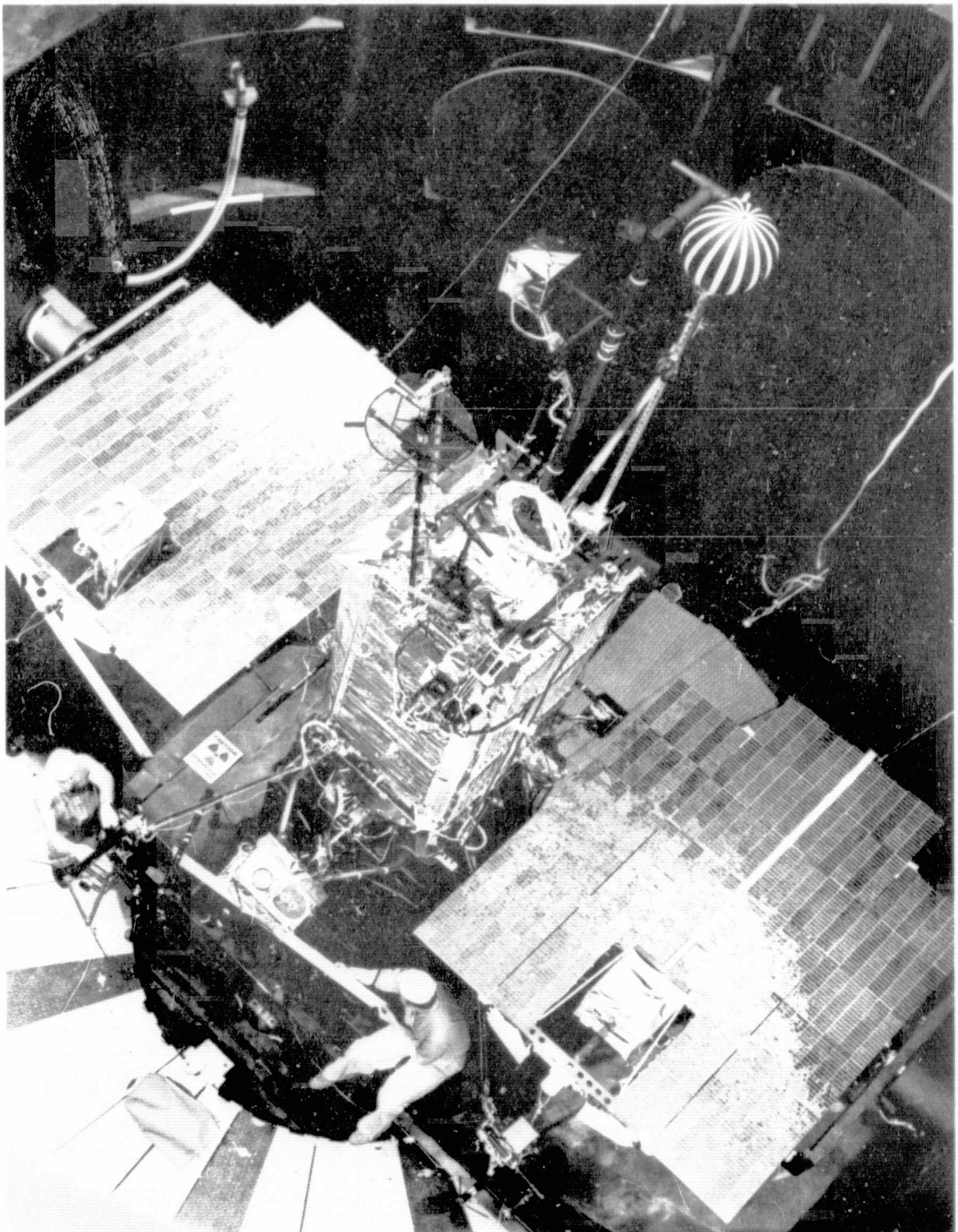
Jones, S.L. et al: OGO-E Cosmic Radiation---Nuclear Abundance Experiment, *Trans. IEEE*, *NS-14*, 56, Feb. 1967.

Kane, S.R.: Observations of Two Components in Energetic Solar X-Ray Bursts, *Astrophys, J.*, *157*, L139, Aug. 1969.

MacRae, B.D.: Instrumentation for Radio Astronomy Measurements Aboard the OGO-5 Spacecraft, *NASA CR-98670*, 1968.

Rogowski, L.K., et al: Primary Electron Detector Experiment for OGO-E, *IEEE Trans.*, *NS-16*, 352, Feb. 1969.

ORBITING GEOPHYSICAL OBSERVATORY V (Continued)



EXPLORER XXXVII 1968 17A

Mar. 5, 1968	Scout/Wallops	98.7 min
Active	195 lb	324/545 miles
In orbit	J. Holtz (NASA)	H. Glaser (NASA)
		R.W. Kreplin (NRC)

Objectives: To monitor the Sun's X-ray emissions as functions of time.

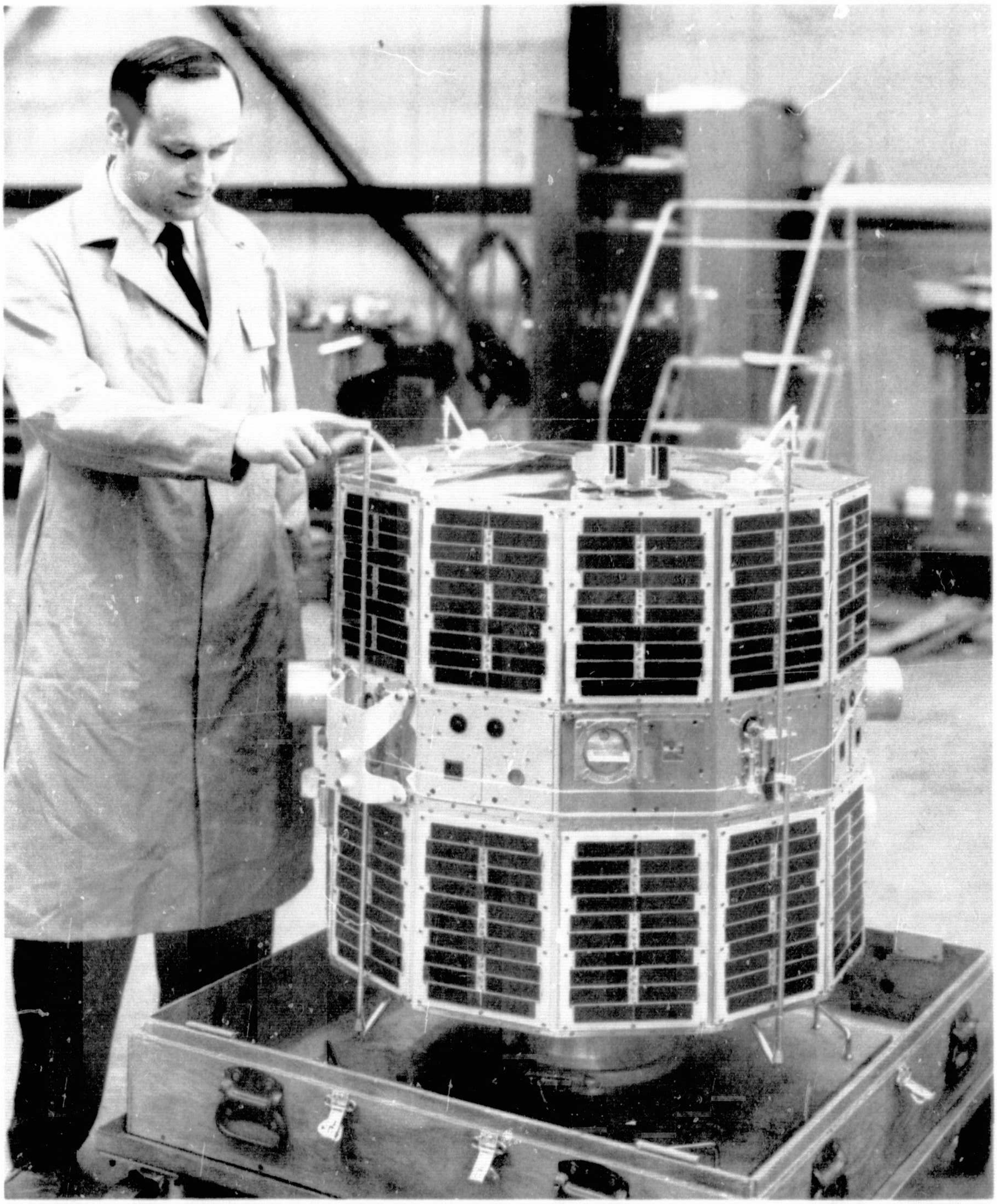
Experiment/Instrument	Experimenter/Affiliation
Scintillation counter-S	--- /NRL
X-ray photometers-S	--- /NRL
Geiger counters-S	--- /NRL
Ultraviolet photometers-S	--- /NRL

Remarks: Explorer XXXVII was the second Solar Explorer launched for NRL by NASA in a joint project to study the Sun.

Selected References:

NASA: Solar Explorer B, *NASA News Release 68-36*, 1968.

EXPLORER XXXVII (Continued)



ESRO IIB 1968 41A

May 17, 1968	Scout/WTR	98.9 min
Active	196 lb	205/677 miles
In orbit	H. L. Eaker	L.H. Meredith

Objective: To measure solar and cosmic radiation.

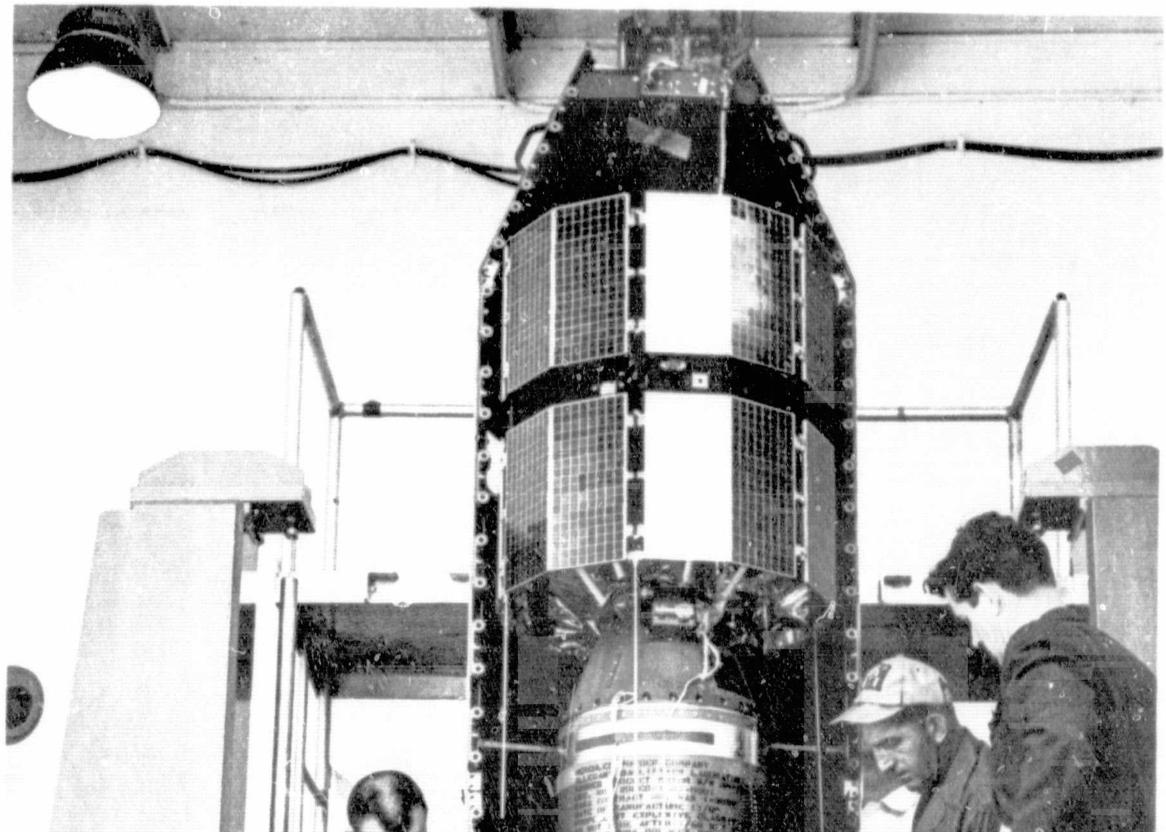
Experiment/Instrument	Experimenter/Affiliation
Geiger counters-E	H. Elliott/Imperial College J. J. Quenby
Proportional-counter, scintillator, Cerenkov-counter package-E	H. Elliott/Imperial College R. Hynds
Cerenkov counter-E	P. L. Marsden/U. Leeds J. G. Wilson
Hard solar X-ray detector-S	K. A. Pound/U. Leicester R.L.F. Boyd/University College J. L. Culhane
Solid-state telescope-S	C. deJager/U. Utrecht W. deGraaf A. C. Brinkman
Solid-state telescope-E	J. Labeyrie/Centre D'Etudes Nuclaires de Scalay

Remarks: Launched by NASA for the European Space Research Organization (ESRO) on a reimbursible basis.

Selected References:

See: References under ESRO IIA.

ESRO IIB (Continued)



NIMBUS B None

May 18, 1968	Thorad-Agena/WTR	---
May 18, 1968	1360 lb	---
Suborbital	H. Press	W. Nordberg

Objectives: Weather research and sensor development; more specifically, to determine the spatial and temporal variations of atmospheric structure - particularly temperature - and temporal variations in the solar ultraviolet. Engineering objectives: to demonstrate the use of radioisotope power and the feasibility of data collection by satellite.

Experiment/Instrument	Experimenter/Affiliation
Infrared interferometer spectrometer (IRIS) -P	R. A. Hanel/GSFC
Satellite infrared spectrometer (SIRS)-P	D. Wark/ESSA
Interrogating, Recording and Locating System (IRLS)	G. Hogan/GSFC
High Resolution Infrared Radiometer (HRIR)-P	T. Cherrix/GSFC
Medium Resolution Infrared Radiometer (MRIR)-P	A. W. McCulloch/GSFC
Monitor of Ultraviolet Solar Energy (MUSE)-S	D. F. Heath/GSFC
Image Dissector Camera (IDCS)	G. Branchflower/GSFC

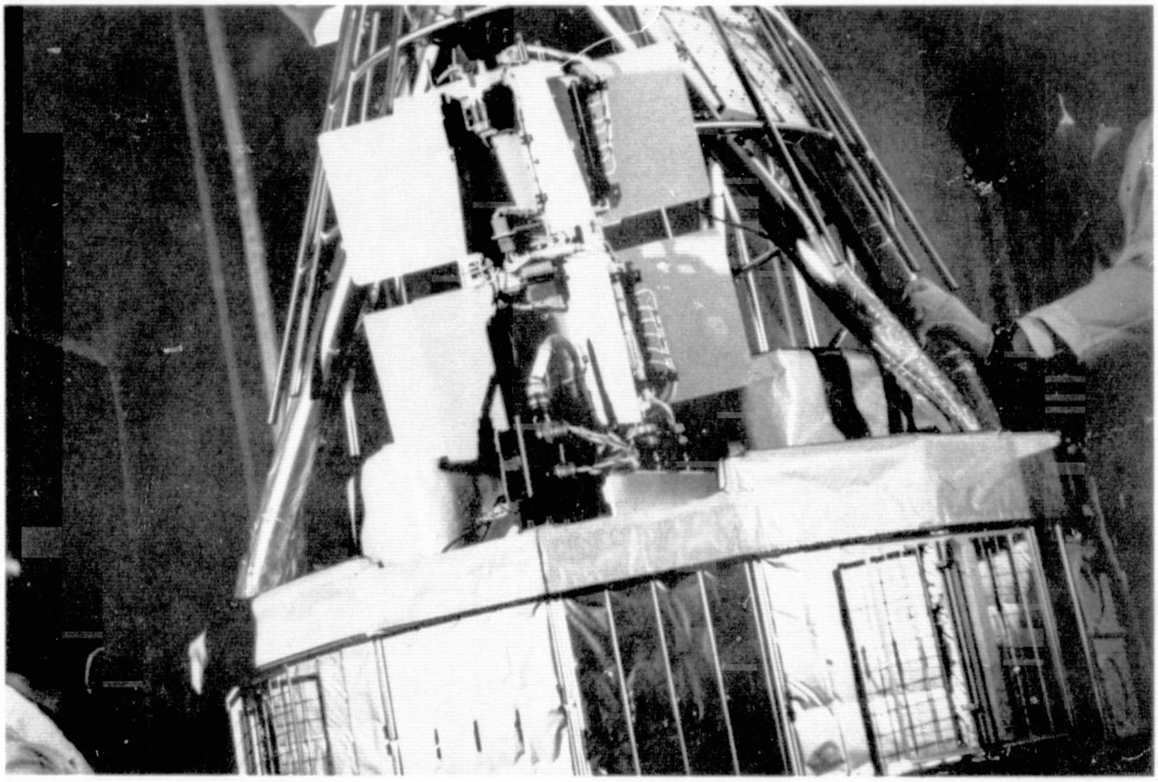
Remarks: Nimbus B was launched with the Army Secor X geodeic satellite, but a booster guidance malfunction forced destruction of the payload. Carried the Snap-19 radioisotope power supply.

Selected References:

See: References under Nimbus I and II.

C.3

NIMBUS B (Continued)



EXPLORER XXXVIII 1968 55A

July 4, 1968	TAID/WTR	224 min.
Active	607 lb	3636/3614 miles
In orbit	J. T. Shea	R. G. Stone

Objectives: To monitor low-frequency cosmic radio noise using large deployable antennas; to monitor the radio noise emitted by the Sun, Jupiter, and the Earth.

Experiment/Instrument	Experimenter/Affiliation
Four 9-step receivers-A	R. G. Stone/GSFC
Two burst receivers-A	R. G. Stone/GSFC
One electron trap-A	R. G. Stone/GSFC
One impedance probe-A	R. G. Stone/GSFC
One capacitance probe-A	R. G. Stone/GSFC

Remarks: Explorer XXXVIII (also called an RAE or Radio Astronomy Explorer) successfully deployed its four 750-ft. antennas and a damper boom on Oct. 8, 1968. Explorer XXXVIII has detected sharply-beamed, sporadic, low-frequency radio signals from Jupiter.

Selected References:

Airborne Instruments Laboratory: Flight Burst Radiometer Assembly System for Radio Astronomy Explorer Satellite, *NASA CR-91288*, 1967.

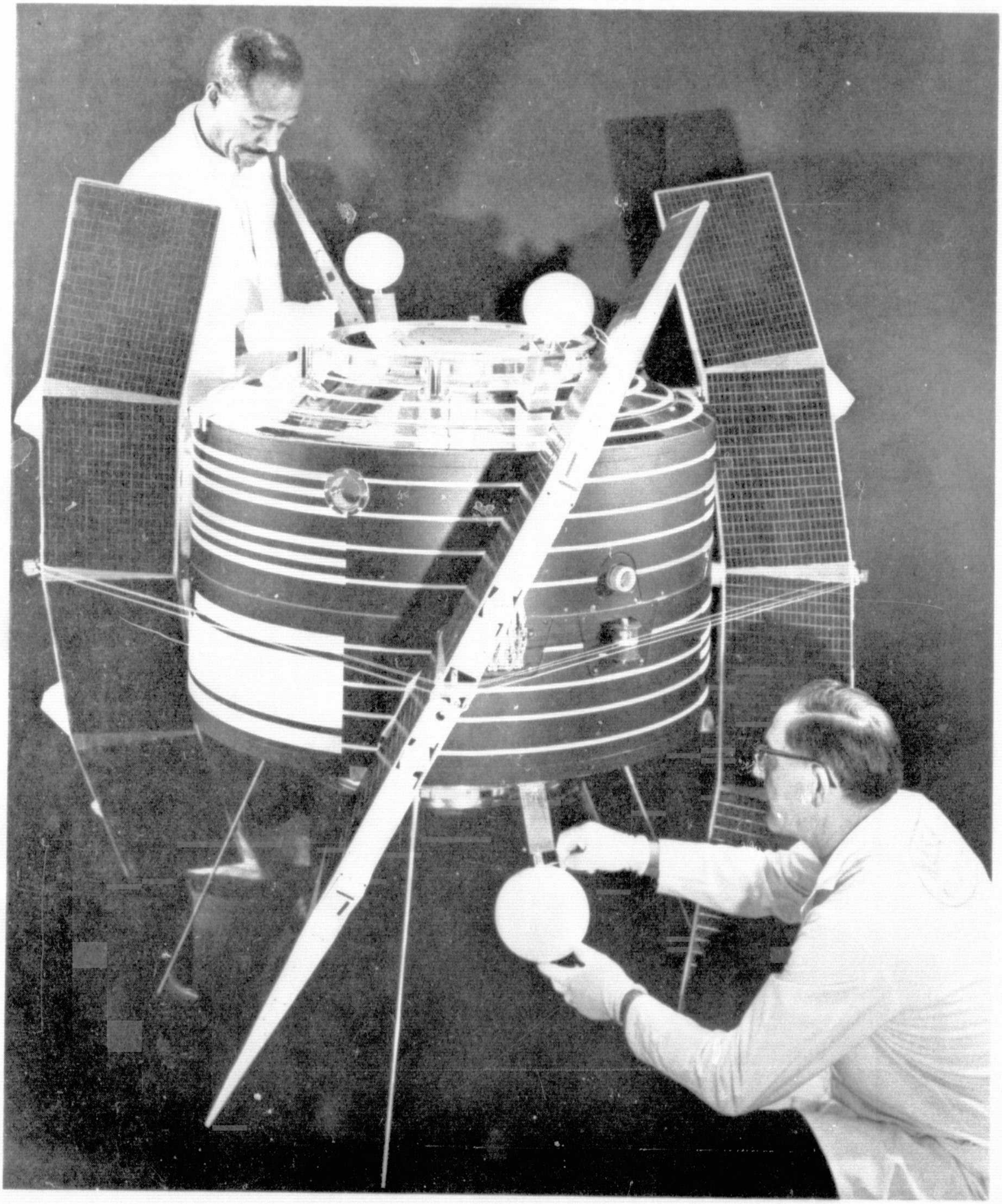
Somerlock, C.R. and Krustins, J.: A Precision Spacecraft Radiometer for Hectometer Wavelengths, *NASA TN-D-4634*, 1968.

Stone, R.G.: RAE---1500-ft Antenna Satellite, *Astronautics & Aeronautics*, *3*, 46, March 1965.

Alexander, J.K. et al: The Spectrum of Cosmic Radio Background between 0.4 and 6.5 MHz, *Astrophys. J.*, *157*, L163, Sept. 1969.

Tossman, B.E.: Magnetic Attitude Control System for Radio Astronomy Explorer-A Satellite, *J. Spacecraft and Rockets*, *6*, 239, March 1969.

EXPLORER XXXVIII (Continued)



EXPLORER XXXIX 1968 66A
EXPLORER XL 1968 66B

Aug. 8, 1968	Scout/WTR	118 min
Active	20.8 lb (XXXIX)	418/1574 miles
In orbit	157 lb (XL)	423/1574 miles
	R. Miller (XXXIX & XL)	G.M. Keating (XXXIX)
		J.A. Van Allen (XL)

Objectives: Explorer XXXIX (An Air Density Explorer): to study density and temperature variations of the atmosphere at intermediate latitudes. Explorer XL (Injun V): to return radiation belt data.

Experiment/Instrument	Experimenter/Affiliation
Explorer XL	
Particle differential energy analyzer (LEPEDEA)-E	--- /State U. Iowa
Solid-state detector-E	--- /State U. Iowa
VLF receiver-I	--- /State U. Iowa
Spherical particle analyzers-E	--- /State U. Iowa

Remarks: A dual launch. An interdisciplinary project designed to study interaction of solar radiation with the atmosphere and during the solar maximum.

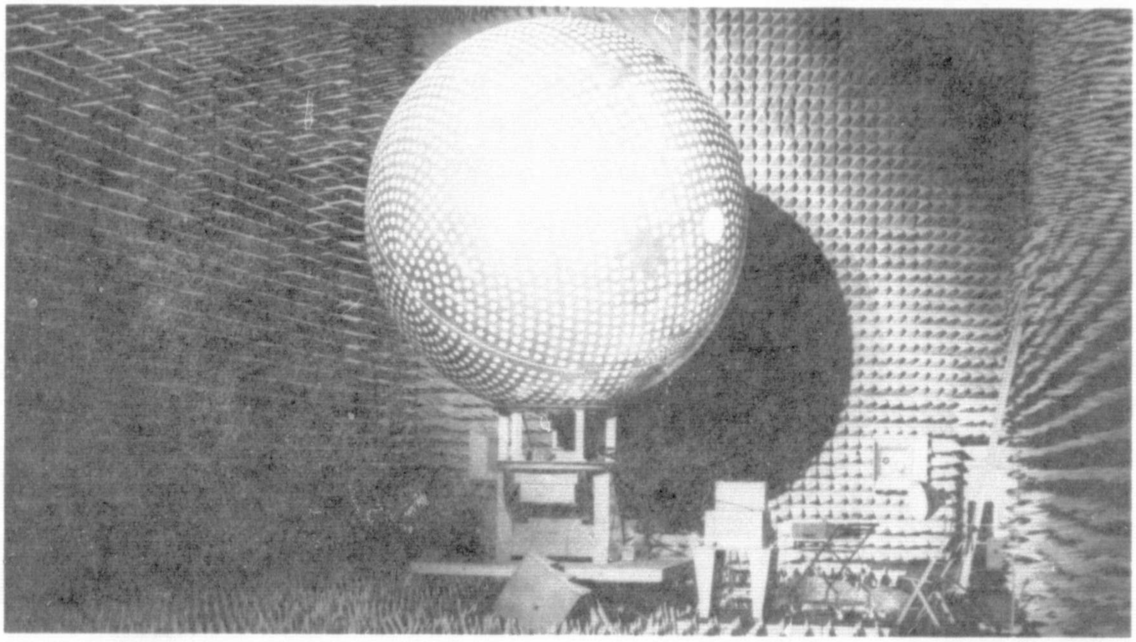
Selected References:

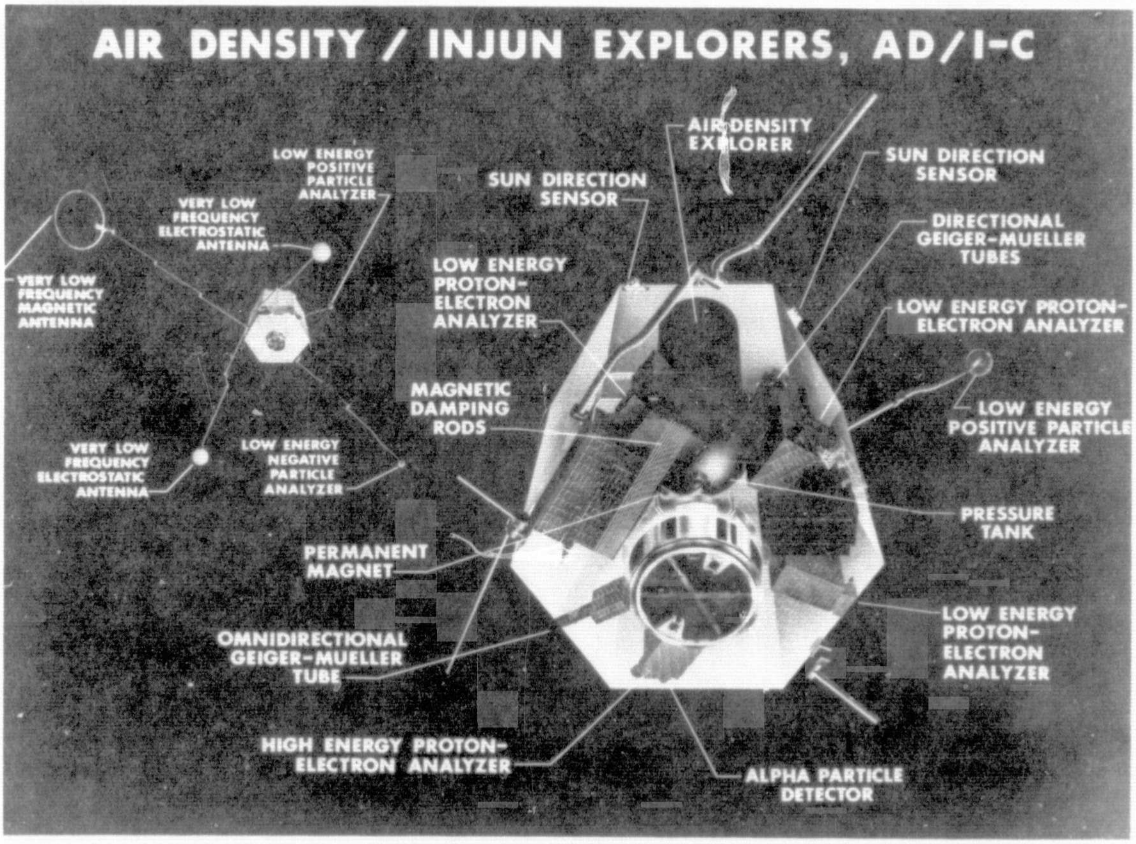
Anon: Explorers 39 and 40, *Spacelog, 8*, 47, Winter 1968-1969.

Gurnett, D.A., et al: Initial Observations of VLF Electric and Magnetic Fields with the Injun 5 Satellite, *NASA CR-101677*, 1969.

See: NASA News Releases and Press Kits.

EXPLORER XXXIX
EXPLORER XL (Continued)





APPLICATIONS TECHNOLOGY SATELLITE IV 1968 68A

Aug. 10, 1968	Atlas-Centaur/ETR	94.5 min
Oct. 17, 1968	864 lb	135/480 miles
Oct. 17, 1968	D. V. Fordyce	---

Objectives: To perform communications, meteorological, technological, and scientific experiments in a synchronous orbit.

Experiment/Instrument	Experimenter/Affiliation	
Gravity-gradient experiment	---	/GSFC
Microwave experiment	---	/GSFC
Day-night camera	---	/GSFC
	---	/Lewis Research Center

Remarks: Second-stage launch vehicle restart failure prevented attainment of synchronous orbit. Gravity-gradient experiment could not be performed.

Selected References:

Anon: Applications Technology Satellite, *Spacelog, 8,* 43, Winter 1968-1969.

Hunter, R.E., et al: Cesium Contact Ion Microthruster Experiment Aboard Applications Technology Satellite (ATS)-IV, *J. Spacecraft and Rockets, 6,* 968, Sept. 1969.

Shaw, R., Pugmire, T.K., and Callens, R.A.: Ammonia Resistojet Station Keeping Subsystem Aboard Applications Technology Satellite (ATS)IV, *AIAA Paper 69-296,* 1969.

APPLICATIONS TECHNOLOGY SATELLITE IV (Continued)

ESSA VII 1968 69A

Aug. 16, 1968	Delta/WTR	115 min
Active	320 lb	889/913 miles
In orbit	---	---

Objective: To provide continuing observation of the Earth's cloud cover on a global basis.

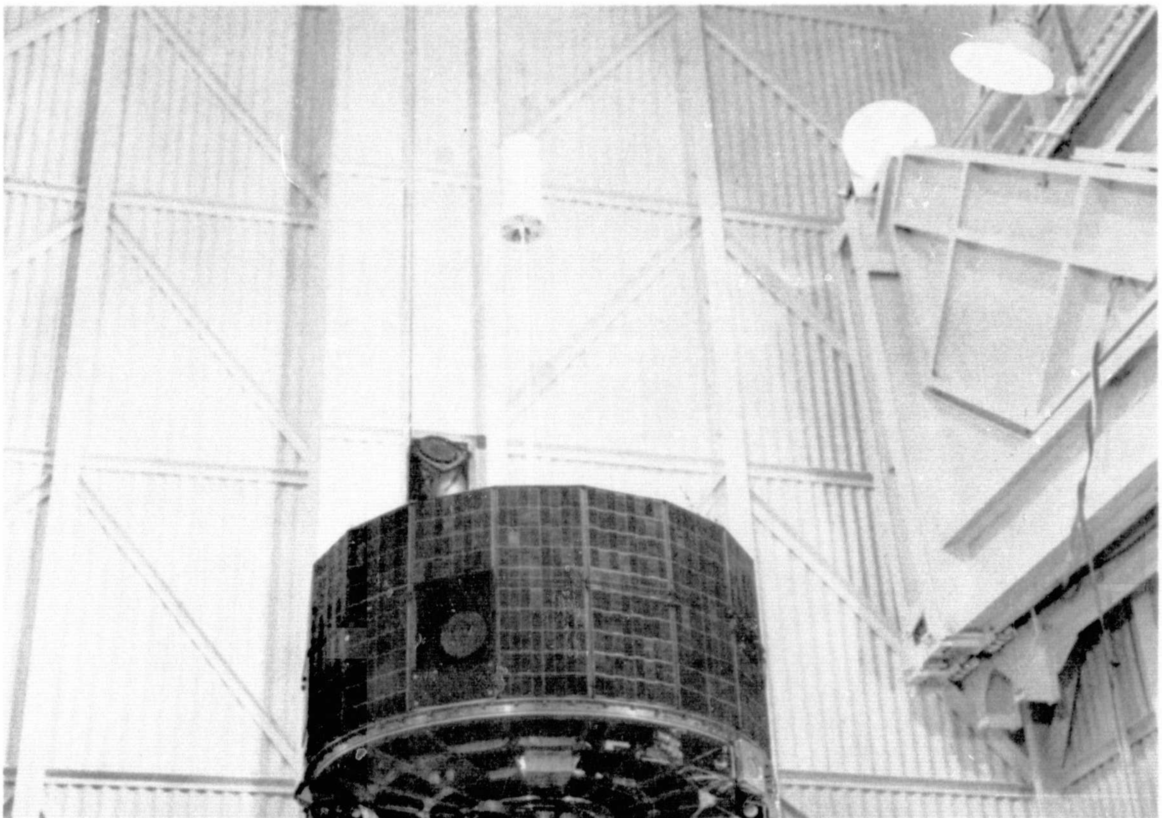
Remarks: In a Sun-synchronous orbit. Launched for ESSA by NASA on a reimbursible basis. Replaced ESSA V in TOS system.

Selected References:

Anon: ESSA 7, *Spacelog*, *8*, 55, Winter 1968-1969.

See also: References under ESSA I.

ESSA VII (Continued)



INTELSAT III F-1		None
Sept. 19, 1968	Delta/ETR	---
----	623 lb	---
Suborbital	---	---

Objective: Commercial communications.

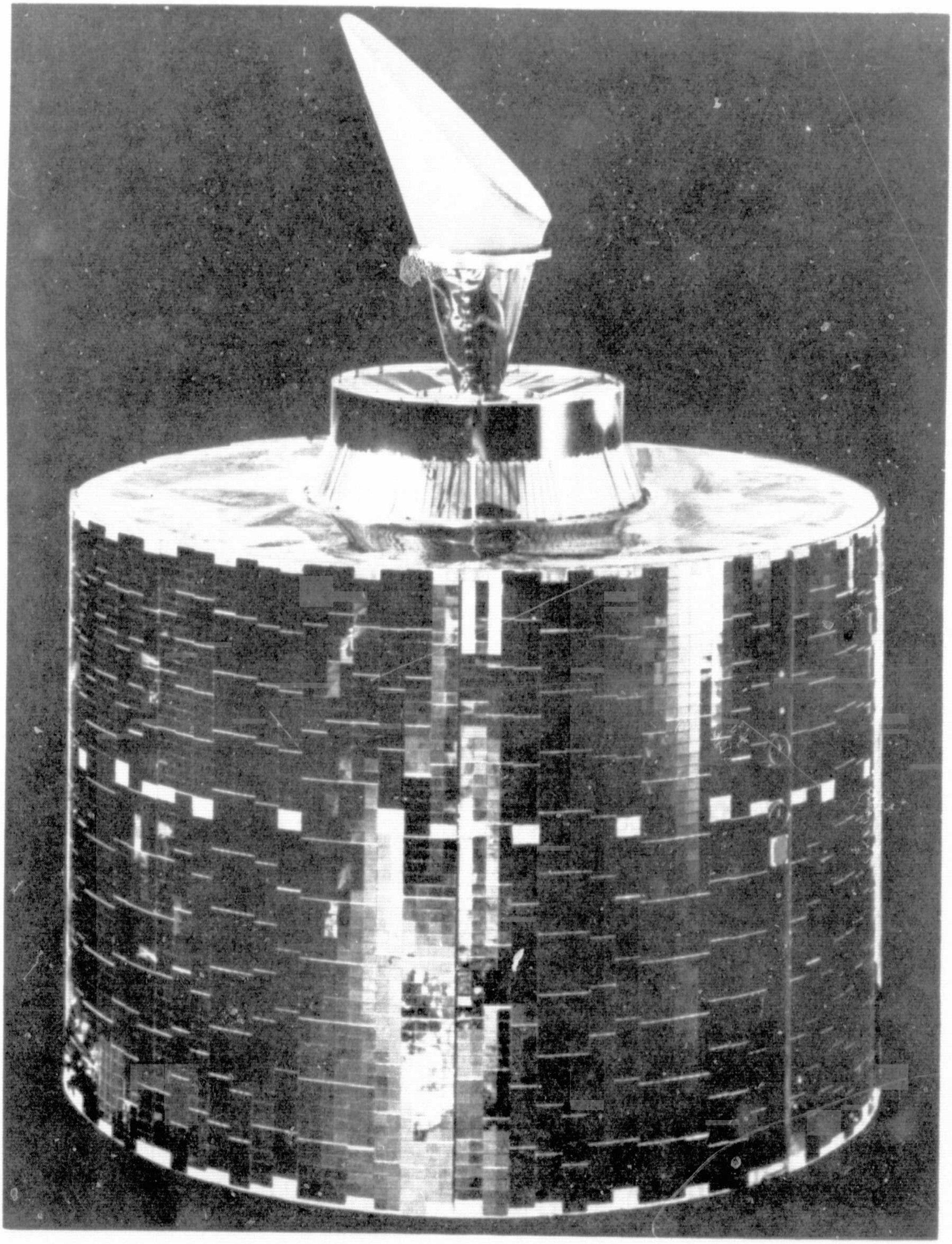
Remarks: Launched by NASA for Comsat Corp. on a reimbursible basis. Due to a control system failure the launch vehicle was destroyed.

Selected References:

Feigen, M. et al: The Intelsat III Satellite, *IEEE Conf. Rec.*, *4*, 646, 1968.

Donnelly, F.E., Jr., Graunas, R.P., and Killian, J.D.: The Design of the Mechanically Despun Antenna for the Intelsat-III Communications Satellite, *IEEE Trans.*, *AP-17*, 407, July 1969.

INTELSTAT IIIF-1 (Continued)



ESRO IA

Oct. 3, 1968	Scout/WTR	102.8 min
Active	189 lb	161/949 mi.
In Orbit	J.R. Holtz	E.R. Schmerling

Objective: To make an integrated study of the high altitude ionosphere, particularly impinging particles and auroral light. (Also called Aurorae)

Experiment/Instrument	Experimenter/Affiliation
Langmuir probes-I	A.P. Willmore/University College
Auroral photometers-I	A. Egeland/U. Oslo
Scintillation detector-E	R. Dalziel/DSIR, Slough
Electrostatic analyzer-E	W. Riedler/Kiruna Geophysical Observatory
Scintillator counter-E	R. Dalziel/DSIR, Slough
Solid-state detectors-E	F. Sorass/U. Bergen
Geiger counters-E	G.H. Skouli/Norwegian Defense Research Establishment

Remarks: Launched by NASA for the European Space Research Organization (ESRO) on a reimbursible basis.

Selected References:

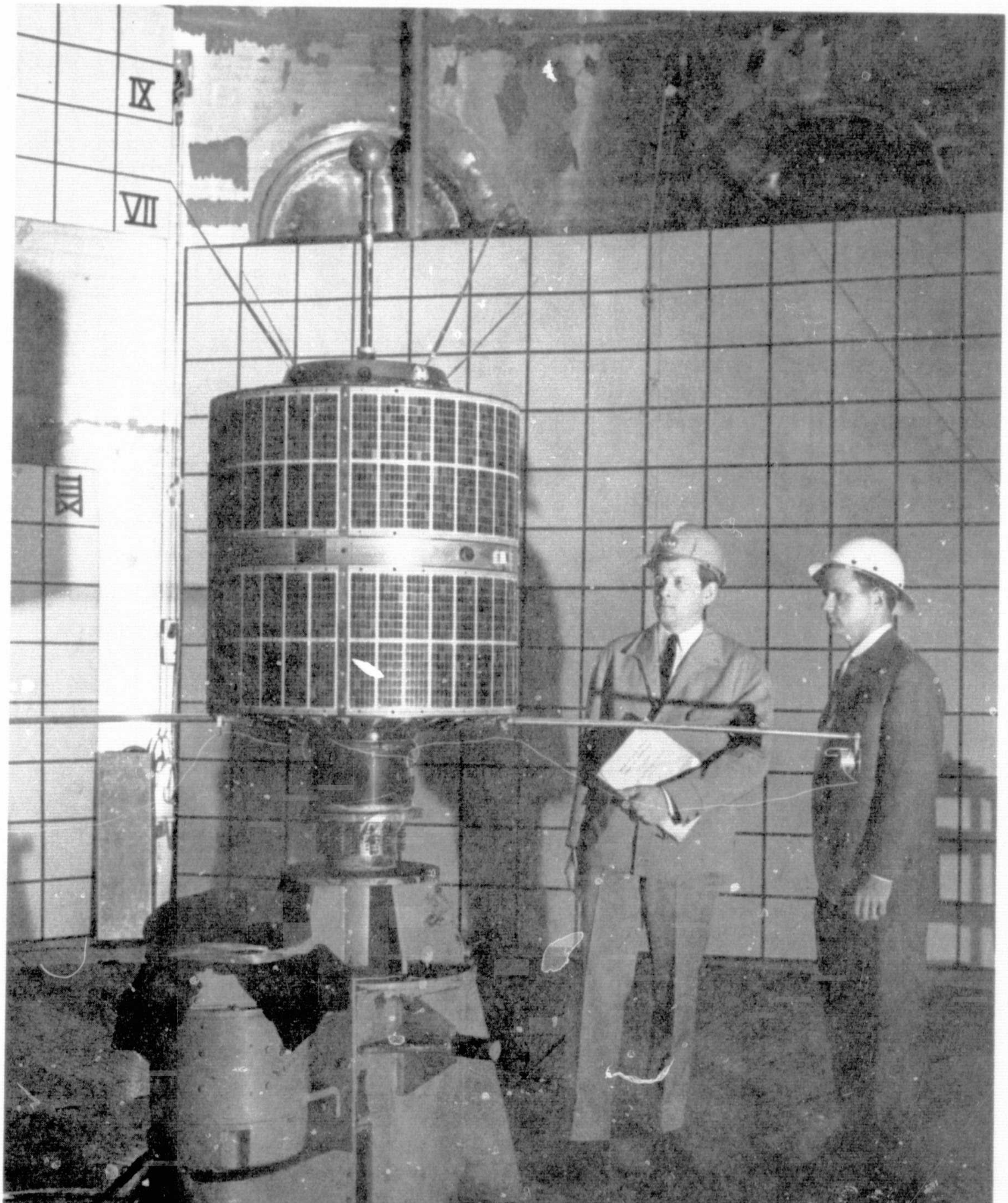
Lines, A.W.: Design of Spacecraft for Experiments in the ESRO Scientific Programme, *J. Roy. Astronautical Soc.*, *69*, 759, Nov. 1965.

Mullinger, D.E.: Technical Description of the ESRO I Scientific Satellite, in *Proceedings of the International Symposium on Space Technology and Science*, Y. Kuroda, ed., AGNE Publishing, Inc., Tokyo, 1968, p. 695.

Mullinger, D.E.: The ESRO-I/Aurorae Project, *ESRO/ELDO Bulletin*, 6, April 1969.

NASA: ESRO-I Press Kit, *NASA News Release 68-158*, 1968.

ESRO IA (Continued)



TEST AND TRAINING SATELLITE II 1968 100B

Nov. 8, 1968	Delta/ETR	97.9 min.
Active	40 lb	232/587 mi.
In orbit	P. Burr	----

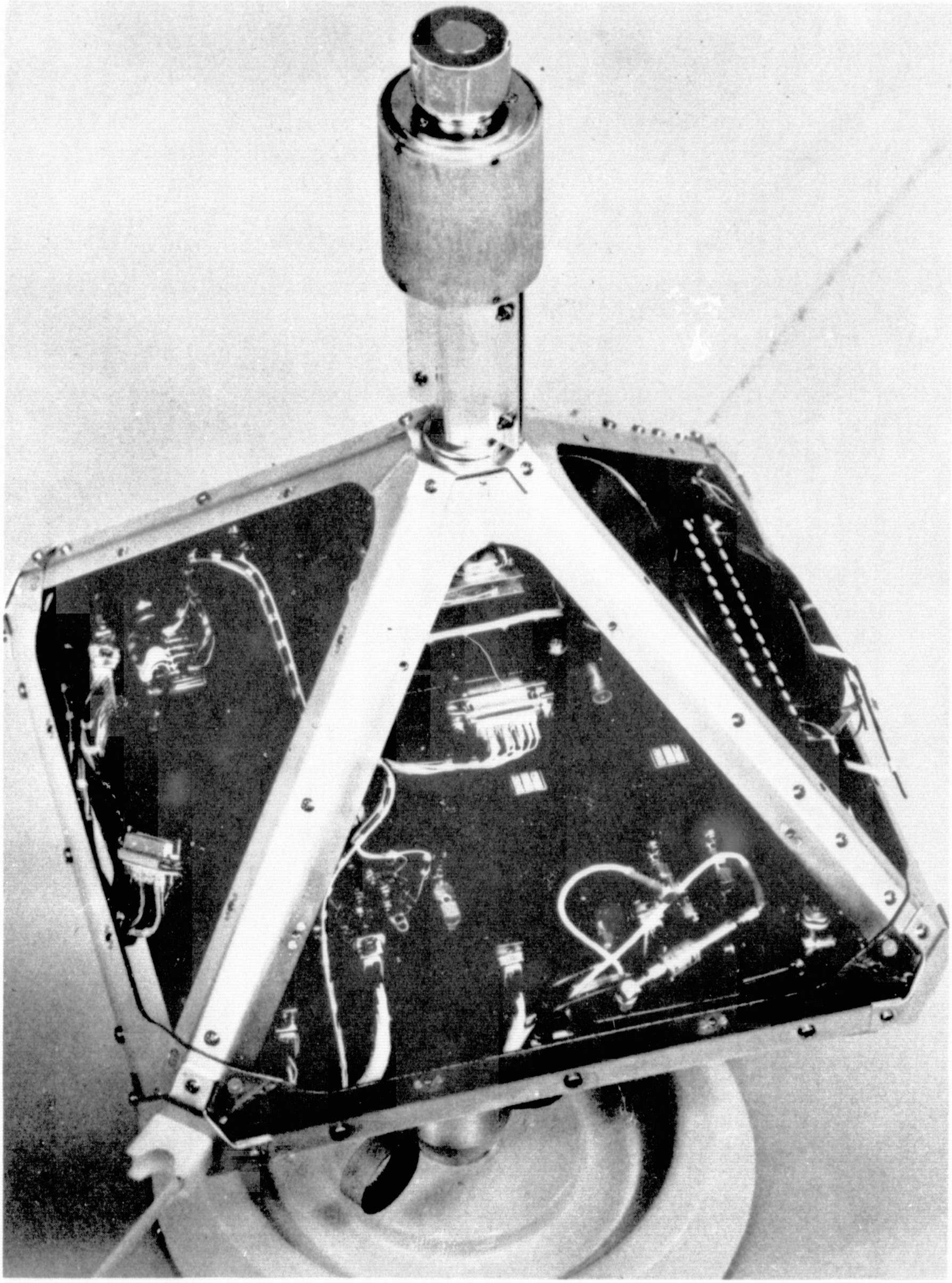
Objectives: To check out Manned Space Flight Network stations prior to manned missions; to help train ground personnel; to simulate routine, all-weather missions; and to develop and verify target acquisition and handover techniques.

Remarks: Also called TTS-II or TETR-II (an obsolete acronym). TTS II was launched piggyback along with Pioneer IX as a secondary-objective spacecraft. The TTS-II payload included an S-band transponder so that it could be acquired and tracked by Manned Space Flight Network stations. Routine tracking and housekeeping telemetry, however, were handled by STADAN.

Selected References:

See: References under TTS I.

TEST AND TRAINING SATELLITE II (Continued)



HEOS I 1968 109A

Dec. 5, 1968	Delta/ETR	6792 min.
Active	241 lb	262/138,119 mi.
In orbit	R.J. Goss	B. Taylor

Objectives: To study interplanetary radiation, solar wind, and magnetic fields outside the magnetosphere during the period of maximum solar activity.

Experiment/Instrument	Experimenter/Affiliation
Fluxgate magnetometer -E	H. Elliott/Imperial College P. Hedgecock/U. London
Ground observation of barium-copper oxide release-P	R. Lust/Max Planck Inst. H. Gollnitz/for Extra-terrestrial Physics
Cerenkov-scintillator telescope	H. Elliott/Imperial College A. Engel/U. London
Solid-state telescope-E	H. Elliott/Imperial College R. Hynds/U. London
Electrostatic analyzer-E	Prof. Coutrez/U. Brussels W. Scholiers
Solid-state telescope-E	J. Labeyrie/Centre D'Etudes J. Engelman/Nuclaires de Scalay L. Koch
Electrostatic analyzer-E	A. Bonetti/U. Florence G. Pizella/U. Rome
Radiation telescope and Cerenkov counter-E	C. Occhialini-Dilworth/U. Milan C. Bland J. Labeyrie/Centre D'Etudes Nuclaires de Scalay

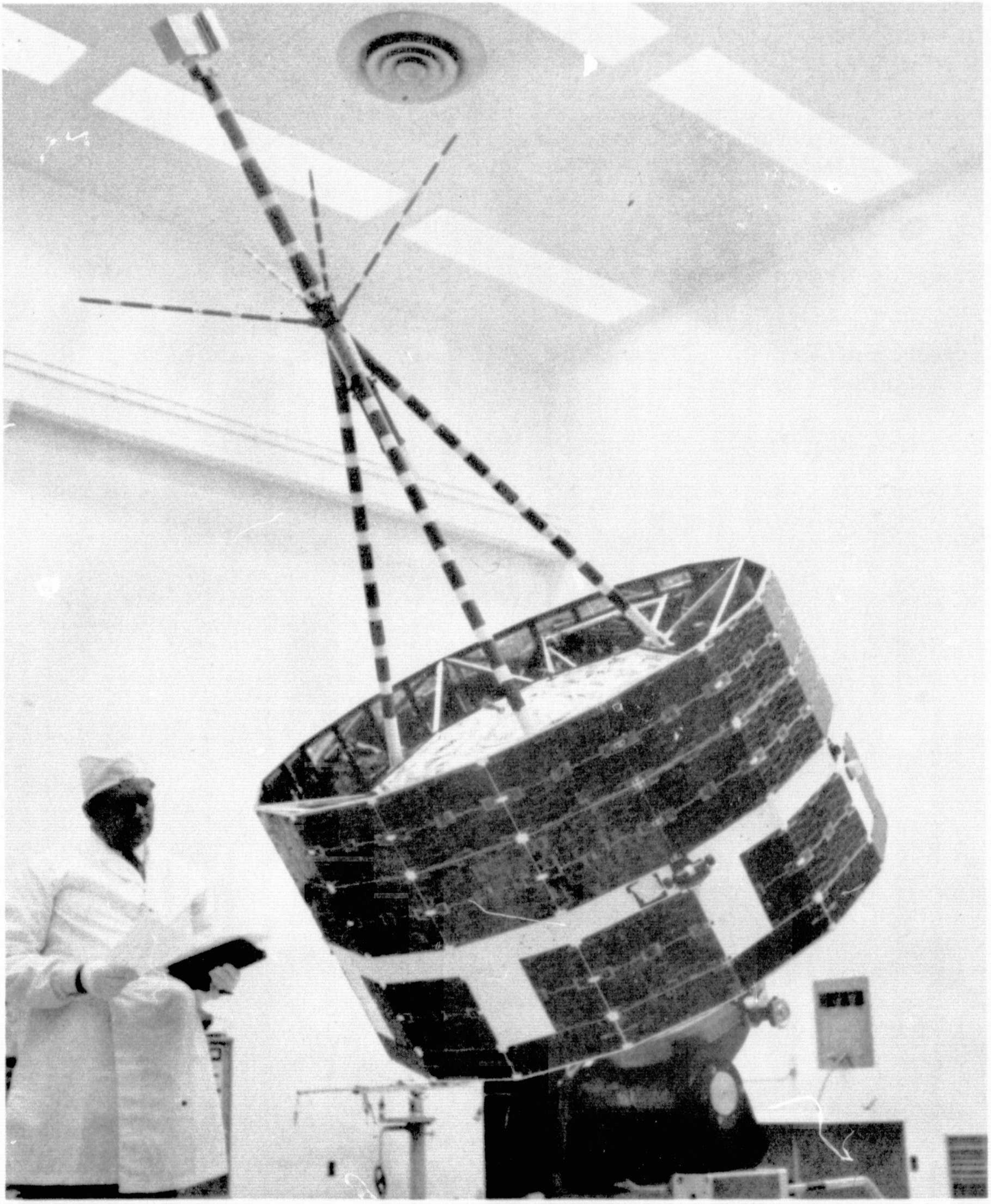
Remarks: HEOS (Highly Eccentric Orbit Satellite) was launched for the European Space Research Organization (ESRO) by NASA on a reimbursible basis. Released barium cloud from orbit March 18, 1969.

Selected References:

NASA: HEOS-A, *NASA News Release 68-204*, 1968.

Anon: Europe's Cislunar Probe, *Spaceflight, 11*, 222, July 1969.

HEOS I (Continued)



ORBITING ASTRONOMICAL OBSERVATORY II 1968 110A

Dec. 7, 1968	Atlas-Centaur/ETR	100.3 min.
Active	4400 lb	475/483 miles
In orbit	J. Purcell	J.E. Kupperian

Objectives: To survey the ultraviolet spectra and helium content of hot, young stars; to study the ultraviolet spectra of giant stars; to study the distribution and density of interstellar gas.

Experiment/Instrument	Experimenter/Affiliation
Ultraviolet TV telescopes (Celescope) - A	F. Whipple/Smithsonian Astrophysical Observatory
Ultraviolet photometers-A	A.D. Code/U. Wisconsin

Remarks: The OAO II is successfully producing stellar ultraviolet data in large quantities. Preliminary data indicate that young stars are much hotter than previously supposed. Some older galaxies are emiting much more strongly in the ultraviolet region of the spectrum than expected.

Selected References:

Davis, R.J., ed.: The Celescope Experiment, *NASA CR-100522*, 1968.

Goldberg, L.: Ultraviolet Astronomy, *Sci. Amer.*, *220*, 92, June 1969.

ORBITING ASTRONOMICAL OBSERVATORY II (Continued)

ESSA VIII 1968 114A

Dec. 15, 1968	Delta/WTR	114.6 min.
Active	300 lb	880/910 mi.
In orbit	----	----

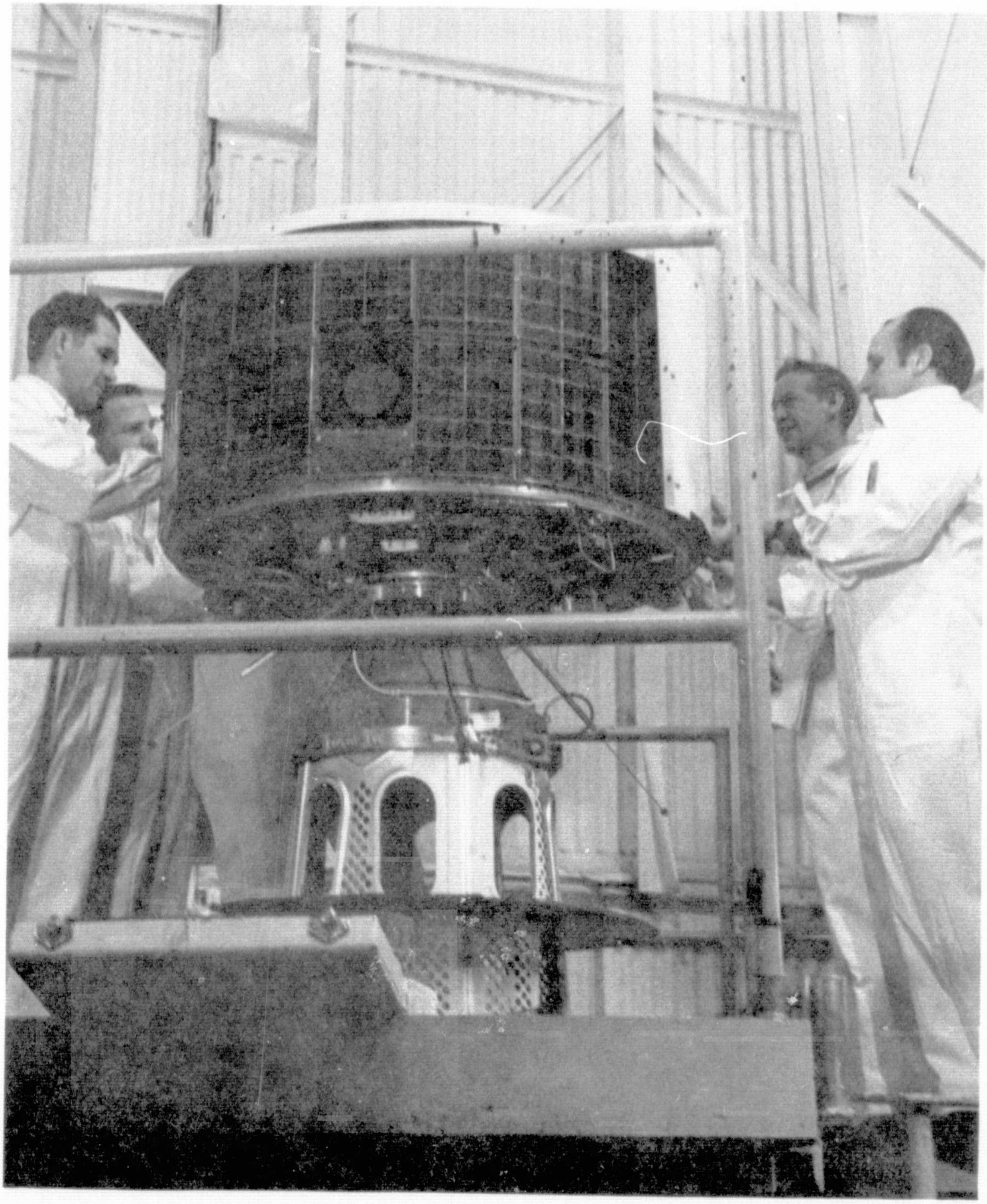
Objective: To provide continuing observation of the Earth's cloud cover on a global basis.

Remarks: Launched by NASA for ESSA on a reimbursible basis. Carries two 1-inch Automatic Picture Transmission (APT) cameras for local reception of cloud-cover pictures.

Selected References:

See: References under ESSA I.

ESSA VIII (Continued)



INTELSAT III F-2 1968 116A

Dec. 19, 1968	Delta/ETR	1436 min.
Active	642 lb	22,244/22,257 mi.
In orbit	----	

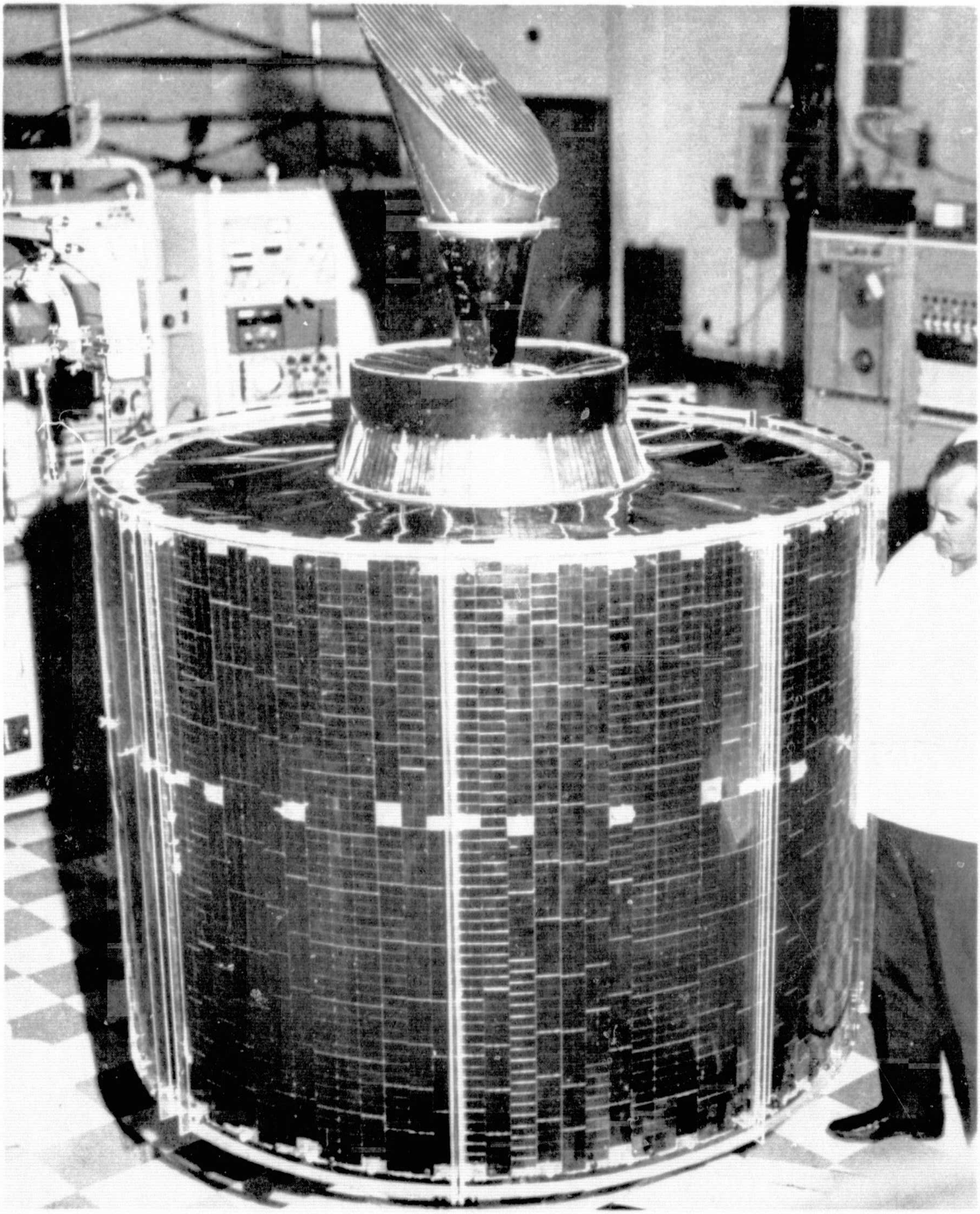
Objective: Commercial communications

Remarks: Launched by NASA for Comsat Corp. on a reimbursible basis. First truly global communication satellite.

Selected References:

See: References under INTELSAT III F-1.

INTELSAT III F-2 (continued)



ORBITING SOLAR OBSERVATORY V 1969 006A

Jan. 22, 1969	Delta/ETR	95.6 min.
Active	620 lb	333/349 mi.
In orbit	J. M. Thole	S. P. Maran

Objectives: The primary objective of OSO V was to obtain high resolution spectroscopic data from the Sun between 1 and 1250 A.

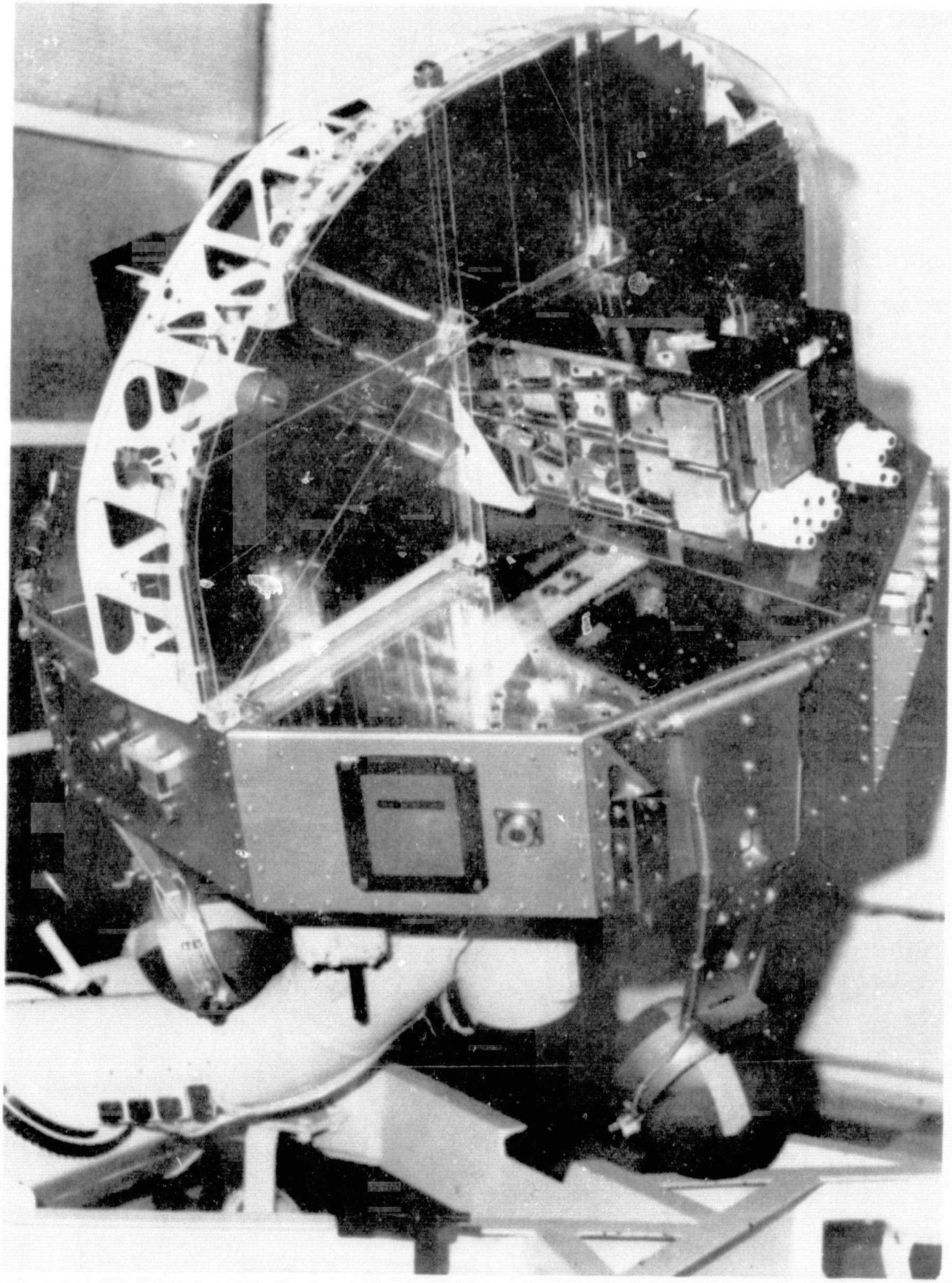
Instrument/Discipline	Experimenter/Affiliation
Pointed X-ray spectrometer	W.M. Neupert/GSFC
Pointed X-ray spectroheliograph	R.L.F. Boyd/University College
Pointed ultraviolet spectroheliograph	J.D. Purcell/NRL
Zodiacal light telescope	E.P. Ney/U. Minn.
Lyman-alpha cell	J.E. Blamont/U. Paris
Solar ultraviolet monitor	W.A. Rense/U. Colo.
Gamma-ray detector	K. Frost/GSFC
X-ray monitor	T.A. Chubb/NRL

Remarks: Six experiments fully operational; two partially operational.

Selected References:

See: General references under OSO I.

ORBITING SOLAR OBSERVATORY V (Continued)



ISIS I 1969 009A

Jan. 30, 1969	Delta/WTR	128.4 min.
Active	520 lb	600/3515 mi.
In orbit	E. D. Nelson	J. Jackson

Objectives: To gather information on the nature and behavior of the ionosphere at high latitudes; and to study ionospheric storms, polar blackouts, and other disturbances with the goal of improving long-range radio communication.

Instrument/Discipline	Experimenter/Affiliation
Swept-frequency sounder	E. Warren/CRC G.L. Nelms/CRC
Fixed-frequency sounder	W. Calvert/ESSA G.L. Nelms/CRC
Radio noise receiver	T. Hartz/CRC
VLF receiver and resonance exciter	R. Barrington/CRC
Energetic particle detectors	I. McDiarmid/Nat.Res.Council
Radio beacon	P. Forsyth/U. W. Ontario
Electrostatic probe	L. Brace/GSFC
Ion mass spectrometer	R. Narcisi/AFCRL
Spherical electrostatic probe	R. Sagalyn/AFCRL
Soft particle spectrometer	W. Heikkila/U. Texas

Remarks: ISIS Program is conducted jointly by the Canadian Defence Research Board and NASA. ISIS I, with ten experiments, is considerably more complex than its predecessors Alouettes I and II.

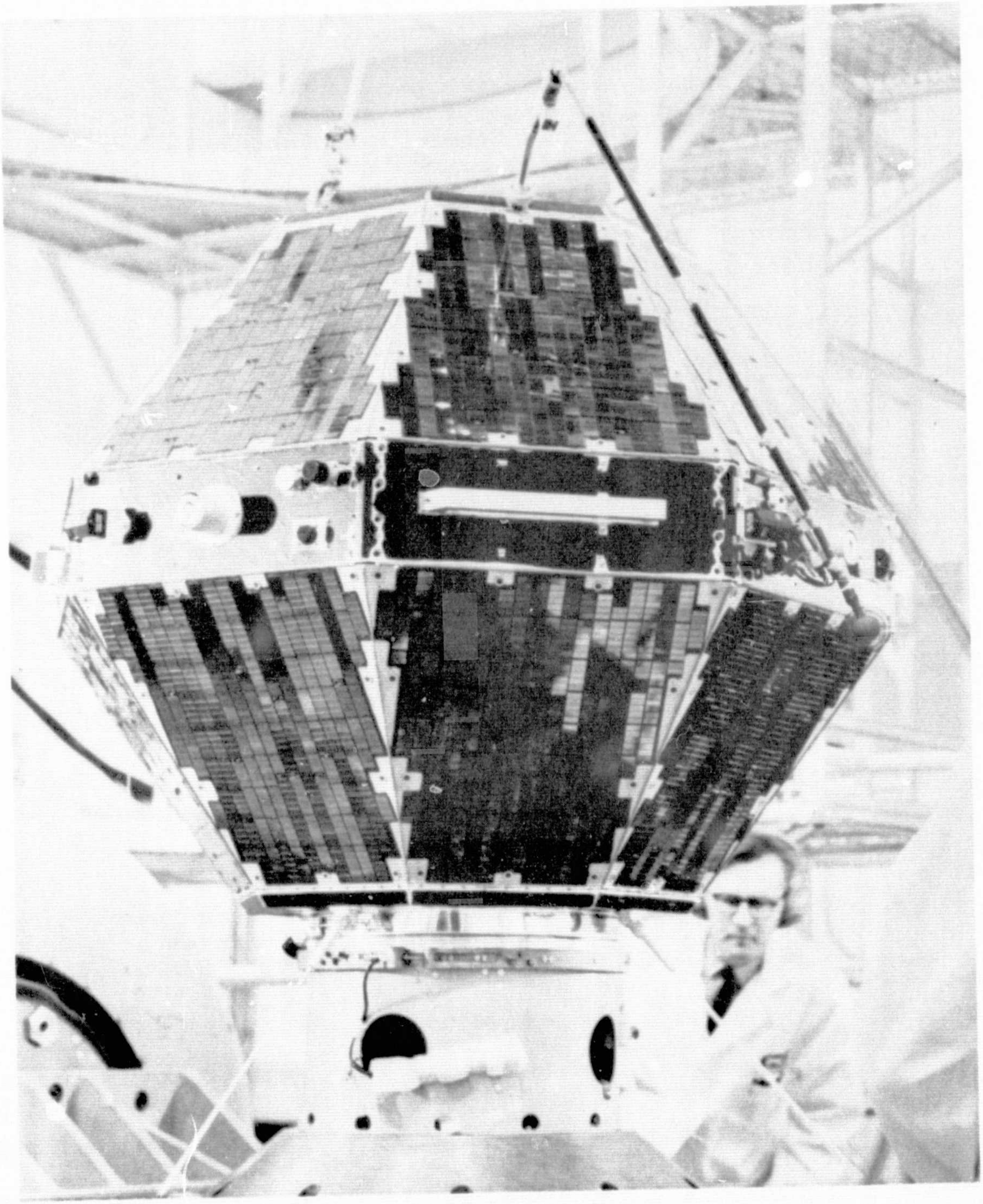
Selected References:

Florida, C.D.: The Development of a Series of Ionospheric Satellites, *IEEE Proc., 57*, 867, June 1969.

Muldrew, D.B.: Preliminary Results of ISIS-A Concerning Electron Density Variations, Ionospheric Resonances and Cerenkov Radiation, *COSPAR Paper*, Prague, 1969.

Zuran, J.: Antenna-System Design of the ISIS-A Scientific Satellite, *Proc. IEE, 116*, 923, June 1969.

ISIS I (Continued)



INTELSAT III F-3 1969 011A

Feb. 6, 1969	Delta/ETR	1436 min.
Active	285 lb.	22,238/22,238 mi.
In orbit	----	----

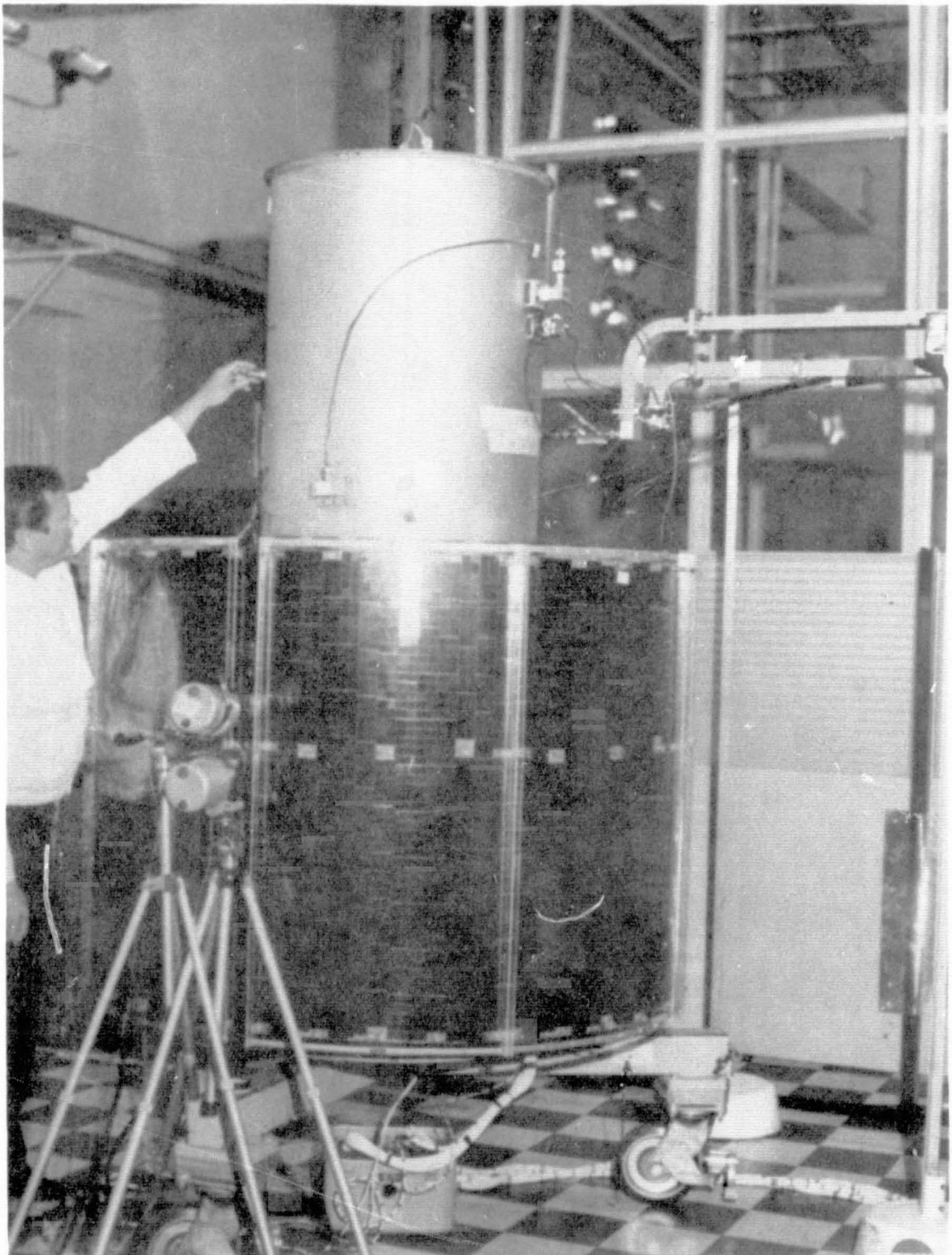
Objective: Commercial communications.

Remarks: Launched by NASA for Comsat Corp. on a reimbursible basis.

Selected References:

See: References under INTELSAT III F-1.

INTELSAT III F-3 (Continued)



ESSA IX 1969 016A

Feb. 26, 1969	Delta/ETR	115 min.
Active	300 lb	883/943 mi.
In orbit	----	----

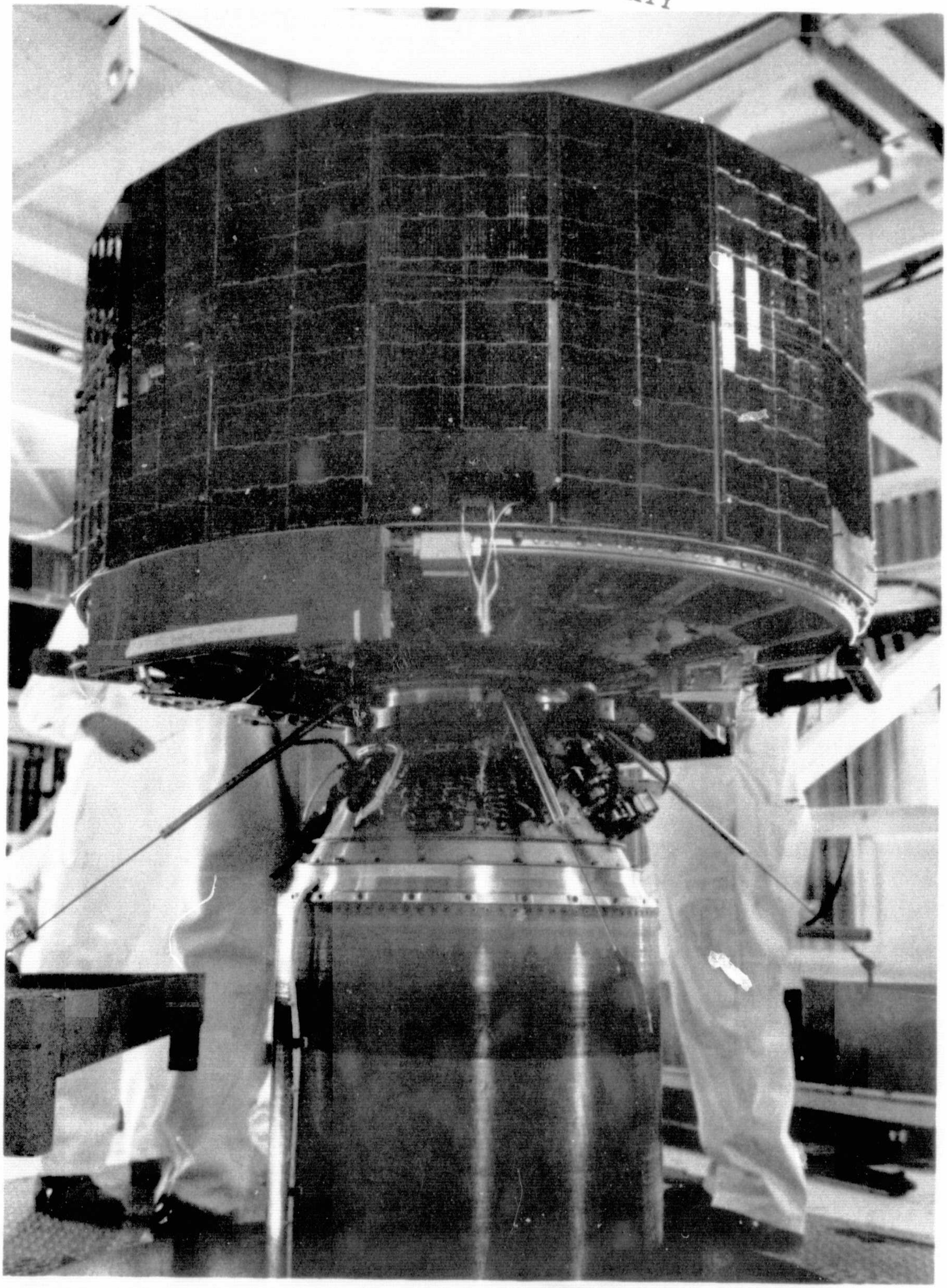
Objective: To provide continuing observation of the Earth's cloud cover on a global basis.

Remarks: Launched by NASA for ESSA on a reimbursible basis. Carries two 1-inch Advanced Vidicon Camera System (AVCS) cameras. Final launch in Tiros Operational Satellite (TOS) series.

Selected References:

See: References under ESSA I.

ESSA IX (Continued)



NIMBUS III 1969 037A

Apr. 14, 1969	Thorad-Agena/WTR	107.3 min.
Active	1360 lb	665/703 mi.
In orbit	H. Press	W. Nordberg

Objectives: Weather research and sensor development; more specifically, to determine the spatial and temporal variations of atmospheric structure---particularly temperature---and temporal variations in the solar ultraviolet. Engineering objectives: to demonstrate the use of radioisotope power and the feasibility of data collection by satellite.

Experiment/Instrument Experimenter/Affiliation

Same as Nimbus B, except that C.E. Cote/GSFC was the experimenter for the IRLS experiment.

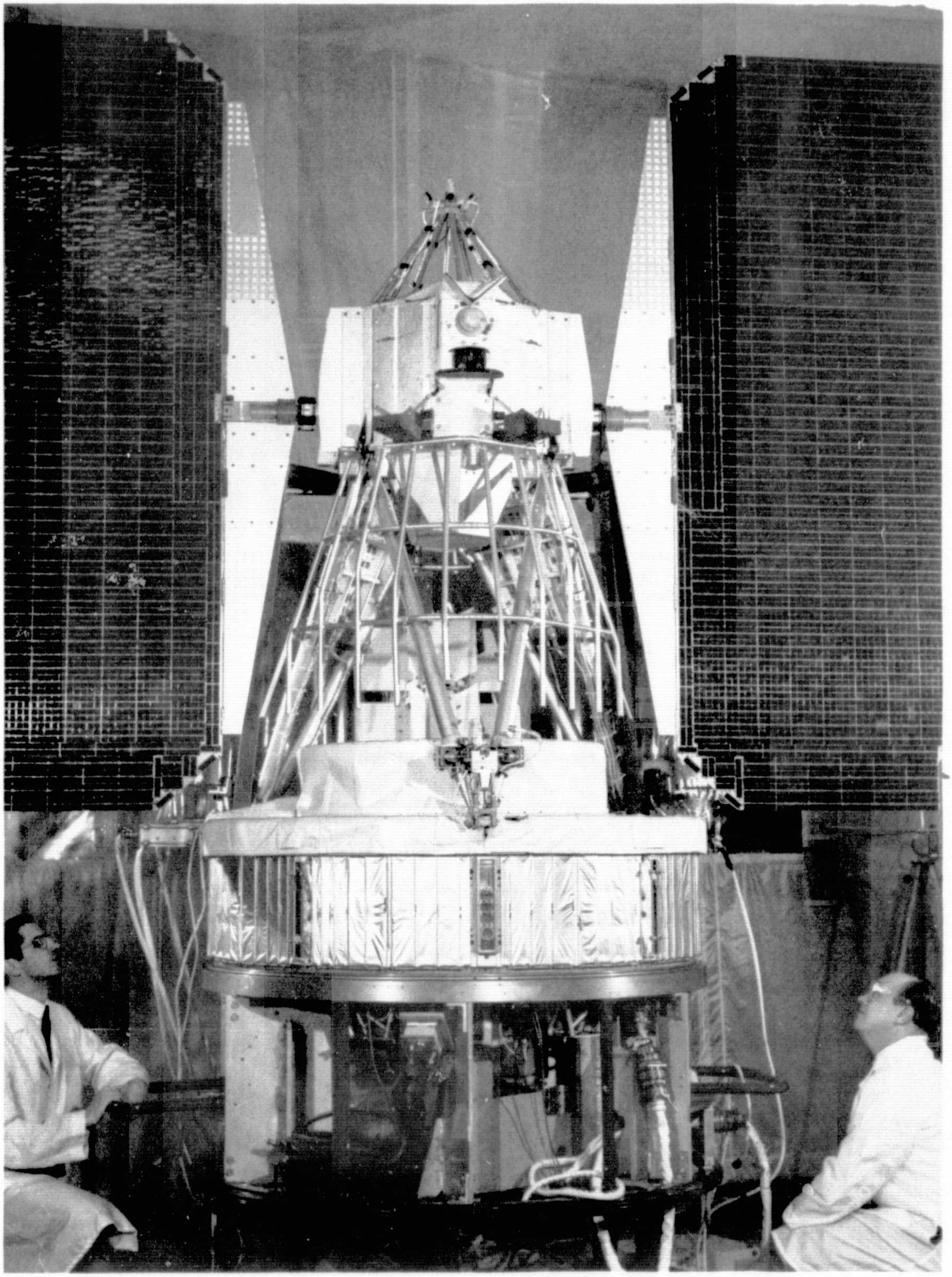
Remarks: Launched with the military geodetic satellite Secor 13 riding piggyback. Nimbus III was a replacement for Nimbus B1 which was destroyed during launch. Nimbus III carried the Snap-19 radioisotope power supply, Nimbus III participated in GARP (Global Atmospheric Research Program) and BOMEX (Barbados Oceanographic and Meteorological Experiment). Nimbus III can measure atmospheric temperature from the surface to 100,000 feet altitude over the entire globe twice a day.

Selected References:

Haley, R.L.: Meteorological Satellites---Beyond the First Nine Years, *AAS Paper 69-421*, 1969.

See also: References under Nimbus I and Nimbus II.

NIMBUS III (Continued)



INTELSAT III F-4 1969 045A

May 22, 1969	Delta/ETR	1436 min.
Active	642 lb	22,238/22,238 mi.
In orbit	----	----

Objective: Commercial communications.

Remarks: Launched by NASA for Comsat Corp. on a reimbursible basis.

Selected References:

See: References under INTELSAT III F-1.

ORBITING GEOPHYSICAL OBSERVATORY VI 1969 051A

Jun. 5, 1969	Thorad-Agena D/WTR	99.6 min.
Active	1394 lb	248/683 mi.
In orbit	W. E. Scull	N. W. Spencer

Objectives: To make scientific measurements in the Earth's upper atmosphere and ionosphere, the auroral regions, and the edges of the radiation zone. Emphasis was placed upon the interrelationships between particle fluxes, the auroras, the airglow, the geomagnetic field, ionosphere composition, wave propagation, and solar inputs.

Experiment/Instrument	Experimenter/Affiliation
Atmospheric density gauge	G.W. Sharp/Lockheed
Langmuir probes	A.F. Nagy/U. Mich. L.B. Brace/GSFC
Quadrupole mass spectrometer	C.A. Reber/GSFC G.R. Carigan/U. Mich.
Airglow photometer	T.M. Donahue/U. Pittsburgh J.E. Blamont/U. Paris
RF mass spectrometer	R.A. Pickett/GSFC
Ion mass spectrometer	W.B. Hanson/Southwest Center for Advanced Studies
Planar ion trap	W.B. Hanson/Southwest Center for Advanced Studies
Four energy transfer probes	D. McKeon/Faraday Labs.
X-ray detectors and counters	R.W. Kreplin/NRL
Six grating spectrometers	D.E. Bedo/AFCRL
Ultraviolet prism spectrometer	V.H. Regener/U.N.Mex.
Photometer and interferometer for auroras and airglow	J.E. Blamont/U. Paris
Ultraviolet photometer	C.A. Barth/U. Colo. E.F. Mackay/Packard Bell
Lyman-alpha photometer	M.A. Clark/Aerospace Corp G. Munch/C.I.T.
Auroral particle detectors	D.S. Evans/GSFC
Electron detectors for trapped and precipitated electrons	T.A. Farley/UCLA
Electron detectors for trapped and precipitated electrons	D.J. Williams/GSFC
Neutron monitor	J.A. Lockwood/U.N.H.
Solar cosmic-ray detector	A.J. Masley/McDonnell-Douglas
Cosmic-ray telescope	E.C. Stone/C.I.T.
Two Rb-vapor magnetometers	J.C. Cain/GSFC
Triaxial search-coil magnetometer	E.J. Smith/JPL R.E. Holzer/UCLA
Electric-field detector	T.L. Aggson/GSFC
VLF detector	R.A. Helliwell/Stanford
Whistler detector	T. Laaspere/Dartmouth

ORBITING GEOPHYSICAL OBSERVATORY VI (Continued)

Remarks: 23 of the 25 experiments functioned normally.

Selected References:

Carden, R.C.: An Experiment to Study Electric and Electromagnetic Fields in the Frequency Range 10 Hz to 540 kHz on OGO-F, *IEEE Trans.*, *GE-7*, 78, April 1969.

Entenmann, R.: Engineering Report: OGO-F-22 Search Coil Magnetometer, *NASA CR-73646*, 1968.

Lockwood, J.A., Chupp, E.L., and Jenkins, R.W.: Cosmic Ray Neutron Monitor for OGO-F, *IEEE Trans.*, *GE-7*, 88, April 1969.

Parker, P.J.: Last of the OGO's, *Spaceflight*, *11*, 363, Oct. 1969.

Trainor, J.H., and Williams, D.J.: Design of a Long-Life Reliable Nuclear Experiment for Space Flight, *IEEE Trans.*, *GE-7*, 74, April 1969.

EXPLORER XLI 1969 053A

June 21, 1969	Delta/WTR	4840 min.
Active	174 lb	210/132,885 mi.
In orbit	P. Butler	F.B. McDonald

Objectives: To continue studies of the radiation environment in cislunar space and the characteristics of the interplanetary magnetic field and how it is affected by the solar wind; to monitor solar flares in support of the Apollo missions.

Experiment/Instrument	Experimenter/Affiliation
Three-axis fluxgate magnetometer	N.F. Ness/GSFC
Cosmic-ray telescope	J.A. Simpson/U. Chicago
Cosmic-ray telescope	F.B. McDonald/GSFC
Proton and alpha detector	F.B. McDonald/GSFC
Cosmic-ray ion chamber	K.Anderson/U. Calif.
Solar-flare electron analyzer	R. Lin/U. Calif.
Solar proton detector	C. Bostrom/Applied Physics Laboratory D.J. Williams/GSFC
Cosmic-ray anisotropy telescope	K.G. McCracken/Southwest Center for Advanced Studies
Low energy particle telescope	W.L. Brown/Bell Labs.
Plasma analyzer	T.D. Wilkerson/U. Md. K.W. Ogilvie/GSFC
Proton and electron differential analyzer #1	J.A. Van Allen/State University of Iowa
Proton and electron differential analyzer #2	L.A. Frank/State University of Iowa

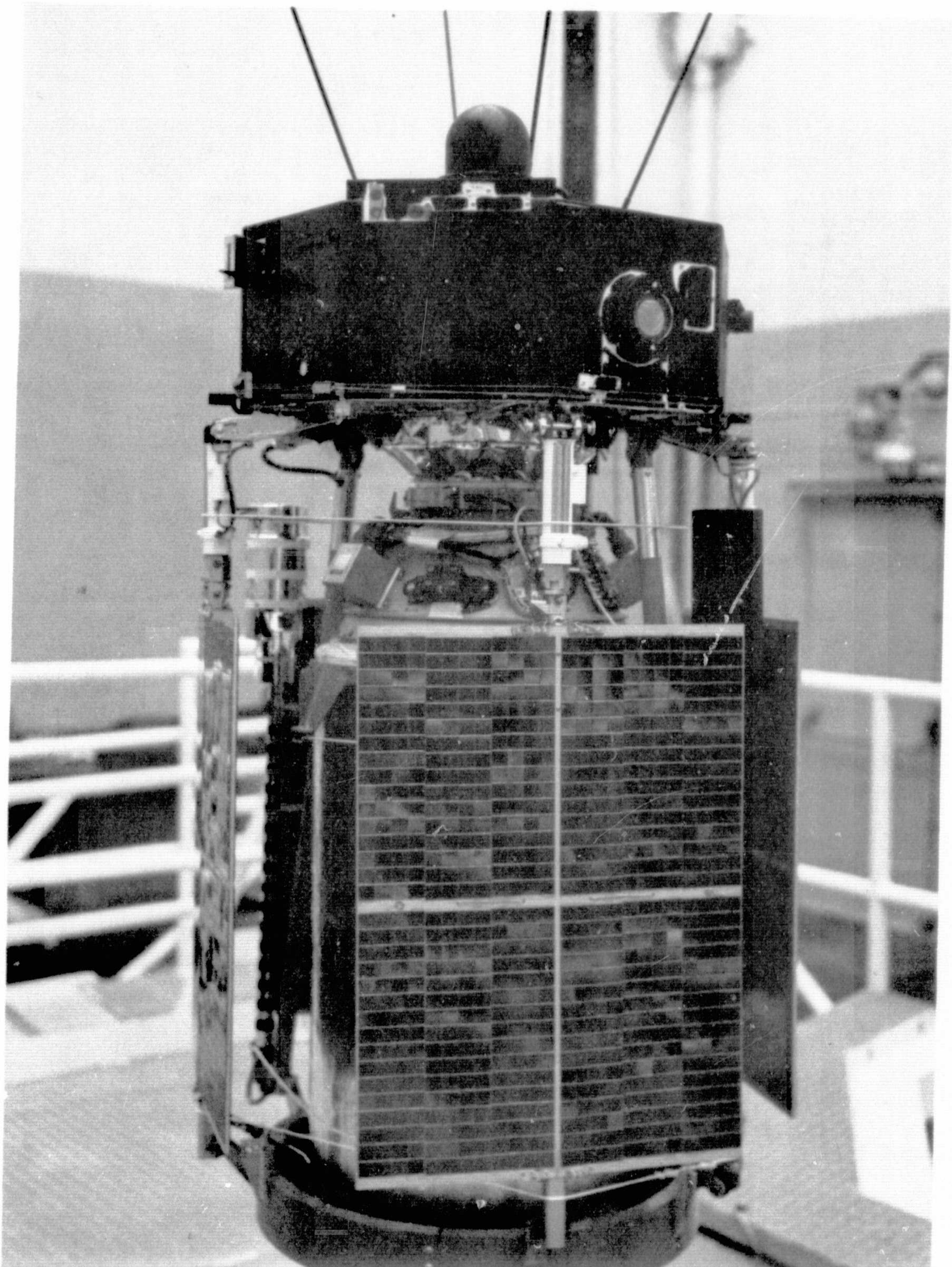
Remarks: Called IMP-G (for Interplanetary Monitoring Platform-G) prior to launch, Explorer XLI is the seventh IMP.

Selected References:

NASA: IMP-G Press Kit, *NASA News Release 69-89*, 1969.

See also: References under Explorers XVIII, XXVIII, and other IMPs.

EXPLORER XLI (Continued)



INTELSAT III F-5 | 1969 064A

July 26, 1969	Delta/ETR	146.7 min.
Retired	641 lb	167/3355 mi.
In orbit	----	----

Objective: Commercial communications.

Remarks: Launched by NASA for Comsat Corp. on a reimbursible basis. Due to a third-stage failure, the desired synchronous orbit was not achieved and the spacecraft was unusable.

References:

See: References under INTELSAT III F-1.

ORBITING SOLAR OBSERVATORY VI 1969 068A

Aug. 9, 1969	Delta/ETR	95.1 min.
Active	638 lb	305/344 mi.
In orbit	J. M. Thole	S. P. Maran

Objectives: To study from satellite orbit evolutionary changes of various solar features, particularly the centers of activity.

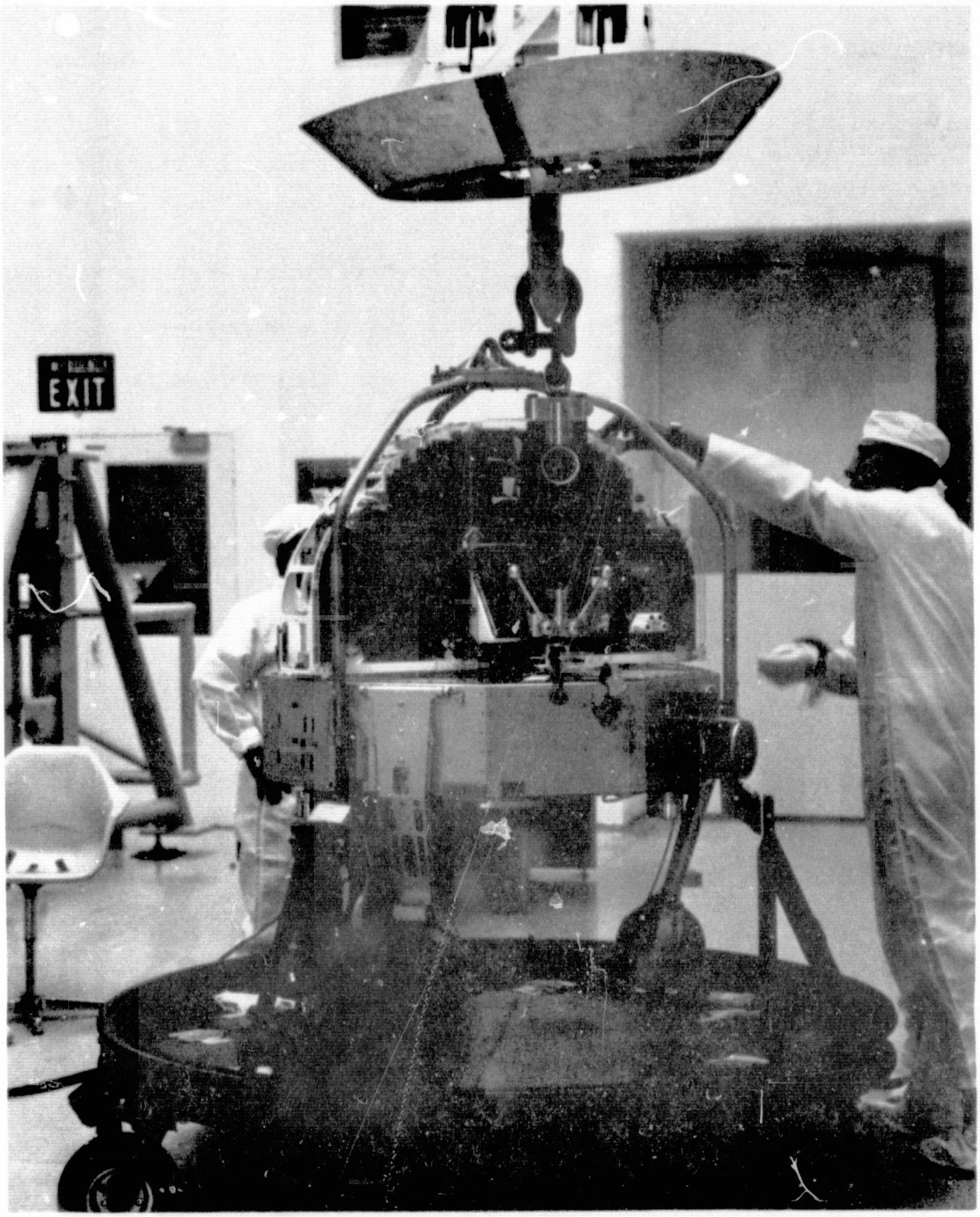
Instrument/Discipline	Experimenter/Affiliation
Ultraviolet spectroheliograph-S	L. Goldberg/Harvard
X-ray mapping and burst spectrometer-S	R.W. Kreplin/NRL
Zodiacal light polarimeter-A	A.L. Rouy/Rutgers
X-ray emission line spectrometers-S	H.V. Argo/Los Alamos
Neutron telescope-S	C.P. Leavitt/U. N. Mex.
X-ray telescope-S	D. Brini/U. Bologna
Ultraviolet polychrometer-S	R.L.F. Boyd/University College

Remarks: First OSO capable of offset scanning; that is, examining a specific part of the Sun's disk in detail. Dual launch with PAC I, a gravity-gradient-test satellite.

Selected References:

See: General references under OSO I.

ORBITING SOLAR OBSERVATORY VI (Continued)



APPLICATIONS TECHNOLOGY SATELLITE V 1969 069A

Aug. 12, 1969	Atlas-Centaur/ETR	1436 min.
Active	951 lb	22,196/22,277 mi.
In orbit	D. V. Fordyce	----

Objectives: To test gravity-gradient attitude control equipment and communication equipment suitable for air-traffic control.

Experiment/Instrument	Experimenter/Affiliation
Gravity-gradient stabilization experiment	----/----
Microwave communication experiment	----/----
Millimeter wave experiment	----/----
Environmental Measurement Experiments Package:	----/----
Tridirectional medium-energy particle detector	
Unidirectional low-energy particle detector	
Bidirectional low-energy particle detector	
Omnidirectional high-energy particle detector	
Solar radio burst experiment	
Electric field experiment	

Remarks: Malfunction of nutation damper caused spacecraft to precess rather than remain stabilized. Classified as a partial success.

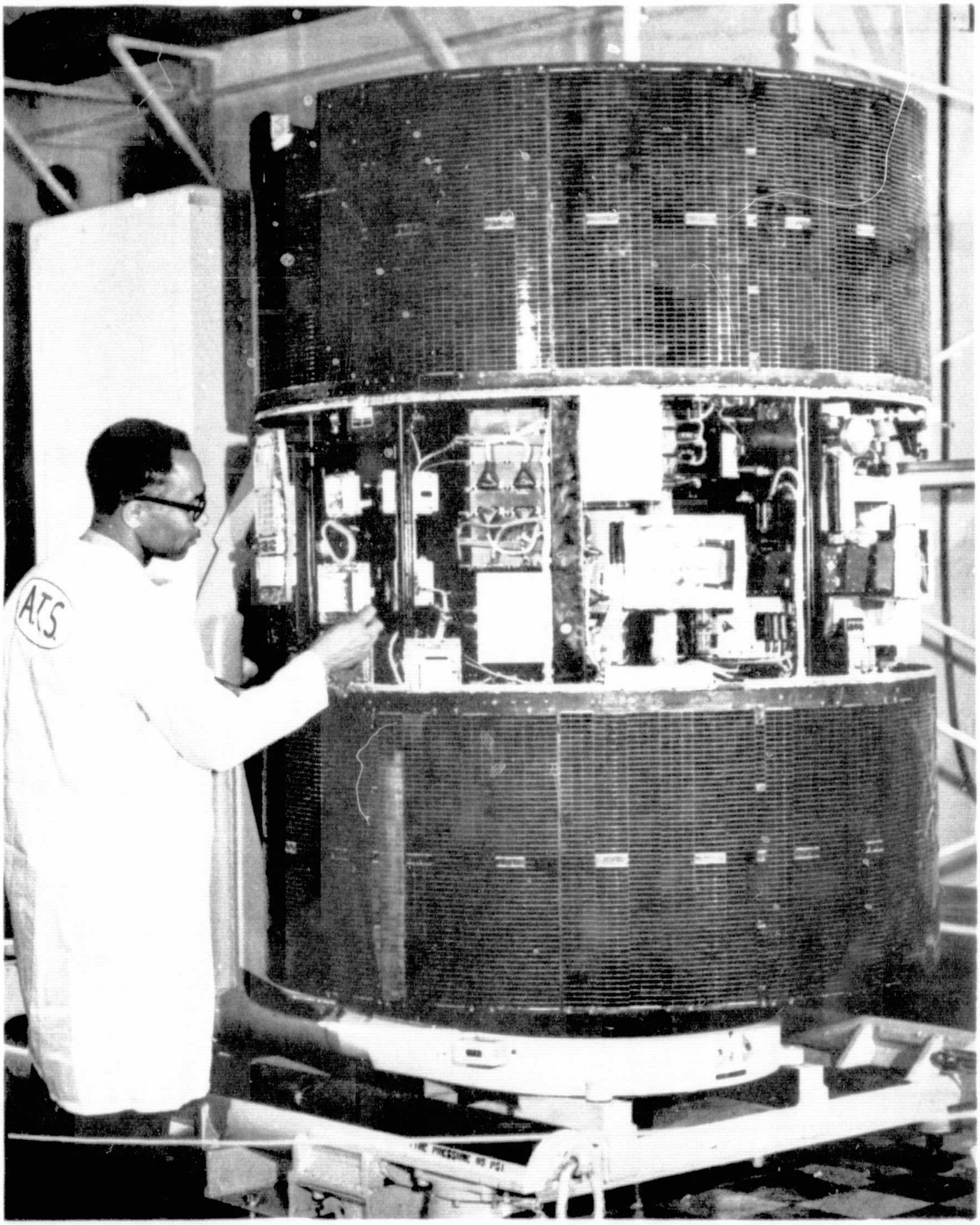
Selected References:

McDaniel, J.D.: A Low-Energy Channel-Multiplier Spectrometer for ATS-E, *IEEE Trans.*, *NS-16*, 359, Feb. 1969.

NASA: ATS-E Press Kit, *NASA News Release 69-114*, 1969.

See also: References under other ATS satellites.

APPLICATIONS TECHNOLOGY SATELLITE V (Continued)



TEST AND TRAINING SATELLITE C None

Aug. 27, 1969	Delta/ETR	----
Aug. 27, 1969	40 lb	----
Suborbital	P. Burr	----

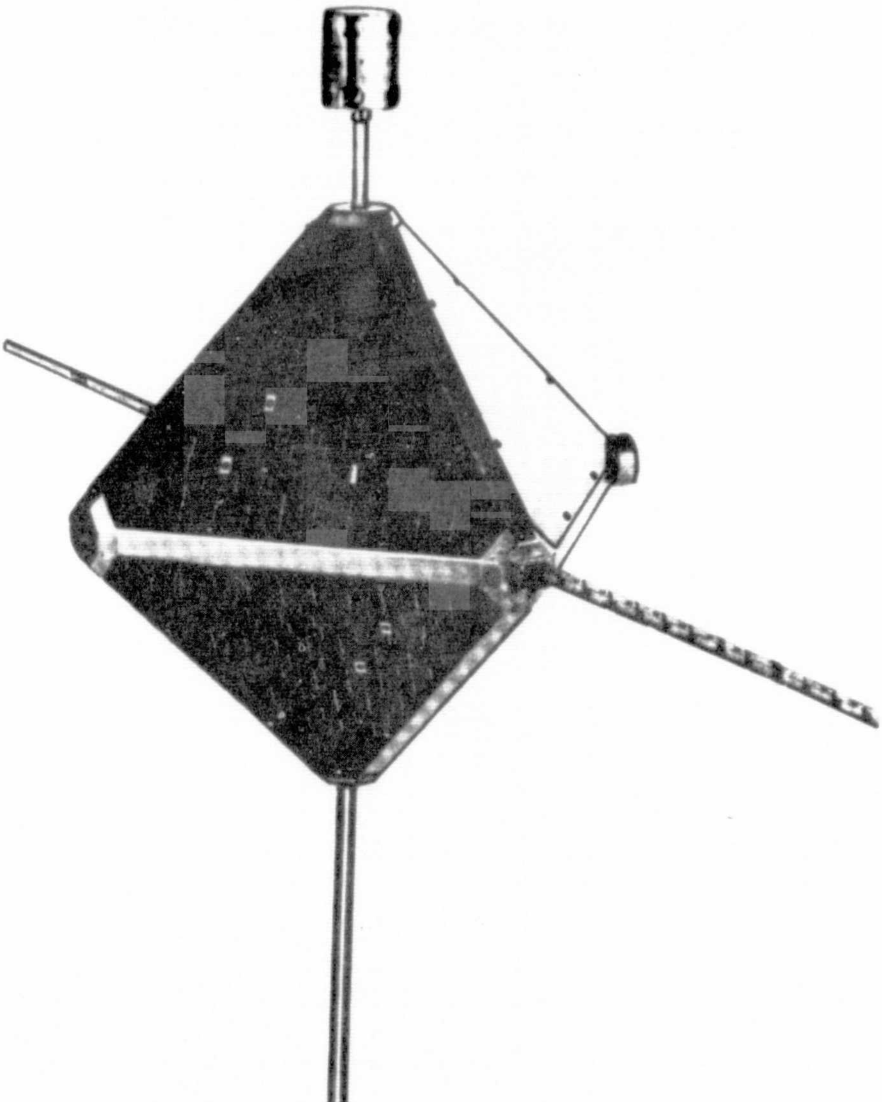
Objectives: To check out Manned Space Flight Network stations prior to manned missions; to help train ground personnel; to simulate routine, all-weather missions; and to develop and verify target acquisition and handover techniques.

Remarks: Also called TTS C or TETR C (an obsolete acronym). TTS C was launched piggyback along with Pioneer E as a secondary objective spacecraft. A first-stage failure of the Delta launch vehicle caused the intentional destruction of both spacecraft.

Selected References:

See: References under TTS I.

TEST AND TRAINING SATELLITE C (Continued)



ESRO IB 1969 083A

Oct. 1, 1969 Scout/WTR
Active 188 lb
In orbit short-lived H. L. Eaker ----

Objectives: To make an integrated study of the high altitude ionosphere, particularly impinging particles and auroral light. (Also called Borealis)

Experiment/Instrument	Experimenter/Affiliation
Same as ESRO IA	

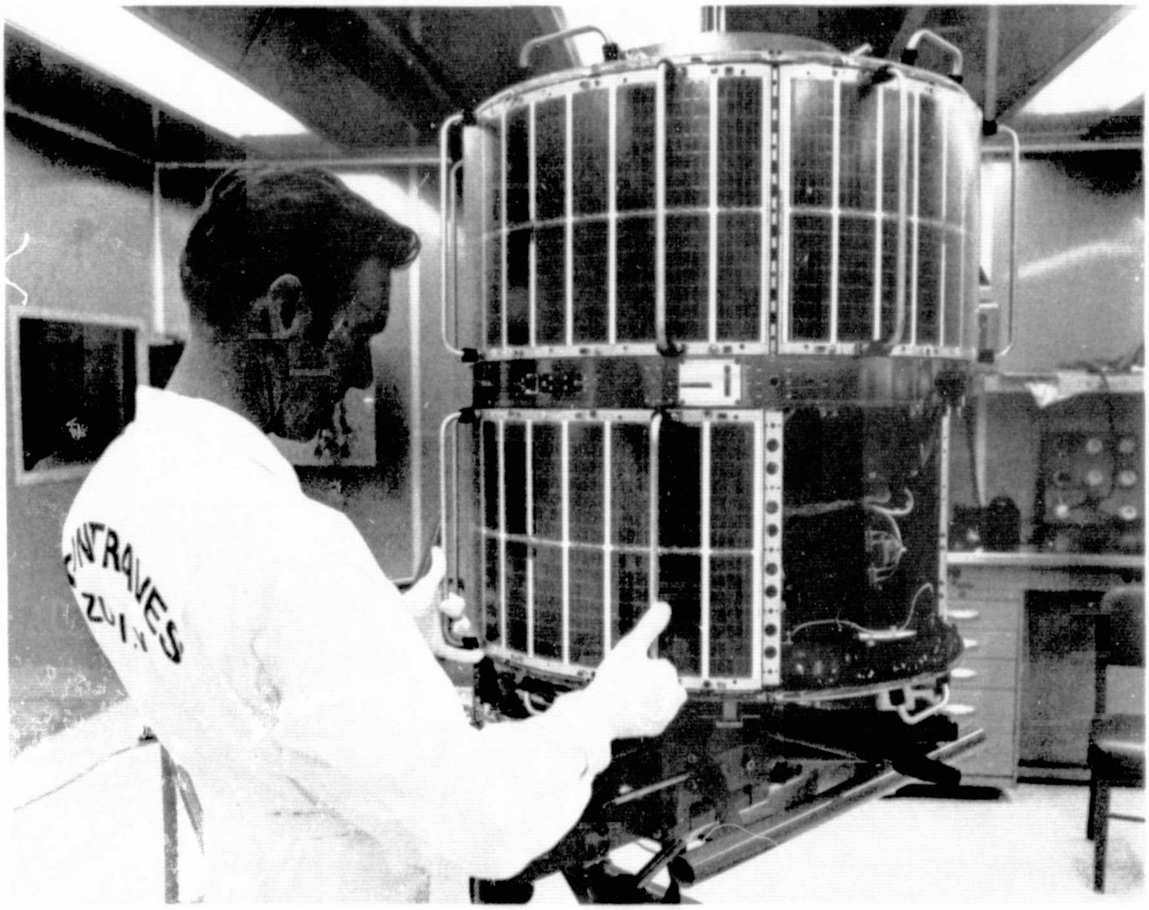
Remarks: A repeat of ESRO IA. One-to-two month lifetime predicted based upon low altitude orbit achieved.

Selected References:

NASA: ESRO-1B Press Kit, *NASA News Release 69-138*, 1969.

See also: References under ESRO IA.

ESRO IB (Continued)



GRS I 1969 097A

Nov. 8, 1969 Scout/WTR
Active 159 lb
In Orbit A. L. Franta G. F. Pieper

Objectives: To study the inner radiation belt, the auroral zones of the Northern Hemisphere, and the spectral variations of solar particles during solar flares.

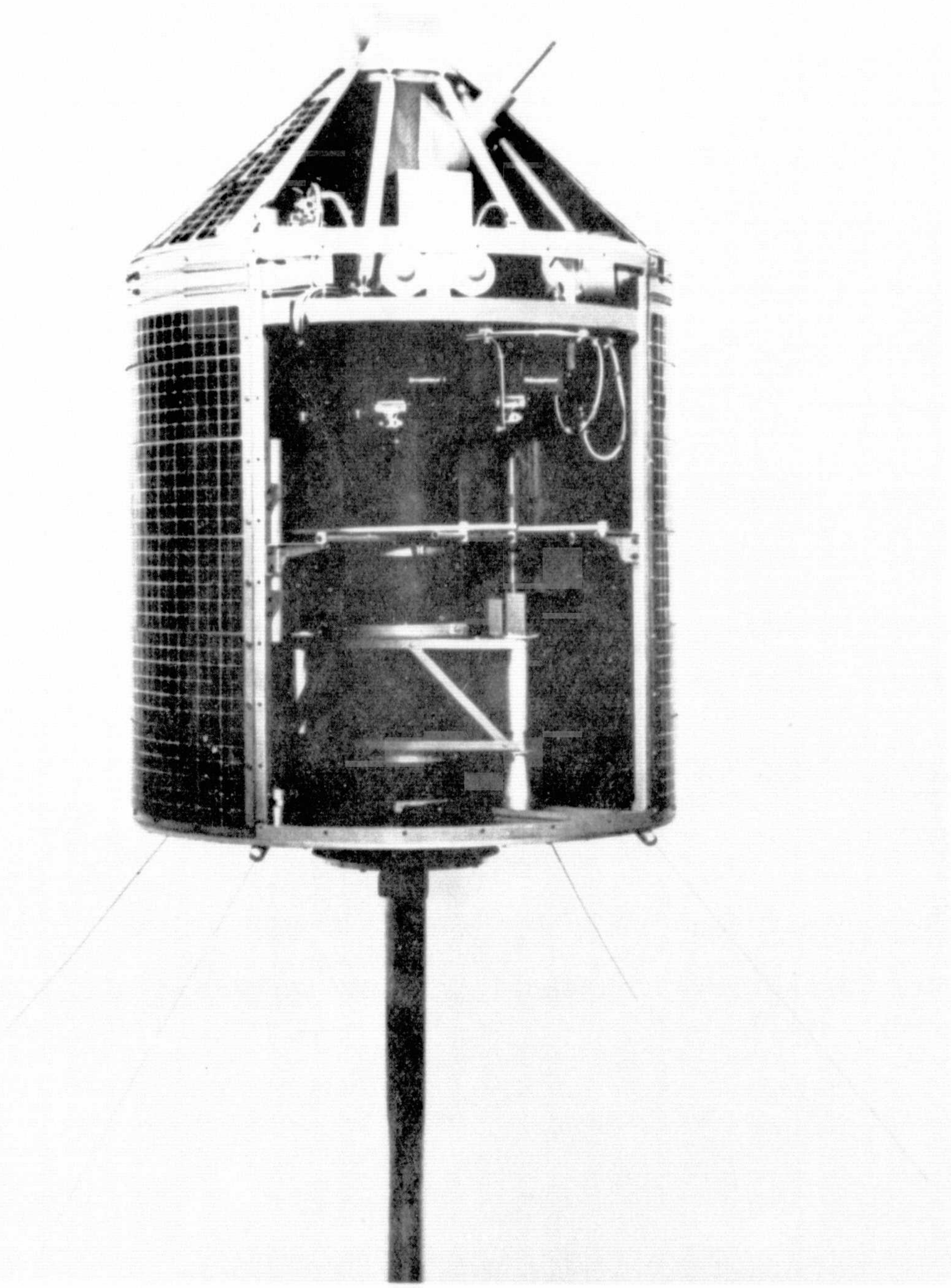
Experiment/Instrument	Experimenter/Affiliation
Two-axis fluxgate magnetometer	G. Musmann/Institut für Geophysik
Proton-alpha telescope	D. Hovestadt/Max Planck Institut
Low-energy proton telescope	J. Moritz/Institut für Reineund Angewandtekern-physik
Proton-electron detector	D. Hovestadt/Max Planck Institut
Three electron detectors	L. Rossberg/Max Planck Institut
Geiger-Mueller proton monitor	E. Kirsch/Max Planck Institut
Three auroral photometers	A. Rossbach/DFVLR, Institut für Physik der Atmosphare

Remarks: First German satellite. Also called Azur.

Selected References:

NASA: German Research Satellite (GRS-A) Press Kit, *NASA News Release 69-146*, 1969.

GRS I (Continued)



GODDARD SATELLITE PROJECTS, 1959-1969
SUMMARY TABLE*

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	Totals
Explorers	VI VII	VIII	IX X XI XII XIII	XIV XV	XVII XVIII	XX XXI XXII XXVI	XXVII XXVIII XXIX XXX XXXI	XXXII XXXIII	XXXIV XXXV	XXXVI XXXVII XXXVIII XXXIX XL	XLI	31
Observatories				OSO-I		OGO-I	OSO-II OGO-II	OAO-I OGO-III	OSO-III OGO-IV OSO-IV	OGO-V OAO-II	OSO-V OGO-VI OSO-VI	14
Communication Satellites		Echo I		Telstar I Relay I	Syncom I Telstar II Suncom II	Relay II Echo II Syncom III	Early Bird	Intelsat IIA	Intelsat IIB Intelsat IIC Intelsat IID	Intelsat III-f1 Intelsat III-f2	Intelsat III-f3 Intelsat III-f4 Intelsat III-f5	19
Weather Satellites		Tiros I Tiros II	Tiros III	Tiros IV Tiros V Tiros VI	Tiros VII Tiros VIII	Nimbus I	Tiros IX Tiros X	ESSA I ESSA II ESSA III Nimbus II	ESSA IV ESSA V ESSA VI	ESSA VII ESSA VIII	ESSA IX Nimbus III	22
Application Technology Satellites (ATS)								ATS-I	ATS-II ATS-III	ATS-IV	ATS-V	5
International Satellites				Ariel I Alouette I		Ariel II San Marco I	Alouette II FR-1A		San Marco II Ariel III ESRO IIA	ESRO IIB ESRO 1A HEOS I	ISIS-I ESRO-IB GRS I	15
Probes		Pioneer VP-21		P-21A								3
Others	Vanguard III								TTS-I	TTS-II		3
Totals	3	5	7	11	7	11	12	10	17	16	13	112

*Includes all satellites successfully launched by Goddard Space Flight Center

II. GODDARD SOUNDING ROCKET PROJECTS

The following table presents key information for all Goddard sounding rocket flights.

Key to Sounding Rocket Nomenclature:

Experimenter Affiliation

Type of Experiment

18.24 GE

Sounding Rocket Type

Vehicle Number
(of the Type Designated)

Affiliation Code:

G	Goddard Space Flight Center
N	Other NASA Centers
U	College or University
D	Department of Defense
A	Other Government Agency
C	Industrial
I	International

Experiment Code:	A	Aeronomy
	B	Biology
	E	Particles and Fields
	G	Galactic Astronomy
	I	Ionospheric Physics
	L	Lunar and Planetary Astronomy
	M	Meteorology
	P	Special Projects
	R	Radio Astronomy
	S	Solar Physics
	T	Test and Support
Sounding Rocket Type Code:*	1.	Aerobee 100
	2.	Arcon
	3.	Nike-Asp
	4.	Aerobee 150/150A
	5.	Iris
	6.	Aerobee 300
	7.	Jason (Argo E-5)
	8.	Javelin (Argo D-4)
	9.	Skylark
	10.	Nike-Cajun
	11.	Journeyman (Argo D-8)

*See Section III for brief descriptions of some of these sounding rockets.

Sounding Rocket Type Code (continued)		
	12.	Special Projects
	13.	Aerobee 170
	14.	Nike-Apache
	15.	Arcas
	16.	Astrobee 1500
	17.	Aerobee 350
	18.	Nike-Tomahawk
	19.	Black Brant IV
	20.	Bullpup Cajun

Firing Site Abbreviations

ARG	Chamical, Argentina
ASC	Ascension Island, South Atlantic
UAS	Woomera, Australia
BRAZ	Natal, Brazil
BRAZ-A	Rio Grande Beach, Brazil
EGL	Eglin Air Force Base, Florida
FBKS	Poker Flat Rocket Range, Fairbanks, Alaska
FC	Fort Churchill, Canada
HAWAII	Barking Sands, Hawaii
IND	Thumba, India
ITALY	Sardinia, Italy
NOR	Andoya, Norway
NWT	Cape Parry, Northwest Territories, Canada
NZ	Karikari, New Zealand
PAK	Karachi, Pakistan

Firing Site Abbreviations (Continued)

PB	Point Barrow, Alaska
PMR	Pacific Missile Range, California
PR	Camp Tortuguera, Puerto Rico
RB	Resolute Bay, Northwest Territories, Canada
SP	Arenosillo, Spain
SWE	Kronogard, Sweden
SUR	Coronie, Surinam
WI	Wallops Island, Virginia
WS	White Sands, New Mexico

Affiliation Abbreviations

AFCRL	Air Force Cambridge Research Laboratory
AIL	Airborne Instruments Laboratory
AMES	Ames Research Center (NASA)
AS&E	American Science and Engineering
BRL	Ballistic Research Laboratories
BuStds	National Bureau of Standards
Col. Astr. Lab.	Columbia Astrophysics Laboratory
Col. Rad. Lab.	Columbia Radiation Laboratory
CRPL	Central Radio Propagation Laboratory (NBS)
DRTE	Canadian Defence Research Telecommunications Establishment
ESSA	Environmental Science Services Administration

Affiliation Abbreviations (Continued)

GCA	Geophysics Corporation of America
GSFC	Goddard Space Flight Center
JHU	Johns Hopkins University
JPL	Jet Propulsion Laboratory
LARC	NASA Langley Research Center
LeRC	NASA Lewis Research Center
MSC	NASA Manned Spacecraft Center
NCAR	National Center for Atmospheric Research
NOTS	Naval Ordnance Test Station
NRL	Naval Research Laboratory
NYU	New York University
SCAS	Southwest Center for Advanced Studies
Varian	Varian Associates

Goddard Sounding Rocket Flights---Aeronomy

NASA						RESULT**
				1959		
3.13 CA	Aug 17	WI	S	GCA/Dubin	Sodium Vapor	S
3.14 CA	Aug 19	WI	X	GCA/Dubin	Sodium Vapor	X
3.15 CA	Nov 18	WI	S	GCA/Dubin	Sodium Vapor	S
3.16 CA	Nov 19	WI	S	GCA/Dubin	Sodium Vapor	X
3.17 CA	Nov 20	WI	S	GCA/Dubin	Sodium Vapor	X
				1960		
4.09 GA	Apr 29	WI	S	GSFC/Horowitz	Atm. Composition	S
3.23 CA	May 24	WI	X	GCA/Dubin	Sodium Vapor	X
3.24 CA	May 25	WI	S	GCA/Dubin	Sodium Vapor	S
10.03 GA	Jun 16	WI	P	GSFC/Nordberg	Grenade	X
10.04 GA	Jul 9	WI	S	GSFC/Nordberg	Grenade	S
10.01 GA	Jul 14	WI	S	GSFC/Nordberg	Grenade	X
10.05 CA	Sep 20	WI	S	GSFC/Nordberg	Grenade	X
10.09 UA	Nov 2	WI	S	U.Mich./Dubin	Atm. Composition	X
8.04 CA	Nov 10	WI	S	Lockheed/Dubin	Ionosphere	P
4.14 GA	Nov 15	WI	S	GSFC/Taylor	Atm. Composition	S
10.10 UA	Nov 16	WI	S	U.Mich./Dubin	Atm. Composition	S

*Sounding rocket performance: S = Successful; P = Partially Successful; X = Unsuccessful

+Overall Flight results: Same code.

10.11 CA	Dec 9	WI	X	GCA/Dubin	Sodium Vapor	X
10.12 CA	Dec 9	WI	S	GCA/Dubin	Sodium Vapor	S
8.05 CA	Dec 10	WI	S	GCA/Dubin	Sodium Vapor	S
10.06 GA	Dec 14	WI	S	GSFC/Nordberg	Grenade	S
				1961		
10.07 GA	Feb 14	WI	S	GSFC/Nordberg	Grenade	S
10.08 GA	Feb 17	WI	P	GSFC/Nordberg	Grenade	S
10.33 GA	Apr 5	WI	S	GSFC/Nordberg	Grenade	P
3.05 CA	Apr 19	WI	S	GCA/Dubin	Sodium Vapor	S
3.06 CA	Apr 21	WI	S	GCA/Dubin	Sodium Vapor	S
3.07 CA	Apr 21	WI	X	GCA/Dubin	Sodium Vapor	X
3.08 CA	Apr 21	WI	S	GCA/Dubin	Sodium Vapor	S
10.34 GA	Apr 27	WI	X	GSFC/Smith	Grenade	X
10.02 GA	May 5	WI	S	GSFC/Smith	Grenade	S
10.28 GA	May 6	WI	S	GSFC/Smith	Grenade	S
10.29 GA	May 9	WI	S	GSFC/Smith	Grenade	P
10.50 UA	Jun 6	WI	S	U.Mich/Dubin	Atm. Structure	S
10.56 UA	Jun 9	WI	S	U.Mich./Dubin	Atm. Composition	X
10.30 GA	Jul 13	WI	S	GSFC/Smith	Grenade	S
10.31 GA	Jul 14	WI	S	GSFC/Smith	Grenade	S
10.32 GA	Jul 20	WI	S	GSFC/Smith	Grenade	S

10.35 GA	Jul 21	WI	S	GSFC/Smith	Grenade	X
10.57 UA	Jul 26	WI	S	U.Mich./ Dubin	Atm. Composition	X
8.06 CA	Sep 13	WI	S	GCA/Smith	Sodium Vapor	S
8.22 CA	Sep 13	WI	S	GCA/Smith	Sodium Vapor	S
3.09 CA	Sep 16	WI	X	GCA/Smith	Sodium Vapor	X
3.18 CA	Sep 16	WI	S	GCA/Smith	Sodium Vapor	S
10.36 GA	Sep 16	WI	P	GSFC/Smith	Grenade	P
10.37 GA	Sep 17	WI	S	GSFC/Smith	Grenade	X
3.19 CA	Sep 17	WI	S	GCA/Smith	Sodium Vapor	S
1.08 GA	Sep 23	FC	S	Varian/Martin	Atm. Structure	S
1.09 GA	Sep 30	FC	S	Varian/Martin	Atm. Structure	S
8.23 GA	Oct 10	WI	S	GSFC/Taylor	Ionosphere	S
1.10 GA	Oct 15	FC	S	Varian/Martin	Atm. Structure	S
1.07 GA	Oct 17	FC	S	Varian/Martin	Atm. Structure	S
1.11 GA	Nov 2	FC	S	Varian/Martin	Atm. Structure	S
1.12 GA	Nov 5	FC	S	Varian/Martin	Atm. Structure	S
10.72 NA	Nov 18	WI	S	LaRC/Hord	Airglow	S
10.64 GA	Dec 21	WI	S	U.Mich./Spencer	Atm. Structure	S
				1962		
10.90 UA	Feb 20	WI	S	U.Mich./Dubin	Atm. Composition	S
10.100 CA	Mar 1	WI	S	GCA/Smith	Sodium Vapor	S

10.38 GA	Mar 2	WI	S	GSFC/Smith	Grenade	S
10.101 CA	Mar 2	WI	S	GCA/Smith	Sodium Vapor	S
10.39 GA	Mar 2	WI	S	GSFC/Smith	Grenade	S
4.18 GA	Mar 19	WI	X	U.Mich./Spencer	Atm. Structure	X
10.102 CA	Mar 23	WI	S	GCA/Smith	Sodium Vapor	S
10.40 GA	Mar 23	WI	S	GSFC/Smith	Grenade	S
10.103 CA	Mar 27	WI	S	GCA/Smith	Sodium Vapor	S
10.41 GA	Mar 28	WI	S	GSFC/Smith	Grenade	S
10.79 NA	Apr 5	WI	S	LeRC/Potter	Ozone	S
10.42 GA	Apr 17	WI	S	GSFC/Smith	Grenade	S
3.20 CA	Apr 17	WI	S	GCA/Smith	Sodium Vapor	S
5.04 GA	May 3	WI	P	GSFC/Taylor	Atm. Structure	S
10.91 UA	May 18	WI	S	U.Mich./Dubin	Atm. Composition	S
14.19 UA	Jun 6	WI	S	U.Mich./Spencer	Atm. Structure	S
10.43 GA	Jun 7	WI	S	GSFC/Smith	Grenade	S
3.21 CA	Jun 7	WI	S	GCA/Smith	Sodium Vapor	S
3.22 CA	Jun 7	WI	X	GCA/Smith	Sodium Vapor	X
Rehbar 1*	Jun 7	PAK	S	GSFC/Mustafa	Sodium Vapor	X
10.44 GA	June 8	WI	S	GSFC/Smith	Grenade	S
Rehbar 2*	Jun 11	PAK	S	GSFC/Mustafa	Sodium Vapor	X
K-62-1*	Aug 7	SWE	S	GSFC/Witt	Air Sample	S

*Nike-Cajun

K-62-3*	Aug 11	SWE	S	GSFC/Witt	Air Sample	S
K-62-4*	Aug 11	SWE	S	GSFC/Witt	Air Sample	P
14.30 CA	Aug 23	WI	P	Lockheed/Depew	Atm. Structure	X
K-62-5*	Aug 31	SWE	S	GSFC/Witt	Air Sample	X
1.13 NA	Sep 6	WS	S	JPL/Barth	Ultraviolet Airglow	S
14.16 CA	Nov 7	WI	S	GCA/Smith	Sodium	S
10.65 GA	Nov 16	FC	X	GSFC/Smith	Grenade	X
1.14 NA	Nov 20	WS	X	JPL/Barth	Ultraviolet Airglow	X
6.06 GA	Nov 20	WI	S	GSFC/Brace	Thermosphere Probe	S
14.17 CA	Nov 30	WI	A	GCA/Smith	Sodium Vapor	S
14.20 UA	Dec 1	WI	S	U.Mich/Spencer	Atm. Structure	S
10.45 GA	Dec 1	WI	S	GSFC/Smith	Grenade	S
10.68 GA	Dec 1	FC	S	GSFC/Smith	Grenade	X
14.45 AA	Dec 1	EGL	S	AFCRL/Dubin	Sodium Vapor	X
14.46 AA	Dec 3	EGL	S	AFCRL/Dubin	Sodium Vapor	P
10.46 GA	Dec 4	WI	S	GSFC/Smith	Grenade	X
10.67 GA	Dec 4	FC	S	GSFC/Smith	Grenade	S
14.18 CA	Dec 5	WI	S	GCA/Smith	Sodium Vapor	P
10.47 GA	Dec 6	WI	S	GSFC/Smith	Grenade	S
10.66 GA	Dec 6	FC	S	GSFC/Smith	Grenade	S
4.74 UA	Dec 13	WI	X	JHU/Dubin	Airglow	X

*Nike-Cajun

1963

10.80 NA	Jan 17	WI	S	LeRC/Potter	Ozone	S
4.73 UA	Jan 29	WI	X	JHU/Dubin	Airglow	X
3.11 CA	Feb 18	WI	X	GCA/Smith	Sodium Vapor	X
14.35 CA	Feb 20	WI	S	GCA/Smith	Sodium Vapor	S
10.48 GA	Feb 20	WI	S	GSFC/Smith	Grenade	S
10.58 GA	Feb 20	FC	S	GSFC/Smith	Grenade	S
14.39 CA	Feb 21	WI	S	GCA/Smith	Sodium Vapor	S
10.53 GA	Feb 28	WI	S	GSFC/Smith	Grenade	S
10.59 GA	Feb 28	FC	S	GSFC/Smith	Grenade	S
10.54 GA	Mar 9	WI	S	GSFC/Smith	Grenade	S
10.60 GA	Mar 9	FC	S	GSFC/Smith	Grenade	S
14.08 UA	Mar 28	WI	S	U.Mich/Dubin	Atm. Composition	S
14.09 UA	Mar 28	WI	S	U.Mich/Dubin	Atm. Composition	X
6.07 GA	Apr 18	WI	S	U.Mich/Brace	Thermosphere Probe	S
4.98 UA	May 7	WI	S	JHU/Dubin	Airglow	S
14.110 CA	May 8	WI	S	Lockheed/Bourdeau	Massenfilter	X
10.77 IA	May 16	PAK	S	GSFC/Pakistan	Sodium Vapor	X
14.140 DA	May 18	EGL	S	AFCRL-Ga. Tech./-	Sodium Vapor	S
14.141 DA	May 18	EGL	S	AFCRL-Ga.Tech./-	Sodium Vapor	S
14.137 IA	May 20	Italy	S	Italy/--	Sodium Vapor	S
14.138 IA	May 21	Italy	S	Italy/--	Sodium Vapor	S

14.139 IA	May 21	Italy	S	Italy/--	Sodium Vapor	S
14.13 CA	May 22	FC	S	GCA/Dubin	Sodium Vapor	S
14.14 CA	May 22	FC	S	GCA/Dubin	Sodium Vapor	S
10.130 DA	May 22	EGL	S	AFCRL-Ga. Tech./--	Sodium Vapor	S
14.14 CA	May 23	FC	S	GCA/Dubin	Sodium Vapor	S
14.40 CA	May 24	WI	S	GCA/Dubin	Sodium Vapor	S
14.41 CA	May 24	WI	S	GCA/Dubin	Sodium Vapor	X
14.42 CA	May 25	WI	S	GCA/Dubin	Sodium Vapor	S
4.75 UA	Jul 20	FC	X	JHU/Dubin	Airglow	X
K63-1*	Jul 27	SWE	S	SWE/Witt	Grenade	S
K63-2*	Jul 29	SWE	S	SWE/Witt	Grenade	S
K63-3*	Aug 1	SWE	S	SWE/Witt	Grenade	S
10.75 UA	Aug 2	WI	S	U.Mich/Holtz	Atm. Density	S
K63-4*	Aug 7	SWE	S	SWE/Witt	Grenade	S
10.92 NA	Sep 25	WI	S	LaRC	Chemical Release	S
10.93 NA	Sep 25	WI	S	LaRC	Chemical Release	S
14.102 NA	Oct 9	WI	S	LeRC/Potter	Chemical Release	S
14.103 NA	Oct 10	WI	S	LeRC/Potter	Chemical Release	S
4.76 UA	Nov 12	WI	S	JHU/Dubin	Airglow	S
4.85 NA	Nov 18	WI	S	JPL/Barth	Airglow	S

*Nike-Cajun

14.128 IA	Nov 21	IND	S	India/Dubin	Sodium Vapor	P
14.10 UA	Nov 26	WI	S	U.Mich/Dubin	Atm. Composition	S
10.131 UA	Nov 26	WI	S	U.Mich/Dubin	Atm. Density	S
10.55 GA	Dec 7	WI	S	GSFC/Smith	Grenade	S
14.21 UA	Dec 7	WI	S	U.Mich./Theon	Atm. Structure	S

1964

14.129 IA	Jan 8	IND	S	India/Dubin	Sodium Vapor	S
14.130 IA	Jan 12	IND	S	India/Dubin	Sodium Vapor	S
14.38 CA	Jan 15	WI	X	GCA/Smith	Sodium Vapor	X
14.106 CA	Jan 15	WI	P	GCA/Smith	Sodium Vapor	S
14.125 CA	Jan 16	WI	S	GCA/Smith	Sodium Vapor	S
14.126 CA	Jan 16	WI	S	GCA/Smith	Sodium Vapor	S
8.31 DA	Jan 17	WI	S	NRL/Dubin	Composition-Airglow	S
10.61 GA	Jan 24	WI	S	GSFC/Smith	Grenade	S
10.86 GA	Jan 24	FC	X	GSFC/Smith	Grenade	X
6.09 GA	Jan 29	WI	S	GSFC/Brace	Thermosphere Probe	S
10.71 GA	Jan 29	WI	S	GSFC/Smith	Grenade	S
10.89 GA	Jan 29	FC	S	GSFC/Smith	Grenade	S
10.81 GA	Jan 29	ASC	S	GSFC/Smith	Grenade	S
14.22 UA	Feb 4	ASC	S	U.Mich/Smith	Atmos. Structure	S
10.62 GA	Feb 4	WI	S	GSFC/Smith	Grenade	S
10.87 GA	Feb 5	FC	S	GSFC/Smith	Grenade	S

10.63 GA	Feb 5	WI	S	GSFC/Smith	Grenade	S
10.136 GA	Feb 13	WI	S	GSFC/Smith	Grenade	S
10.82 GA	Feb 13	ASC	S	GSFC/Smith	Grenade	S
10.88 GA	Feb 13	FC	S	GSFC/Smith	Grenade	S
4.124 UA	Feb 27	FC	P	JHU/Dubin	Aurora	S
10.137 GA	Mar 7	WI	S	GSFC/Smith	Grenade	S
14.134 IA	Apr 9	PAK	S	Pakistan/--	Sodium Vapor	X
4.86 NA	Apr 14	WS	X	JPL/--	Airglow	X
14.24 UA	Apr 15	ASC	S	U.Mich/Smith	Atm. Structure	S
14.23 UA	Apr 15	ASC	S	U.Mich/Smith	Atm. Structure	S
10.142 UA	Apr 17	WI	S	U.Mich/Dubin	Atm. Density	S
10.73 GA	Apr 18	FC	S	GSFC/Smith	Grenade	S
10.83 GA	Apr 18	WI	S	GSFC/Smith	Grenade	S
4.113 GA-GI	Apr 21	WS	X	GSFC/Aikin	Astrochemistry and Ionospheres	X
14.54 DA	May 28	WS	X	AFCRL/Smith	Air Sampling	X
14.49 CA	Jul 15	WI	S	GCA/Smith	Sodium Vapor	S
14.50 CA	Jul 15	WI	S	GCA/Smith	Sodium Vapor	S
14.51 CA	Jul 15	WI	S	GCA/Smith	Sodium Vapor	S
14.52 CA	Jul 15	WI	S	GCA/Smith	Sodium Vapor	S
6.10 GA	Jul 28	FC	S	GSFC/Brace	Thermosphere Probe	S
10.114 GA	Aug 5	ASC	S	GSFC/Smith	Grenade	X

14.55 DA	Aug 6	SWE	S	AFCRL/Smith	Air Sampling	X
10.138 GA	Aug 7	SWE	S	GSFC/Smith	Grenade	S
10.78 GA	Aug 7	WI	S	GSFC/Smith	Grenade	S
10.104 GA	Aug 8	FC	S	GSFC/Smith	Grenade	S
14.56 DA	Aug 12	SWE	S	AFCRL/Smith	Air Sampling	S
10.139 GA	Aug 12	SWE	S	GSFC/Smith	Grenade	X
10.84 GA	Aug 12	WI	S	GSFC/Smith	Grenade	S
10.105 GA	Aug 12	FC	S	GSFC/Smith	Grenade	S
14.57 DA	Aug 16	SWE	S	AFCRL/Smith	Air Sampling	S
10.140 GA	Aug 16	SWE	S	GSFC/Smith	Grenade	S
10.85 GA	Aug 16	WI	S	GSFC/Smith	Grenade	S
10.115 GA	Aug 16	ASC	S	GSFC/Smith	Grenade	S
10.116 GA	Aug 16	ASC	S	GSFC/Smith	Grenade	S
14.58 DA	Aug 17	SWE	S	AFCRL/Smith	Air Sampling	S
10.141 GA	Aug 17	SWE	S	GSFC/Smith	Grenade	S
10.106 GA	Aug 18	FC	S	GSFC/Smith	Grenade	S
10.113 GA	Aug 18	WI	S	GSFC/Smith	Grenade	S
4.115 NA	Sep 18	WI	S	JPL/Barth	Dayglow	S
14.195 CA	Oct 7	WI	S	GCA/Dubin	Luminous Cloud Ionospheres	S
8.03 CA	Oct 8	WI	S	Lockheed/Dubin	Ion Composition	S
14.194 CA	Oct 8	WI	S	GCA/Dubin	Luminous Cloud Ionospheres	S

14.197 CA	Nov 1	FC	S	GCA/Dubin	Luminous Cloud Ionospheres	S
10.132 GA	Nov 3	WI	S	GSFC/Smith	Grenade	X
10.107 GA	Nov 5	WI	S	GSFC/Smith	Grenade	S
8.34 UA	Nov 5	WI	S	JHU/Dubin	Airglow	S
10.133 GA	Nov 6	WI	S	GSFC/Smith	Grenade	S
14.131 IA	Nov 6	IND	S	India/--	Sodium Vapor	S
10.134 GA	Nov 6	WI	S	GSFC/Smith	Grenade	S
10.135 GA	Nov 6	WI	S	GSFC/Smith	Grenade	S
14.204 IA	Nov 9	IND	S	India/--	Sodium Vapor	S
14.205 IA	Nov 10	IND	S	India/--	Sodium Vapor	S
14.114 CA	Nov 10	SHIP	S	GCA/Smith	Sodium Vapor	S
14.53 CA	Nov 10	WI	S	GCA/Smith	Sodium Vapor	S
14.115 CA	Nov 11	SHIP	S	GCA/Smith	Sodium Vapor	S
14.112 CA	Nov 11	WI	S	GCA/Smith	Sodium Vapor	S
14.116 CA	Nov 12	SHIP	S	GCA/Smith	Sodium Vapor	S
14.113 CA	Nov 12	WI	S	GCA/Smith	Sodium Vapor	X
4.45 GA	Nov 16	WI	S	GSFC/Brace	Thermosphere Probe	S
4.118 NA	Nov 16	WS	S	GSFC/Ames	Micrometeoroid	X
14.233 UA	Nov 17	SHIP	S	U.Mich/Dubin	Atm. Density	S
10.153 UA	Nov 17	SHIP	S	U.Mich/Dubin	Atm. Density	S
14.29 UA	Nov 19	SHIP	X	U.Mich/Smith	Pitot Probe	X
10.117 GA	Nov 19	WI	S	GSFC/Smith	Grenade	S

14.135 IA	Nov 30	PAK	S	Pakistan	Sodium Vapor	S
14.136 IA	Dec 1	PAK	S	Pakistan	Sodium Vapor	S
4.83 GA	Dec 1	WS	S	GSFC/Hennes	Ultraviolet Airglow	S
4.132 GA-GI	Dec 16	WS	S	GSFC/Berg	Micrometeoroid	S
4.125 UA	Dec 17	WS	S	JHU/Dubin	Airglow	S

1965

14.142 NA	Jan 7	WI	S	LeRC/Potter	Airglow	P
4.111 NA	Jan 13	WI	S	JPL/Dubin	Airglow	S
10.124 GA	Jan 27	PB	S	GSFC/Smith	Grenade	S
10.121 GA	Jan 27	FC	S	GSFC/Smith	Grenade	S
10.118 GA	Jan 27	WI	S	GSFC/Smith	Grenade	S
10.125 GA	Feb 4	PB	S	GSFC/Smith	Grenade	S
10.119 GA	Feb 4	WI	S	GSFC/Smith	Grenade	S
10.122 GA	Feb 4	FC	S	GSFC/Smith	Grenade	S
10.126 GA	Feb 8	PB	S	GSFC/Smith	Grenade	S
10.120 GA	Feb 8	WI	S	GSFC/Smith	Grenade	S
10.123 GA	Feb 8	FC	S	GSFC/Smith	Grenade	S
14.11 UA	Feb 18	FC	S	U.Mich/Dubin	Composition	S
4.129 UA	Feb 19	FC	S	JHU/Dubin	Auroral Studies	S
14.95 UA	Feb 19	FC	S	U.Mich/Dubin	Composition	S
10.155 UA	Feb 26	SHIP	S	U.Mich/Dubin	Air Density	X

14.196 CA	Feb 28	FC	S	GCA/Dubin	Ionospheres-Luminescent Cloud	S
14.198 CA	Feb 28	FC	X	GCA/Dubin	Iono-Lum. Cloud	X
14.199 CA	Feb 28	FC	X	GCA/Dubin	Iono-Lum. Cloud	X
14.200 CA	Feb 28	FC	X	GCA/Dubin	Iono-Lum. Cloud	X
14.253 IA	Mar 1	NOR	S	Sweden/--	Discharge of TNT	S
Ferdinand IX*	Mar 3	NOR	P	Norway/Kane	Auroral Absorption	X
14.254 IA	Mar 5	NOR	S	Sweden/--	Luminescent Cloud	S
14.64 UA	Mar 8	SHIP	S	U.Mich/Smith	Atm. Structure	S
14.65 UA	Mar 9	SHIP	S	U.Mich/Smith	Atm. Structure	S
14.98 UA	Mar 11	SHIP	S	U.Mich/Dubin	Composition	S
10.156 UA	Mar 11	SHIP	S	U.Mich/Dubin	Air Density	S
14.99 UA	Mar 11	SHIP	S	U.Mich/Dubin	Composition	S
Ferdinand X*	Mar 15	NOR	P	Norway/Kane	Auroral Absorption	X
14.62 UA	Mar 18	WI	S	SCAS/Horowitz	Composition	P
12.05 GA**	Mar 19	WI	S	GSFC/Brace	Thermosphere Probe	S
6.11 GA	Mar 20	WI	S	GSFC/Brace	Thermosphere Probe	S
Ferdinand XI*	Mar 22	NOR	P	Norway/Kane	Auroral Absorption	X
14.132 NA	Apr 1	WI	S	LeRC/Potter	Airglow	S

* Nike-Apache

** Nike-Tomahawk

14.66 UA	Apr 4	SHIP	S	U.Mich/Smith	Atm. Structure	S
14.26 UA	Apr 6	SHIP	S	U.Mich/Smith	Atm. Structure	S
14.63 UA	Apr 9	SHIP	S	U.Mich/Smith	Atm. Structure	S
14.67 UA	Apr 13	SHIP	S	U.Mich/Smith	Atm. Structure	S
14.27 UA	Apr 13	SHIP	S	U.Mich/Smith	Atm. Structure	S
14.101 UA	Apr 13	SHIP	S	U.Mich/Dubin	Composition	X
4.127 UA	Apr 15	WS	S	U.Minn/Dubin	Composition	S
14.100 UA	Apr 15	SHIP	S	U.Mich/Dubin	Composition	X
14.25 UA	Apr 15	SHIP	S	U.Mich/Smith	Atm. Structure	S
10.171 NA	Apr 23	WI	S	LaRC/Tolefson	Chemiluminescent Cloud	S
14.255 NA	Apr 23	WI	S	LaRC/Tolefson	Chemiluminescent Cloud	S
10.150 GA	Apr 28	PB	S	GSFC/Smith	Grenade	X
10.94 IA	Apr 29	PAK	S	Pakistan/--	Grenade	S
10.95 IA	Apr 30	PAK	S	Pakistan/--	Grenade	X
10.127 GA	May 3	WI	S	GSFC/Smith	Grenade	X
14.47 UA	May 22	ASC	S	U.Mich/Smith	Pitot Probe	S
14.48 UA	May 22	ASC	S	U.Mich/Smith	Pitot Probe	S
14.201 CA	Jun 23	WI	S	GCA/Dubin	Ionosphere-Lum. Cloud	S
4.112 NA	Jun 29	WS	S	JPL/Dubin	Airglow	S

4.128 UA	Jul 15	WS	S	U.Minn/Dubin	Composition	S
10.154 UA	Aug 7	WI	S	U.Mich/Dubin	Air Density	S
10.157 UA	Aug 8	WI	S	U.Mich/Dubin	Air Density	S
10.144 UA	Aug 1	WS	S	Dudley Obs/Dubin	Micrometeoroid	X
14.133 NA	Aug 19	WI	S	LeRC/---	Airglow	X
8.11 UA	Aug 25	WI	S	U.Pitt/Dubin	Helium Ionization	S
14.224 IA	Sep 18	Surinam	S	Netherlands/Dubin	Sodium Vapor	S
14.225 IA	Sep 21	Surinam	S	Netherlands/Dubin	Sodium Vapor	S
14.226 IA	Sep 24	Surinam	S	Netherlands/Dubin	Sodium Vapor	S
14.227 IA	Sep 27	Surinam	S	Netherlands/Dubin	Sodium Vapor	S
4.150 GA-GI-GB	Sep 28	WS	S	GSFC/Berg	Micrometeoroid, Ionospheres	S
14.202 CA	Oct 5	FC	S	GCA/Dubin	Ionosphere-Luminescent cloud	S
14.203 CA	Oct 6	FC	X	GCA/Dubin	Ionosphere-Luminescent cloud	X
4.142 NA	Oct 19	WI	S	U.Colo./Dubin	1965F Comet Spectra	X
4.164 UA	Oct 21	WI	S	JHU/Dubin	1965F Comet Spectra	S
18.03 GA	Nov 9	FC	S	GSFC/Brace	Thermosphere Probe	S
18.02 GA	Nov 10	FC	S	GSFC/Brace	Thermosphere Probe	S
4.119 NA	Nov 16	WS	S	Ames/Dubin	Micrometeoroid	S

14.78 UA	Nov 18	WS	S	Dudley Obs/Dubin	Micrometeoroid	S

1966

10.158 UA	Jan 25	WI	S	U.Mich/Dubin	Air Density	S
10.159 UA	Feb 3	WI	S	U.Mich/Dubin	Air Density	S
10.143 UA	Feb 4	WI	S	U.Mich/Dubin	Air Density	S
4.162 UA	Feb 20	FC	S	JHU/Dubin	Auroral Physics	P
14.211 IA	Feb 25	PAK	S	Pakistan/Dubin	Sodium Vapor	S
14.212 IA	Feb 26	PAK	S	Pakistan/Dubin	Sodium Vapor	X
8.25 GA-GI	Mar 2	WI	S	GSFC/Smith	Geoprobe	S
14.257 IA	Mar 24	IND	S	India/--	Sodium Vapor	X
14.258 IA	Mar 25	IND	S	India/--	Sodium Vapor	X
4.143 UA	Apr 14	WS	S	U.Colo/Dubin	Dayglow	S
4.165 UA	Apr 21	WS	S	JHU/Dubin	Planetary Ultraviolet	P
14.96 UA	Jul 11	FC	S	U.Mich/Dubin	Atm. Composition	S
8.12 UA	Jul 12	WI	S	U.Pitt/Dubin	Atm. Composition	S
8.32 DA	Aug 15	WI	S	NRL/Dubin	Atm. Composition	S
14.170 UA	Aug 16	WS	S	Dudley Obs/Dubin	Micrometeoroid	P
18.05 GA	Aug 26	WI	S	GSFC/Brace	Thermosphere Probe	S
18.06 GA	Aug 26	WI	S	GSFC/Brace	Thermosphere Probe	S
18.22 GA	Aug 28	WI	S	GSFC/Brace	Thermosphere Probe	S
14.278 CA-CI	Sep 14	FC	S	GCA/Dubin	Ionosphere-Luminescent Cloud	S

14.279 CA-CI	Sep 14	FC	S	GCA/Dubin	Ionosphere-Luminescent Cloud	P
14.280 CA-CI	Sep 16	FC	S	GCA/Dubin	Ionosphere-Luminesecnt Cloud	S
14.281 CA-CI	Sep 16	FC	S	GCA/Dubin	Ionosphere-Luminescent Cloud	S
14.282 CA-CI	Sep 16	FC	S	GCA/Dubin	Ionosphere-Luminescent Cloud	S
8.27 IA	Sep 24	WI	S	Germany/Adamson	Barium Release	S
18.26 IA	Sep 25	WI	S	Germany/Adamson	Barium Release	S
4.161 NA	Oct 22	WS	S	Ames/Dubin	Micrometeoroid	S
4.195 GA-GI	Oct 25	WS	S	GSFC/Berg	Micrometeoroid	S
14.77 CA-CI	Nov 12	BRAZ-A	S	GCA/Dubin	Eclipse	S
14.299 UA	Nov 18	WS	S	Dudley Obs/Dubin	Micrometeoroid	X
4.181 UA	Nov 30	WS	S	U.Minn/Dubin	Atm. Composition	S
4.180 UA	Dec 2	WS	S	U.Minn/Dubin	Atm. Composition	S
				1967		
4.163 UA	Feb 17	FC	S	JHU/Dubin	Auroral Spectra	S
14.161 IA	Mar 6	IND	S	India/Dubin	Luminescent Cloud	X
14.162 IA	Mar 9	IND	S	India/Dubin	Luminescent Cloud	X
14.163 IA-II	Mar 12	IND	S	India/Dubin	Ionosphere-Luminescent Cloud	P
14.206 IA-II	Mar 12	IND	S	India/Dubin	Ionosphere-Luminescent Cloud	S
14.267 IA-II	Mar 13	IND	S	India/Dubin	Ionosphere-Luminescent Cloud	P

14.283 CA	Mar 31	WI	S	GCA/Dubin	Luminescent Cloud	X
8.43 UA	May 17	WI	S	U.Pitt/Dubin	Atm. Composition	S
14.300 UA	May 31	WS	X	Dudley Obs/Dubin	Micrometeoroid	X
4.222 NA	Jun 6	WS	S	Ames/Dubin	Micrometeoroid	S
4.179 UA	Jun 21	WS	S	U.Minn/Dubin	Atm.Composition	S
4.212 UA	Jul 20	WS	S	U.Minn/Dubin	Atm. Composition	S
4.211 UA	Jul 20	WS	S	U.Minn/Dubin	Atm. Composition	S
15.16 DA	Aug 2	PMR	S	NOTS/Horowitz	Ozone Distribution	X
14.343 GT-UA	Aug 5	WS	S	GSFC/Wood	Recovery System Test	X
4.207 UA	Aug 8	WS	S	U.Mich/Dubin	Composition	S
4.223 NA	Aug 11	WS	S	Ames/Dubin	Micrometeorite	S
15.17 DA	Aug 21	PMR	S	NOTS/Horowitz	Ozone Distribution	S
15.35 DA	Sep 14	Hawaii	S	NOTS/Horowitz	Ozone Distribution	X
15.36 DA	Sep 17	Hawaii	S	NOTS/Horowitz	Ozone Distribution	S
18.50 GA	Sep 18	WI	S	GSFC/Brace	Thermosphere Probe	S
15.37 DA	Sep 19	Hawaii	S	NOTS/Horowitz	Ozone Distribution	S
15.38 DA	Oct 13	Hawaii	S	NOTS/Horowitz	Ozone Distribution	S
15.39 DA	Oct 19	Hawaii	S	NOTS/Horowitz	Ozone Distribution	S
15.40 DA	Oct 22	Hawaii	S	NOTS/Horowitz	Ozone Distribution	S
15.41 DA	Oct 25	Hawaii	S	NOTS/Horowitz	Ozone Distribution	S
18.66 UA	Dec 5	FC	S	U.Alaska/Dubin	Auroral Studies	S
4.197 UA	Dec 5	WS	S	JHU/Dubin	Planetary Atmospheres	S
14.347 UA	Dec 12	WI	S	U.Colo/Dubin	Atm. Composition	S

<u>1968</u>

14.259 IA	Feb 2	IND	S	India/Dubin	Luminescent Cloud	S
4.217 UA	Feb 9	FC	S	JHU/Dubin	Auroral Physics	S
14.284 CA	Feb 21	WI	S	GCA/Dubin	Aeronomy-Luminescent Cloud	P
14.208 CA	Feb 22	WI	S	GCA/Dubin	Luminescent Cloud/ Ionosphere	S
18.67 UA	Feb 23	FC	S	U.Alaska/Dubin	Auroral Studies	S
14.350 CA	Feb 27	WI	S	GCA/Dubin	Aeronomy-Luminescent Cloud	P
18.68 UA	Feb 28	FC	S	U.Alaska/Dubin	Auroral Studies	S
18.53 GA	Mar 17	PR	S	GSFC/Spencer	Thermosphere Probe	S
18.49 GA	Mar 17	PR	P	GSFC/Spencer	Thermosphere Probe	P
18.51 GA	Mar 17	PR	S	GSFC/Spencer	Thermosphere Probe	S
8.40 UA	Apr 9	WI	S	U.Pitt./Dubin	Composition	S
4.238 UA	Apr 23	WS	S	U.Colo./Dubin	Airglow	S
14.335 UA	Jun 10	WS	S	Dudley Obs/Dubin	Micrometeoroid	S
14.355 IA	Jun 11	SWE	S	Germany/--	Micrometeoroid	S
14.354 IA	Jun 12	SWE	S	Germany/--	Micrometeoroid	S
14.349 UA	Jul 24	WI	S	U.Colo/Dubin	Atm. Composition	S
10.253 UA	Jul 24	WI	S	U.Mich/Dubin	Air Density	P
14.348 UA	Jul 24	WI	S	U.Colo/Dubin	Atm. Composition	S
10.254 UA	Jul 24	WI	S	U.Mich/Dubin	Air Density	P

18.31 UA	Jul 31	WI	S	JHU/Dubin	Airglow	S
4.224 NA	Aug 1	FC	S	Ames/Dubin	Micrometeoroid	P
18.51 GA	Aug 8	WI	S	GSFC/Brace	Thermosphere Probe	S
18.56 GA	Aug 9	WI	S	GSFC/Brace	Thermosphere Probe	S
14.336 UA	Aug 12	WS	S	Dudley Obs/Dubin	Micrometeoroid	S
14.301 UA	Aug 20	WS	S	Dudley Obs/Dubin	Micrometeoroid	S
4.241 UA	Oct 1	WS	S	U.Colo/---	Ultraviolet Dayglow	S
18.69 UA	Oct 16	WI	S	U.Mich/Dubin	Atm. Composition	S
14.351 UA	Dec 4	WS	S	Dudley Obs/Dubin	Micrometeoroid	S
8.51	Dec 10	FC	S	U.Pitt/Dubin	Composition	X
14.352 UA	Dec 14	WS	S	Dudley Obs/Dubin	Micrometeoroid	S

1969

14.389 UA	Jan 31	WI	S	U.Colo/Dubin	Atm. Composition	S
4.272 UA	Feb 4	FC	S	U.Minn/Dubin	Atm. Composition	S
4.273 UA	Feb 6	FC	P	U.Minn/Dubin	Atm. Composition	P
14.390 UA	Feb 6	WI	S	U.Colo/Dubin	Atm. Composition	S
4.308 UA	Feb 8	WS	S	JHU/Dubin	Planetary UV	X
4.188 UA	Feb 12	FC	S	JHU/Dubin	Airglow	X
18.86 CA	Feb 13	WI	S	GCA/Dubin	Luminescent Cloud	S

14.389 UA	Jan 31	WI	S	U.Colo/Dubin	Atm. Composition	S
4.273 UA	Feb 4	FC	S	U.Minn/Dubin	Atm. Composition	S
4.273 UA	Feb 6	FC	P	U.Minn/Dubin	Atm. Composition	P
14.390 UA	Feb 6	WI	S	U.Colo/Dubin	Atm. Composition	S
4.308 UA	Feb 8	WS	S	JHU/Dubin	Planetary UV	X
4.188 UA	Feb 12	FC	S	JHU/Dubin	Airglow	X
18.86 CA	Feb 12	WI	S	GCA/Dubin	Luminescent Cloud	S
18.81 UA	Mar 11	FC	S	U.Colo/Dubin	Auroral Studies	S
14.387 UA	Jun 28	WI	S	U.Colo./Dubin	Airglow	S
14.422 UA	Aug 13	WS	S	Dudley Obs./Dubin	Micrometeorite	S
18.78 GA	Aug 21	WI	S	GSFC/Cooley	Atm. Composition	S
18.102 GA	Aug 21	WI	S	GSFC/Spencer	Thermosphere Probe	S
14.423 UA	Aug 22	WS	S	Dudley Obs./Dubin	Micrometeorite	S

Goddard Sounding Rocket Flights---Particles and Fields

1960

10.17 GE	Jun 6	FC	S	GSFC/Fichtel	SBE	S*
8.07 GE	Jun 30	WI	X	GSFC/Heppner	Magnetic Field	X
10.18 GE	Jul 22	FC	S	GSFC/Fichtel	SBE	S
4.16 UE	Aug 23	WI	S	NYU/Meredith	Cosmic Ray	S
10.19 GE	Sep 3	FC	S	GSFC/Fichtel	SBE	S
10.20 GE	Sep 3	FC	S	GSFC/Fichtel	SBE	S
11.01 GE	Sep 19	PMR	S	GSFC/Naugle	NERV I	S
10.21 GE	Sep 27	FC	S	GSFC/Fichtel	SBE	S
10.22 GE	Nov 11	FC	S	GSFC/Fichtel	SBE	S
10.23 GE	Nov 11	FC	S	GSFC/Fichtel	SBE	P
10.24 GE	Nov 12	FC	S	GSFC/Fichtel	SBE	S
10.15 GE	Nov 12	FC	S	GSFC/Fichtel	SBE	S
10.16 GE	Nov 13	FC	S	GSFC/Fichtel	SBE	S
10.13 GE	Nov 16	FC	S	GSFC/Fichtel	SBE	S
10.14 GE	Nov 17	FC	S	GSFC/Fichtel	SBE	S
10.26 GE	Nov 18	FC	S	GSFC/Fichtel	SBE	S
10.27 GE	Nov 18	FC	S	GSFC/Fichtel	SBE	S
8.08 GE	Dec 12	WI	S	GSFC/Heppner	Magnetic Fields	S

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*Sounding rocket performance: S = Successful; P = Partially Successful; X = Unsuccessful

+Overall flight results: Same code.

1961

14.03 UE	Jul 14	WI	S	UNH/Heppner	Magnetic Field	S
14.04 UE	Jul 14	WI	S	UNH/Heppner	Magnetic Field	S
14.05 UE	Jul 20	WI	S	UNH/Heppner	Magnetic Field	S
10.76 GE	Dec 10	FC	S	GSFC/Fichtel	Cosmic Ray	S

1963

11.06 UE	Feb 12	PMR	S	U.Minn/Cline	Electron Spectometry	S
4.91 GE	Sep 4	FC	S	GSFC/Fichtel	Cosmic Rays	S
14.06 UE	Sep 9	WI	S	UNH/Schardt	Electrojet	S

1964

14.150 UE	Jan 15	WI	P	Rice/Schardt	Auroral Observations	X
14.79 UE	Jan 25	IND	S	UNH/Schardt	Equatorial Electrojet	S
14.80 UE	Jan 27	IND	S	UNH/Schardt	Equatorial Electrojet	S
14.81 UE	Jan 29	IND	S	UNH/Schardt	Equatorial Electrojet	S
14.82 UE	Jan 31	IND	S	UNH/Schardt	Equatorial Electrojet	S
14.43 GE	Feb. 20	FC	S	GSFC/Evans	Aurora	P
14.44 GE	Feb 29	FC	S	GSFC/Evans	Aurora	P
14.151 UE	Mar 18	FC	S	Rice/Schardt	Aurora	S
14.152 UE	Mar 20	FC	S	Rice/Schardt	Aurora	S
14.153 UE	Mar 23	FC	S	Rice/Schardt	Aurora	S
14.118 GE	Mar 24	FC	S	GSFC/Evans	Aurora	S

14.120 GE	Mar 25	FC	S	GSFC/Evans	Aurora	X
14.119 GE	Mar 26	FC	S	GSFC/Evans	Aurora	P
14.121 UE	Apr 11	FC	S	Alaska/Schardt	Aurora	S
14.122 UE	Apr 15	FC	S	Alaska/Schardt	Aurora	X
14.123 UE	Apr 22	FC	S	Alaska/Schardt	Aurora	S
14.155 GE	Jun 10	WI	S	GSFC/Davis	Magnetic Fields	S
14.156 GE	Jun 25	WI	S	GSFC/Davis	Magnetic Fields	S
14.157 GE	Jun 26	WI	S	GSFC/Davis	Magnetic Fields	S
14.154 UE	Jul 9	WI	S	Rice/Schardt	Airglow	S
4.107 GE	Jul 23	FC	S	GSFC/Fichtel	Cosmic Rays	P
4.108 GE	Jul 25	FC	S	GSFC/Fichtel	Cosmic Rays	S
14.158 GE	Oct 7	WI	X	GSFC/Davis	Magnetic Fields	X
14.159 GE	Oct 8	WI	S	GSFC/Davis	Magnetic Fields	S
14.60 UE	Dec 7	WI	S	UNH/Schardt	Energetic Particles	X

<u>1965</u>

14.61 UE	Feb 3	WI	S	UNH/Schardt	Energetic Particles	S
14.160 GE	Mar 8	SHIP	S	GSFC/Davis	Magnetic Fields	S
14.85 UE	Mar 9	SHIP	S	UNH/Opp	Magnetic Fields	S
14.83 UE	Mar 10	SHIP	S	UNH/Opp	Magnetic Fields	S
14.07 UE	Mar 12	SHIP	S	UNH/Opp	Magnetic Fields	S
14.84 UE	Mag 12	SHIP	S	UNH/Opp	Magnetic Fields	S

14.171 GE	Mar 16	SHIP	S	GSFC/Davis	Geomagnetism	S
14.172 GE	Mar 18	SHIP	S	GSFC/Davis	Geomagnetism	S
14.174 GE	Mar 24	SHIP	S	GSFC/Davis	Geomagnetism	S
14.173 GE	Mar 26	SHIP	S	GSFC/Davis	Geomagnetism	S
14.175 GE	Mar 27	SHIP	S	GSFC/Davis	Geomagnetism	S
14.70 GE	Mar 29	SHIP	S	GSFC/Davis	Geomagnetism	S
14.185 UE	Apr 2	SHIP	S	UNH/Schardt	Energetic Particles	P
14.207 UE	Apr 3	FC	S	Rice/Schardt	Aurora	S
14.184 UE	Apr 5	SHIP	S	UNH/Schardt	Energetic Particles	P
14.186 UE	Apr 13	SHIP	S	UNH/Schardt	Energetic Particles	P
11.07 UE	Apr 14	WI	S	U.Minn/Opp	Energetic Particles	X
4.140 GE	Jun 17	FC	S	GSFC/Fichtel	Energetic Particles	S
4.141 GE	Jun 23	FC	S	GSFC/Fichtel	Energetic Particles	S
14.234 UE	Sep 16	FC	X	U.Cal/Schardt	Energetic Particles	X
14.235 UE	Sep 17	FC	S	U.Cal/Schardt	Energetic Particles	S
14.237 UE	Sep 20	FC	X	U.Cal/Schardt	Energetic Particles	X
14.236 UE	Sep 20	FC	S	U.Cal/Schardt	Energetic Particles	S
14.238 UE	Nov 17	FC	S	Alaska/Opp	Aurora	S
14.239 UE	Nov 20	FC	S	Alaska/Opp	Aurora	S
14.124 UE	Nov 24	FC	S	Alaska/Opp	Aurora	S
14.242 UE	Nov 24	WI	S	Rice/Opp	Magnetic Field	S

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14.188 GE	Feb 10	FC	S	GSFC/Evans	Auroral Physics	S
14.243 UE	Feb 17	WI	S	Rice/Opp	Magnetic Field	S
14.189 GE	Feb 18	FC	S	GSFC/Evans	Auroral Physics	S
14.190 GE	Mar 14	FC	S	GSFC/Evans	Auroral Physics	S
18.07 GE	Mar 23	FC	S	GSFC/Heppner	Magnetic Fields	S
18.08 GE	Apr 14	FC	S	GSFC/Heppner	Magnetic Fields	S
14.59 IE-II	Jul 7	IND	S	India/--	Magnetic Fields and Ionospheres	S
14.218 GE	Jul 20	FC	S	GSFC/Fichtel	SPICE	X
14.183 UE	Aug 24	FC	S	UNH/Opp	Particles and Fields	S
18.18 UE	Sep 1	FC	S	U.Cal/Schardt	Auroral Radiation	S
14.219 GE	Sep 2	FC	S	GSFC/Guss	SPICE	S
14.220 GE	Sep 2	FC	S	GSFC/Guss	SPICE	S
14.221 GE	Sep 3	FC	S	GSFC/Guss	SPICE	S
18.20 UE	Sep 6	FC	S	U.Cal/Schardt	Auroral Radiation	S
18.21 UE	Sep 6	FC	S	U.Cal/Schardt	Auroral Radiation	S
18.19 UE	Sep 17	FC	S	U.Cal/Schardt	Auroral Radiation	S
18.04 GE	Nov 8	WI	S	GSFC/Aggson	Fields	S
14.287 IE	Nov 11	FC	S	Germany/Franta	Energetic Particles	S
18.27 UE	Nov 20	WI	S	UNH/Opp	Energetic Particles	S

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18.23 GE	Jan 28	FC	S	GSFC/Evans	Auroral Studies	P
8.41 UE	Feb 9	FC	S	Rice/Opp	Auroral Studies	S
18.24 GE	Mar 9	FC	S	GSFC/Evans	Auroral Studies	S
8.47 UE	Mar 18	FC	S	Rice/Opp	Auroral Studies	S
18.28 UE	Mar 27	BRAZ	S	UNH/Opp	Energetic Particles	S
18.09 GE	Mar 31	WI	S	GSFC/Wescott	Magnetic Fields	S
14.328 IE	Apr 7	SWE	S	Germany/--	Magnetic Fields	S
14.329 IE	Apr 8	SWE	S	Germany/--	Magnetic Fields	S
14.330 IE	Apr 9	SWE	S	Germany/--	Magnetic Fields	S
14.331 IE	Apr 10	SWE	S	Germany/--	Magnetic Fields	S
14.332 IE	Apr 11	SWE	S	Germany/--	Magnetic Fields	S
18.29 UE	Jun 6	FC	S	UNH/Opp	Cosmic-Ray Intensities	S
14.297 CE	Jun 13	WI	S	AS&E/Schardt	Energetic Particles	S
8.49 IE	Jun 16	BRAZ	S	Germany/Franta	Energetic Particles	S
8.50 IE	Jun 17	BRAZ	S	Germany/Franta	Energetic Particles	S
18.43 GE	Aug 31	NOR	S	GSFC/Heppner	Magnetic Fields	S
18.46 GE	Aug 31	NOR	S	GSFC/Heppner	Magnetic Fields	S
18.44 GE	Sep 2	NOR	S	GSFC/Heppner	Magnetic Fields	S
18.47 GE	Sep 2	NOR	S	GSFC/Heppner	Magnetic Fields	S
18.45 GE	Sep 12	NOR	S	GSFC/Heppner	Magnetic Fields	S
18.48 GE	Sep 12	NOR	S	GSFC/Heppner	Magnetic Fields	X

18.34 UE	Nov 24	FC	S	U.Cal./Schardt	Auroral Studies	X
14.288 IE	Dec 5	SWE	S	Germany/Franta	Energetic Particles	S

1968

18.13 UE	Jan 23	FC	S	U.Alaska/Opp	Particles and Fields	P
18.38 UE	Feb 6	FC	S	UNH/Opp	Electric Field and Auroral Studies	S
14.276 GE	Feb 22	FC	S	GSFC/Evans	Auroral Studies	S
18.61 GE	Feb 22	FC	P	GSFC/Evans	Auroral Studies	X
18.35 UE	Feb 23	FC	S	U.Cal./Schardt	Auroral Studies	S
8.48 UE	Mar 2	FC	S	Rice/Opp	Auroral Studies	S
18.37 UE	Mar 2	FC	S	U.Cal./Schardt	Auroral Studies	P
4.198 GE	Mar 16	WS	S	GSFC/Boldt	Energetic Cosmic Rays	S
18.36 UE	Mar 18	FC	S	U.Cal./Schardt	Auroral Studies	S
18.63 UE	Mar 21	FC	S	U.Md./Opp	Auroral Studies	S
14.375 IE-II	Mar 28	IND	S	Germany/--	Mag. Fields,Ionosphere	S
14.376 IE-II	Mar 30	IND	S	Germany/--	Mag. Fields, Ionosphere	S
14.377 IE-II	Mar 31	IND	S	Germany/--	Mag. Fields, Ionosphere	S
14.378 IE	Mar 31	IND	S	Germany/--	Magnetic Fields	S
14.277 GE	Apr 4	FC	S	GSFC/Evans	Auroral Particles	P
18.60 GE	Apr 4	FC	S	GSFC/Evans	Auroral Particles	S
18.39 UE	Apr 24	FC	S	UNH/Opp	Energetic Particles	S
18.33 CE	Apr 25	FC	S	TRW/Opp	Energetic Particles	S

18.40 UE	Apr 25	FC	S	UNH/Opp	Energetic Particles	S
18.41 UE	Apr 30	FC	X	UNH/Opp	Energetic Particles	X
18.42 UE	May 3	FC	S	UNH/Opp	Energetic Particles	S
14.222 GE	Jun 10	FC	S	GSFC/Bertsch	SPICE	X
14.223 GE	Jun 10	FC	S	GSFC/Bertsch	SPICE	X
19.01 NE	Jun 11	BRAZ	S	MSC/Holtz	Radiation	S
14.320 UE	Aug 7	WI	S	Rice/Opp	Particles & Fields	S
18.75 GE	Sep 20	NOR	S	GSFC/Wescott	Magnetic Fields	S
18.58 IE	Sep 20	NOR	S	Norway/--	Particles and Fields	P
18.76 GE	Sep 21	NOR	S	GSFC/Wescott	Magnetic Fields	S
18.77 GE	Sep 23	NOR	S	GSFC/Wescott	Magnetic Fields	S
18.59 IE	Oct 1	NOR	S	Norway/--	Particles and Fields	S
				1969		
14.321 UE	Feb 27	FC	S	Rice/Opp	Auroral Studies	S
4.199 GE	Mar 3	WS	S	GSFC/Holt	Cosmic Ray	S
18.83 GE	Mar 7	NWT	S	GSFC/Heppner	Electric Fields	S
18.84 GE	Mar 8	NWT	S	GSFC/Heppner	Electric Fields	S
18.85 GE	Mar 9	NWT	S	GSFC/Heppner	Electric Fields	S
18.15 UE	Mar 17	FBKS	S	U.Alaska/Opp	Auroral Studies	P
14.325 GE	Apr 12	FC	S	GSFC/Bertsch	SPICE	S

14.326 GE	Apr 13	FC	S	GSFC/Bertsch	SPICE	S
14.327 GE	Apr 14	FC	S	GSFC/Bertsch	SPICE	S
18.80 CE	Apr 17	FC	S	TRW/Opp	Auroral Studies	S
4.234 NE*	Sep 5	WS	X	NRL	Solar Physics	X
19.05 NE	Sep 19	BRAZ.	S	MSC/Schardt	Energetic Particles	S

*Aerobee 170

Goddard Sounding Rocket Flights--Ionospheric Physics

1959

4.08 GI	Sep 11	FC	S	GSFC/Jackson	Ionosphere	S
4.07 GI	Sep 14	FC	S	GSFC/Jackson	Ionosphere	S
4.02 II	Sep 17	FC	S	DRTE/Jackson	Ionosphere	S
4.03 II	Sep 20	FC	P	DRTE/Jackson	Ionosphere	X

1960

6.01 UI	Mar 16	FC	S	U.Mich./Bourdeau	Ionosphere	S
3.10 UI	Mar 17	FC	X	U.Mich./Bourdeau	Ionosphere	X
6.02 UI	Jun 15	FC	S	U.Mich./Bourdeau	Ionosphere	S
6.03 UI	Aug 3	WI	S	U.Mich./Bourdeau	Ionosphere	S
3.12 CI	Aug 22	WI	X	GCA/Bourdeau	Langmuir Probe	X
1.01 GI	Nov 23	FC	S	GSFC/Whipple	Ionosphere	S
1.02 GI	Nov 27	FC	S	GSFC/Whipple	Ionosphere	S
10.25 CI	Dec 8	WI	S	GCA/Bourdeau	Langmuir Probe	S

1961

6.04 UI	Mar 26	WI	S	U.Mich./Bourdeau	Ionosphere	S
8.10 GI	Apr 27	WI	S	GSFC/Jackson	Ionosphere	P
8.09 GI	Jun 13	WI	S	GSFC/Jackson	Ionosphere	X
8.13 II	Jun 15	WI	S	DRTE/Jackson	Antenna Test	S
8.15 AI	Jun 24	WI	S	CRPL-AIL/Jackson	Ionosphere	S
10.51 CI	Aug 18	WI	S	GCA/Wright	Langmuir Probe	S

8.17 AI	Oct 14	WI	S	GSFC/Jackson	Ionosphere	S
10.52 CI	Oct 27	WI	S	GCA/Bourdeau	Langmuir Probe	S
10.74 GI	Dec 21	WI	S	GSFC/Kane	Ionosphere	S
6.05 UI	Dec 22	WI	S	U.Mich./Wright	Ionosphere	S

1962

8.16 AI	Feb 7	WI	S	GSFC/Jackson	Ionosphere	X
10.110 GI	Apr 26	WI	S	GSFC/Serbu	Electron Temperature	S
8.21 GI	May 3	WI	S	GSFC/Serbu	ELF Electron Trap	X
10.112 GI	May 16	WI	S	GSFC/Serbu	Electron Temperature	S
10.111 GI	May 17	WI	S	GSFC/Serbu	Electron Temperature	S
14.12 GI	Jun 15	WI	S	GSFC/Kane	Ionosphere	S
14.31 GI	Oct 16	WI	S	GSFC/Bauer	Ionosphere	S
10.99 CI	Nov 7	WI	S	GCA/Bourdeau	Ionosphere	S
4.79 II	Nov 16	WI	X	Australia/Cartwright	Ionosphere	X
10.108 CI	Nov 30	WI	S	GCA/Bourdeau	Ionosphere	S
14.32 GI	Dec 1	WI	S	GSFC/Bauer	Ionosphere	S
10.109 CI	Dec 5	WI	S	GCA/Bourdeau	Ionosphere	S
4.80 II	Dec 11	WI	X	Australia/Cartwright	Ionosphere	X
Ferdinand III*	Dec. 11	NOR	S	GSFC/Kane	Ionosphere	S

*Nike-Cajun

<u>1963</u>

14.86 CI	Feb 27	WI	S	GCA/Bourdeau	Ionosphere	S
14.107 GI	Mar 8	WI	S	GSFC/Whipple	Ionosphere	P
14.87 CI	Mar 28	WI	P	GCA/Bourdeau	Ionosphere	S
4.58 UI	Apr 3	WI	S	Stanford/Bourdeau	Ionosphere	S
14.108 GI	Apr 9	WI	S	GSFC/Kane	D-Region	S
4.96 II	Apr 12	WI	S	Australia-Cartwright	VLF Receiver	S
4.44 GI	Apr 23	WI	S	GSFC/Bauer	Electron Density	S
4.97 II	May 9	WI	S	Australia-Cartwright	VLF	S
8.14 GI	Jul 2	WI	S	GSFC/Bauer	Ionosphere	S
4.59 UI	Jul 10	WI	S	Stanford/Bourdeau	Ionosphere	S
14.88 CI	Jul 14	FC	P	GCA/Bourdeau	Ionosphere	P
14.89 CI	Jul 20	FC	X	GCA/Bourdeau	Eclipse Ionosphere	X
14.90 CI	Jul 20	FC	X	GCA/Bourdeau	Eclipse Ionosphere	X
14.91 CI	Jul 20	FC	S	GCA/Bourdeau	Eclipse Ionosphere	S
14.92 CI	Jul 20	FC	S	GCA/Bourdeau	Eclipse Ionosphere	S
14.93 CI	Jul 20	FC	S	GCA/Bourdeau	Eclipse Ionosphere	S
14.94 CI	Jul 20	FC	S	GCA/Bourdeau	Eclipse Ionosphere	S
6.08 GI	Jul 20	WI	S	U.Mich./Brace	Thermosphere Probe	S
Ferdinand V*	Sep 1	NOR	S	GSFC/Kane	Ionosphere	X
Ferdinand IV**	Sep 12	NOR	S	GSFC/Kane	Ionosphere	S

*Nike-Cajun
**Nike-Apache

4.65 GI	Sep 25	WI	S	GSFC/Hirao	Ionosphere	S
4.64 GI	Sep 28	WI	S	GSFC/Hirao	Ionosphere	S
8.18 GI	Sep 29	WI	S	GSFC/Bauer	Ionosphere	S
14.36 DI	Oct 7	FC	S	BRL/Bourdeau	Ionospheres	P
4.93 II	Oct 17	WI	S	France/Shea	Ionospheres	S
4.94 II	Oct 31	WI	S	France/Shea	Ionospheres	S
14.37 GI	Dec 13	WS	P	GSFC/Whipple	Ionospheres	P

<u>1964</u>

Ferdinand VI*	Mar 12	NOR	S	GSFC/Kane	Ionosphere	S
Ferdinand VII*	Mar 15	NOR	S	GSFC/Kane	Ionosphere	S
Ferdinand VIII*	Mar 19	NOR	S	GSFC/Kane	Ionosphere	S
12.03 GT-GI	Apr 15	WI	S	GSFC/Guidotti	Rocket Test-Ionospheres	S
14.143 UI	Apr 16	WI	S	U.Ill/Schardt	Ionospheres	S
4.113 GA-GI	Apr 21	WS	X	GSFC/Aikin	Astrochemistry and Ionospheres	X
14.33 GI	Jun 3	WI	S	GSFC/Bauer	Ionospheres	P
14.144 UI	Jul 15	WI	S	U.Ill/Schardt	Ionospheres	S
14.145 UI	Jul 15	WI	S	U.Ill/Schardt	Ionospheres	S
14.146 UI	Jul 15	WI	S	U.Ill/Schardt	Ionospheres	S
14.127 GI	Jul 16	WI	S	GSFC/Stone	Ionospheres	S

*Nike-Apache

14.34 GI	Aug 26	WI	S	GSFC/Bauer	Ionospheres	S
8.24 GI-II	Oct 19	WI	S	GSFC/Serbu	Ionospheres	P
14.104 DI	Nov 5	FC	S	BRL/Bourdeau	Ionospheres	S
8.19 DI	Nov 5	FC	S	BRL/Bourdeau	Ionospheres	S
14.105 DI	Nov 7	FC	S	BRL/Bourdeau	Ionospheres	S
8.20 DI	Nov 7	FC	S	BRL/Bourdeau	Ionospheres	S
14.147 UI	Nov 10	WI	S	U.Ill/Schardt	IQSY Ionospheres	S
14.149 UI	Nov 19	WI	S	U.Ill/Schardt	IQSY Ionospheres	S
14.148 UI	Nov 19	SHIP	S	U.Ill/Schardt	IQSY Ionospheres	S
14.117 GI	Nov 23	WI	S	GSFC/Bauer	Ionospheres	S
ION 1 64-1*	Dec 1	ARG	S	Argentina/Bauer	Ionospheres	S
ION 1 64-2*	Dec 4	ARG	S	Argentina/Bauer	Ionospheres	S
4.132 GA-GI	Dec 16	WS	S	GSFC/Berg	Micrometeoroid	S
14.209 GI	Dec 16	WS	S	GSFC/Aikin	Ionospheres	S

<u>1965</u>

8.28 UI	Jan 13	WI	S	Penn State/ Schmerling	Mother-Daughter Ionospheres	X
15.03 II	Mar 1	NOR	S	Sweden/--	Ionospheres	S
15.04 II	Mar 2	NOR	S	Sweden/--	Ionospheres	S
15.01 GI	Mar 16	NOR	S	GSFC/Kane	Ionospheres	X

*Nike-Cajun

14.177 GI	Mar 16	SHIP	S	GSFC/Blumle	Ionospheres	S
14.178 GI	Mar 18	SHIP	S	GSFC/Blumle	Ionospheres	S
14.176 GI	Mar 18	SHIP	S	GSFC/Davis	Geomagnetism	S
14.179 GI	Mar 18	SHIP	S	GSFC/Blumle	Ionospheres	S
14.228 UI	Mar 20	SHIP	S	U.Ill/Schmerling	Ionospheres	S
15.02 GI	Mar 23	NOR	S	GSFC/Kane	Ionospheres	S
14.229 UI	Mar 23	SHIP	S	U.Ill/Schmerling	Ionospheres	X
14.180 GI	Mar 24	SHIP	S	GSFC/Blumle	Ionospheres	S
14.181 GI	Mar 26	SHIP	S	GSFC/Blumle	Ionospheres	S
14.182 GI	Mar 27	SHIP	S	GSFC/Blumle	Ionospheres	S
14.230 UI	Apr 5	SHIP	S	U.Ill/Schmerling	Ionospheres	S
14.231 UI	Apr 9	SHIP	S	U.Ill/Schmerling	Ionospheres	S
14.232 UI	Apr 12	SHIP	S	U.Ill/Schmerling	Ionospheres	S
8.29 UI	May 19	WI	S	Penn State/ Schmerling	Mother-Daughter Ionospheres	S
15.18 GI	May 25	NZ	S	GSFC/Kane	D-region Ionospheres	S
8.37 GI	May 26	WI	X	GSFC/Maier	Ionospheres	X
15.05 GI	May 30	NZ	S	Kane/Aikin	Eclipse Ionospheres	S
15.06 GI	May 30	NZ	S	Kane/Aikin	Eclipse Ionospheres	S
15.07 GI	May 30	NZ	S	Kane/Aikin	Eclipse Ionospheres	S
15.08 GI	May 30	NZ	S	Kane/Aikin	Eclipse Ionospheres	S
15.09 GI	May 30	NZ	S	Kane/Aikin	Eclipse Ionospheres	S
15.10 GI	May 30	NZ	S	Kane/Aikin	Eclipse Ionospheres	S

14.245 UI	Jun 14	WI	S	U.Ill/Schmerling	Ionospheres	S
14.246 UI	Jun 17	WI	S	U.Ill/Schmerling	Ionospheres	S
14.215 AI	Jun 18	WI	S	BuStds/Schmerling	Ionospheres	X
14.210 GI	Aug 24	WI	S	GSFC/Bourdeau	Ionospheres	S
14.213 UI	Sep 1	WI	S	SCAS/Schmerling	Ionospheres	S
14.214 UI	Sep 3	WI	S	SCAS/Schmerling	Ionospheres	X
14.244 UI	Sep 15	WI	S	U.Ill/Schardt	IQSY Ionospheres	S
4.138 II	Sep 17	WI	S	France/Stevens	VLF Experiment	S
8.36 GI	Sep 23	WI	S	GSFC/Maier	Ionospheres	S
4.139 II	Sep 25	WI	S	France/Stevens	VLF Experiment	S
4.150 GA-GI -GB	Sep 28	WS	S	GSFC/Berg	Micrometeoroid, Ionospheres, Microorganisms	S
8.30 UI	Oct 5	WI	S	Penn State/ Schmerling	Mother-Daughter Ionospheres	S
8.42 UI	Oct 10	WI	X	Penn State/ Schmerling	Mother-Daughter Ionospheres	X
Ferdinand XII*	Nov 20	NOR	S	Norway/Kane	Ionospheres	S
15.20 GI-II	Dec 2	NOR	S	Norway/Kane	Ionospheres	X
15.19 GI	Dec 6	NOR	S	GSFC/Kane	D-region Ionospheres	S
14.247 UI	Dec 15	WI	S	U.Ill/Schmerling	Ionospheres Radio and Physics	S

*Nike-Apache

14.68 II	Dec 15	BRAZ	S	Brazil/Blumle	Ionospheres	S
14.69 II	Dec 18	BRAZ	S	Brazil/Blumle	Ionospheres	S
				1966		
14.248 UI	Jan 10	WI	S	U.Ill/Schmerling	Ionospheres	P
8.25 GA-GI	Mar 2	WI	S	GSFC/Smith	Geoprobe	S
14.109 GI	Mar 21	NOR	S	GSFC/Kane	Ionospheres	S
14.216 AI	Apr 6	WI	S	BuStds/Schmerling	Ionospheres	P
14.76 UI	Apr 8	WI	S	SCAS/Opp	Ionospheres	S
15.25 GI	May 15	GREECE	X	GSFC/Aikin	Ionospheres	X
15.26 GI	May 20	GREECE	S	GSFC/Aikin	Eclipse Ionospheres	S
15.27 GI	May 20	GREECE	S	GSFC/Aikin	Eclipse Ionospheres	S
15.28 GI	May 20	GREECE	S	GSFC/Aikin	Eclipse Ionospheres	S
15.29 GI	May 20	GREECE	S	GSFC/Aikin	Eclipse Ionospheres	S
15.30 GI	May 20	GREECE	S	GSFC/Aikin	Eclipse Ionospheres	S
15.31 GI	May 21	GREECE	S	GSFC/Aikin	Ionospheres	S
14.270 UI	Jun 14	WI	S	U.Ill/Schmerling	Ionospheres	S
Ferdinand XIII*	Jun 26	NOR	S	Norway/Kane	Ionospheres	S
14.59 IE-II	Jul 7	IND	S	India/--	Magnetic Fields and Ionospheres	S

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*Nike-Apache

14.166 II	Jul 14	WI	S	Germany/Bauer	Ionospheres	S
14.271 UI	Aug 24	WI	S	U.Ill/Schmerling	Ionospheres	S
14.272 UI	Aug 25	WI	S	U.Ill/Schmerling	Ionospheres	P
15.12 GI	Aug 29	WS	S	GSFC/Pederson	Ion Density	P
15.11 GI	Aug 29	WS	S	GSFC/Pederson	Ion Density	P
14.278 CA-CI	Sep 14	FC	S	GDA/Dubin	Ionosphere-Luminescent Cloud	S
14.279 CA-CI	Sep 14	FC	S	GCA/Dubin	Ionosphere-Luminescent Cloud	P
14.280 CA-CI	Sep 16	FC	S	GCA/Dubin	Ionosphere-Luminescent Cloud	S
14.281 CA-CI	Sep 16	FC	S	GCA/Dubin	Ionosphere-Luminescent Cloud	S
14.282 CA-CI	Sep 16	FC	S	GCA/Dubin	Ionosphere-Luminescent Cloud	S
14.164 UI	Sep 16	WI	S	U.Md/Schmerling	Ionospheres	S
8.38 GI	Oct 6	WI	S	GSFC/Maier	Ionospheres	S
4.195 GA-GI	Oct 25	WS	S	GSFC/Berg	Micrometeoroid	S
10.181 AI	Oct 25	WS	S	ESSA/Schmerling	Ionospheres	S
14.77 CA-CI	Nov 12	BRAZ-A	S	GCA/Dubin	Eclipse Ionosphere-Luminescent Cloud	S
14.274 UI	Nov 12	BRAZ-A	S	U.Ill/Schmerling	Eclipse Ionosphere	S
14.302 UI	Nov 12	BRAZ-A	S	U.Ill/Schmerling	Eclipse Ionosphere	S
14.304 UI	Nov 12	BRAZ-A	S	U.Ill/Schmerling	Eclipse Ionosphere	S
14.303 UI	Nov 12	BRAZ-A	S	U.Ill/Schmerling	Eclipse Ionosphere	S

1967

14.275 UI	Jan 31	WI	S	U.Ill/Schmerling	Ionospheres	S
Ferdinand XIV*	Mar 3	NOR	S	Norway/Kane	Ionospheres	S
14.163 IA-II	Mar 12	IND	S	India/Dubin	Ionosphere-Luminescent Cloud	P
14.206 IA-II	Mar 12	IND	S	India/Dubin	Ionosphere-Luminescent Cloud	S
14.267 IA-II	Mar 13	IND	S	India/Dubin	Ionosphere-Luminescent Cloud	P
Ferdinand XV*	Mar 14	NOR	S	Norway/Kane	Ionospheres	S
14.256 II	Mar 16	WI	S	India/Schmerling	Ionospheres	S
18.12 UI	Mar 30	WI	S	U.Md/Schmerling	Ionospheres	S
8.39 GI	Apr 12	FC	S	GSFC/Maier	Ionospheres	S
14.268 UI	May 5	FC	S	SCAS/Schmerling	Ionospheres	S
8.26 UI	Jun 21	WI	S	SCAS/Schmerling	Ionospheres	P
14.273 UI	Aug 8	WI	S	U.Ill/Schmerling	Ionospheres	S
15.21 II	Aug 25	NOR	S	Norway/Kane	Ionospheres	P
14.308 UI	Sep 7	PR	S	U.Ill/Schmerling	Ionospheres	S
14.305 UI	Sep 8	PR	S	U.Ill/Schmerling	Ionospheres	X
14.309 UI	Sep 8	PR	X	U.Ill/Schmerling	Ionospheres	X

*Nike-Apache

8.45 UI	Sep 21	WI	S	U.Iowa/Schmerling	Ionospheres	S
15.22 II	Oct 9	NOR	S	Norway/Kane	Ionospheres	S
15.23 II	Oct 13	NOR	S	Norway/Kane	Ionospheres	S
15.32 GI	Oct 24	Res. Bay	P	GSFC/Kane	Ionospheres	X
15.33 GI	Oct 24	Res. Bay	P	GSFC/Kane	Ionospheres	P
14.298 UI	Nov 16	WI	S	U.Md/Schmerling	Ionospheres	S
8.35 UI	Dec 8	FC	S	SCAS/Schmerling	Ionospheres	S

1968

10.273 GI	Jan 16	WI	S	GSFC/Somayajulu	Lower Ionosphere	S
10.275 GI	Jan 16	WI	S	GSFC/Somayajulu	Lower Ionosphere	S
15.58 GI	Mar 8	IND	S	GSFC/Kane	Lower Ionosphere	S
15.59 GI	Mar 8	IND	S	GSFC/Kane	Lower Ionosphere	S
18.10 GI	Mar 15	WI	S	GSFC/Herman	Ionospheres	S
14.375 IE-II	Mar 28	IND	S	Germany/---	Mag. Fields, Ionosphere	S
14.376 IE-II	Mar 30	IND	S	Germany/---	Mag. Fields, Ionosphere	S
14.377 IE-II	Mar 31	IND	S	Germany/---	Mag. Fields, Ionosphere	S
16.04 UI	Apr 20	WI	S	U.Minn./Schmerling	Ionospheres	X
19.04 II	May 7	WI	S	Canada/---	Ionospheres	S
8.46 UI	May 25	FC	S	U.Iowa/Schmerling	Ionospheres	S
14.358 UI	Jul 24	WI	S	U.Ill/Schmerling	Ionospheres	S
14.359 UI	Jul 24	WI	S	U.Ill/Schmerling	Ionospheres	S

14.360 UI	Jul 24	WI	S	U.Ill/Schmerling	Ionospheres	P
14.361 UI	Jul 24	WI	S	U.Ill/Schmerling	Ionospheres	S
15.52 GI	Aug 2	Res. Bay	S	GSFC/Kane	D-Region Ionosphere	S
15.34 GI	Aug 2	Res. Bay	S	GSFC/Kane	D-Region Ionosphere	S
14.369 GI	Aug 21	WI	S	GSFC/Aikin	Ionospheres	S
14.368 GI	Aug 21	WI	S	GSFC/Aikin	Ionospheres	S
14.370 GI	Aug 21	WI	S	GSFC/Aikin	Ionospheres	S
18.30 UI	Aug 21	WI	S	U.Md./Schmerling	Ionospheres	P
15.43 II	Oct 24	SWE	S	Sweden/--	Ionospheres	S
14.379 GI	Nov 7	WI	S	GSFC/Goldberg	Ion Concentration	P
14.311 GI	Nov 19	WI	S	GSFC/Aikin	Ionospheres	P

<u>1969</u>

14.392 UI	Feb 6	WI	S	U.Ill/Schmerling	Ionospheres	S
14.269 UI	Feb 8	FC	S	SCAS/Schmerling	Ionospheres	S
14.306 UI	Feb 12	FC	S	SCAS/Schmerling	Ionospheres	S
14.374 UI	Feb 17	FC	S	SCAS/Schmerling	Ionospheres	S
14.307 UI	Feb 20	FC	P	SCAS/Schmerling	Ionospheres	X
14.393 UI	Apr 17	WI	S	U.Ill/Schmerling	Ionospheres	P
8.53 UI	Jun 26	BRAZ.	S	SCAS/Schmerling	Ionospheres	S
14.395 UI	Sep 10	WI	S	U.Ill/Schmerling	Ionospheres	S
14.394 UI	Sep 12	WI	S	U.Ill/Schmerling	Ionospheres	S

15.53 GI	Oct 10	RB	S	GSFC/Kane	D-Region Ionospheres	S
15.42 UI	Oct 29	WI	S	Penn State/ Schmerling	Ion Composition	S

Goddard Sounding Rocket Flights---Solar Physics

			1960			
3.01 GS	Mar 1	WI	S	GSFC/Hallam	Solar Study	X
3.02 GS	Mar 3	WI	S	GSFC/Hallam	Solar Study	X
3.03 GS	Apr 27	WI	X	GSFC/Hallam	Solar Study	X
3.04 GS	May 25	WI	X	GSFC/Hallam	Solar Study	X
			1961			
4.25 GS	Sep 30	WI	S	GSFC/Behring	Solar Studies	S
			1962			
4.23 US	Jul 24	WI	S	U.Colo./Lindsay	Sunfollower	P
4.21 US	Nov 27	WS	S	Harvard/Lindsay	Solar Studies	X
			1963			
4.61 AS	Jun 20	WS	S	NRL/Packer	Coronograph	P
4.62 AS	Jun 28	WS	S	NRL/Packer	Coronograph	P
4.77 GS	Jul 20	WS	S	GSFC/Wolff	Solar Studies	X
4.22 US	Sep 6	WS	S	Harvard/Lindsay	Solar Studies	S
4.78 GS	Oct 1	WS	S	GSFC/Hallam	Solar Studies	P
4.33 GS	Oct 15	WS	S	GSFC/Muney	X-Ray	S
			1964			
4.116 GS	Oct 30	WS	S	GSFC/Muney	Solar Studies	S

*Sounding rocket performance: S = Successful; P = Partially Successful; X = Unsuccessful

+Overall flight results: Same code.

1965

4.63 GS	Mar 17	WS	S	GSFC/Muney	Solar Studies	S
4.49 GS	Apr 12	WS	S	GSFC/Fredga	Solar Studies	S
4.146 DS	Oct 20	WS	S	NRL/Smith	1965F Comet Solar Studies	P
4.53 GS	Oct 26	WS	S	GSFC/Fredga	Solar Studies	X
4.145 GS	Dec 2	WS	S	GSFC/Fredga	Solar Studies	S

1966

4.99 DS	Mar 2	WI	S	AFCRL/Smith	Solar Studies	S
4.100 DS	Mar 3	WI	S	AFCRL/Smith	Solar Studies	P
4.24 US	Apr 14	WS	S	U.Colo/Dubin	Solar Studies	P
4.189 DS	Apr 28	WS	S	NRL/Smith	Solar Studies	S
4.95 GS	May 20	WS	S	GSFC/Underwood	Solar X-Ray	S
4.92 GS	May 20	WS	S	GSFC/Neupert	Solar Spectra	S
4.101 DS	Aug 26	WI	S	AFCRL/Schmerling	Solar Studies	S
4.153 GS	Nov 12	WS	S	GSFC/Underwood	Eclipse Solar Studies	S
4.191 DS	Nov 12	WS	S	NRL/Smith	Eclipse Solar Studies	S

1967

16.05 US	Feb 25	WI	S	Harvard/Smith	Solar Physics	X
4.102 DS	Mar 14	WI	S	AFCRL/Schmerling	Monochromatic Extreme Ultraviolet	P
4.103 DS	Mar 22	WI	S	AFCRL/Schmerling	Monochromatic Extreme Ultraviolet	S

4.168 CS	Apr 5	WS	S	Lockheed/Weldon	Solar Physics	S
4.117 GS	Apr 24	WS	S	GSFC/Neupert	Solar X-Ray	S
4.192 DS	May 9	WS	S	NRL/Smith	Solar Studies	S
4.104 DS	Sep 30	WI	S	AFCRL/Schmerling	Monochromatic Extreme Ultraviolet	P
4.152 GS	Oct 3	WS	S	GSFC/Underwood	Solar X-Ray and Ultra-violet	
4.243 DS	Oct 5	WS	S	NRL/Holtz	Solar Studies	S
4.239 US	Oct 19	WS	S	U.Colo/Glaser	Solar Studies	S
				1968		
4.169 CS	Feb 19	WS	S	Lockheed/Glaser	Solar Physics	S
4.209 CS	Mar 15	WS	S	AS&E/Glaser	Solar Physics	P
4.244 DS	Apr 27	WS	S	NRL/Glaser	Solar Physics	S
4.245 DS	Apr 29	WS	S	NRL/Glaser	Solar Physics	S
4.230 GS	May 20	WS	S	GSFC/Fredga	Solar Physics	S
4.134 DS	Jun 8	WS	S	NRL/Glaser	Solar Physics	X
4.263 CS	Jun 8	WS	S	AS&E/Glaser	Solar Physics	S
4.246 DS	Sep 22	WS	S	NRL/Glaser	Solar Corona	S
4.185 US	Sep 24	WS	S	Harvard/Glaser	Solar Studies	X
4.231 GS	Sep 30	WS	S	GSFC/Behring	Solar Extreme Ultra-violet	S
4.248 CS	Oct 16	WS	S	Lockheed/Glaser	Solar Studies	S
4.240 US	Nov 21	WS	S	U.Colo/Glaser	Solar Physics	S

1969

4.135 DS	Feb 12	WS	S	NRL/Glaser	Solar Studies	X
4.282 CS	Apr 8	WS	S	AS&E/Glaser	Solar Studies	S
4.233 GS	Apr 14	WS	S	GSFC/Neupert	Solar Studies	S
4.247 DS	Apr 16	WS	S	NRL/Oertel	Solar Studies	S
4.274 DS	Apr 17	WS	S	NRL/Oertel	Solar Studies	S
4.193 US	Sep 11	WS	S	Harvard/Oertel	Solar Studies	S
4.166 DS	Sep 17	WS	S	AFCRL/Oertel	Solar Studies	S
4.170 US	Sep 23	WS	S	Hawaii/Oertel	Solar Studies	S
4.294 US	Sep 24	WS	S	U.Colo/Oertel	Solar Studies	X
4.283 CS	Nov 4	WS	S	AS & E/Oertel	Solar Physics	S
4.136 DS	Nov 4	WS	S	NRL/Oertel	Solar Physics	S
4.167 DS	Dec 17	WS	S	AFCRL/Oertel	Solar Studies	S

Goddard Sounding Rocket Flights---Galactic Astronomy

			1960			
4.04 GG	Apr 27	WI	P	GSFC/Kupperian	Stellar Fluxes	P*
4.05 GG	May 27	WI	S	GSFC/Boggess	Stellar Fluxes	P
4.06 GG	Jun 24	WI	S	GSFC/Boggess	Stellar Fluxes	S
4.11 GG	Nov 22	WI	S	GSFC/Stecher	Stellar Spectra	S
			1961			
4.34 GG	Mar 31	WI	P	GSFC/Boggess	Stellar Fluxes	P
9.01 GG	Sep 18	AUS	S	GSFC/Boggess	Stellar Photometry	S
9.02 GG	Oct 4	AUS	S	GSFC/Boggess	Stellar Photometry	S
9.03 GG	Nov 1	AUS	S	GSFC/Boggess	Stellar Photometry	P
9.04 GG	Nov 20	AUS	S	GSFC/Boggess	Stellar Photometry	S
			1962			
4.35 GG	Feb 7	WI	X	GSFC/Stecher	Stellar Spectra	X
4.36 GG	Sep 22	WI	S	GSFC/Stecher	Stellar Photometry	X
4.69 CG	Sep 30	WI	S	Lockheed/Dubin	Night Sky Mapping	S
4.54 UG	Oct 30	WI	S	U.Wis/Kupperian	Stellar Studies	S
			1963			
4.70 CG	Mar 16	WI	S	Lockheed/Depew	Stellar Spectra	S
4.30 GG	Mar 28	WS	S	GSFC/Boggess	Stellar Spectra	S

*Sounding rocket performance: S = Successful; P = Partially Successful; X = Unsuccessful

+Overall flight results: Same code.

1963

4.37 GG	Jul 19	WI	S	GSFC/Stecher	Stellar Spectra	S
4.29 GG	Jul 23	WI	S	GSFC/Stecher	Stellar Spectra	S
4.31 GG	Oct 10	WS	X	GSFC/Boggess	Stellar Spectra	X

1964

4.15 GG	Apr 3	WS	S	GSFC/Boggess	Stellar Spectra	X
4.81 GG	Apr 10	WS	X	GSFC/Boggess	Stellar Spectra	X
4.82 GG	Aug 11	WS	S	GSFC/Boggess	Stellar Spectra	X
4.126 GG	Aug 22	WS	P	GSFC/Boggess	Stellar Spectra	S
4.122 CG	Aug 29	WS	S	AS&E/Roman	Stellar Studies	S
4.55 UG	Sep 2	WI	S	U.Wis./ Kupperian	Stellar Studies	S
4.120 CG	Oct 2	WS	S	Lockheed/Roman	Stellar X-Ray	S
4.123 CG	Oct 27	WS	S	AS&E/Roman	Stellar Studies	S
4.52 UG	Nov 3	WS	P	Princeton/--	Stellar Spectra	P
4.109 GG	Nov 7	WS	S	GSFC/Stecher	Stellar Spectra	S
4.110 GG	Nov 14	WS	S	GSFC/Stecher	Stellar Spectra	S

1965

4.133 UG	Mar 6	WS	S	Princeton/Kupperian	Stellar Spectra	X
4.56 GG	Mar 13	WS	S	GSFC/Boggess	Stellar Spectra	X

4.57 GG	Mar 19	WS	S	GSFC/Boggess	Stellar Studies	S
4.114 GG	Apr 24	WS	X	GSFC/Boggess	Stellar Studies	X
4.89 GG	May 5	WI	S	GSFC/Boggess	Stellar Studies	X
4.17 UG	Jun 2	WS	S	Princeton/Kupperian	Stellar Spectra	P
4.147 CG	Sep 22	WS	S	AS&E/Roman	Celestial X-Ray	S
4.121 CG	Oct 1	WS	S	Lockheed/Roman	Stellar X-Ray	S
4.151 UG	Oct 13	WS	S	Princeton/Kupperian	Stellar Spectra	S
4.155 GG	Nov 30	WS	S	GSFC/Scolnik	Stellar Spectra	S
				1966		
4.90 GG	Jan 18	WI	S	GSFC/Wright	Stellar Spectra	X
4.50 UG	Feb 2	WS	S	Princeton/Kupperian	Stellar Spectra	S
4.148 CG	Mar 8	WS	S	AS&E/Roman	Stellar X-Ray	S
4.171 UG	May 18	WI	S	U.Wis/Roman	Stellar Studies	P
4.51 UG	May 24	WS	P	Princeton/Kupperian	Stellar Spectra	P
4.159 GG	Jul 16	WS	S	GSFC/Stecher	Stellar Spectra	S
4.144 DG	Jul 19	WS	P	NRL/Roman	Stellar Spectra	X
4.176 UG	Sep 20	WS	S	Princeton/Kupperian	Stellar Spectra	S
4.149 CG	Oct 12	WS	S	AS&E/Roman	X-Ray Astronomy	S
4.154 GG	Nov 21	WS	S	GSFC/Stecher	Stellar Spectra	S
4.182 UG	Dec 13	BRAZ	S	Catholic U./Roman	X-Ray Astronomy	S

1967

4.160 GG	Mar 3	WS	S	GSFC/Stecher	Stellar Spectra	S
4.84 UG	Mar 3	WS	S	Cornell/Roman	Stellar Infrared	S
4.194 DG	Mar 17	WS	S	NRL/Roman	Stellar Spectra	S
4.204 GG	Apr 1	WS	P	GSFC/Stecher	Stellar Spectra	P
4.186 UG	Apr 7	WS	S	Princeton/Kupperian	Stellar Spectra	P
4.157 GG	May 5	WS	S	GSFC/Evans	Stellar Spectra	P
4.203 UG	May 5	WS	S	Princeton/Roman	Stellar Spectra	X
4.210 GG	Jun 2	WS	S	GSFC/Smith	Stellar Spectra	S
4.190 UG	Jul 8	WS	S	MIT/Roman	X-Ray Spectra	S
4.172 UG	Aug 4	WS	S	U.Wis./Roman	Stellar Ultraviolet	S
4.187 CG	Aug 26	WS	S	Lockheed/Roman	Stellar X-Ray	S
4.158 GG	Oct 27	WS	S	GSFC/Evans	Stellar Spectra	P
4.226 UG	Nov 1	WS	S	Princeton/Roman	Stellar Spectra	S
4.229 DG	Nov 4	WS	S	NRL/Roman	Stellar Spectra	P
4.228 CG	Nov 20	WS	S	AS&E/Roman	Stellar X-Ray	X
4.219 GG	Dec 6	WS	S	GSFC/Smith	Stellar Ultraviolet	P

1968

4.205 GG	Jan 26	WS	S	GSFC/Stecher	Stellar Spectra	P
4.261 CG	Feb 2	WS	S	AS&E/Roman	Stellar X-Ray	X
4.220 GG	Feb 2	WS	S	GSFC/Stecher	Stellar Spectra	S
4.177 UG	Mar 1	WS	S	Cornell/Roman	Infrared Radiation	S

4.255 GG	Mar 22	WS	S	GSFC/Smith	Stellar Spectra	S
14.241 IG	Apr 22	IND	S	India-Japan/---	X-Ray Astronomy	X
14.260 IG	Apr 24	IND	S	India-Japan/---	X-Ray Astronomy	X
4.227 UG	May 3	WS	S	Princeton/Roman	Stellar Spectra	S
4.196 UG	May 3	WS	X	Col.Rad.Lab./ Thaddeus	X-Ray Astronomy	X
4.221 GG	May 17	WS	S	GSFC/Kondo	Stellar Spectra	S
4.173 UG	May 25	WS	S	U.Wis./Roman	Stellar Spectra	X
4.236 UG	Jul 27	WS	S	Col.Rad.Lab/Roman	Stellar X-Ray	S
4.225 UG	Jul 27	WS	S	MIT/Roman	Stellar X-Ray	S
4.174 UG	Sep 21	WS	S	U.Wis./Roman	Stellar Spectra	S
4.265 DG	Oct 10	WS	S	NRL/Roman	Stellar Spectra	X
12.13 GT-UG	Oct 26	WS	S	GSFC/Busse	Rocket Test	S
14.261 IG	Nov 7	IND	S	India/--	X-Ray Astronomy	S
4.268 UG	Nov 15	WS	S	Princeton/Roman	Stellar Spectra	S
4.264 CG	Dec 6	WS	S	AS&E/Roman	X-Ray Astronomy	S
4.178 UG	Dec 20	WS	S	Cornell/Roman	Infrared Radiation	S

<u>1969</u>

4.286 UG	Mar 7	WS	S	Col.Rad.Lab./Roman	Stellar Spectra	S
4.290 DG	Mar 14	WS	S	NRL/Roman	Stellar Studies	S
4.251 GG-UG	Mar 14	WS	S	GSFC/Boggess	Stellar Spectra	P

14.403 IG	Apr 26	IND	S	India/--	X-ray Astronomy	S
4.278 UG	Apr 27	WS	S	MIT/Roman	Stellar X-ray	S
14.404 IG	Apr 28	IND	S	India/--	X-ray Astronomy	S
4.269 UG	Jun 20	WS	S	Princeton/Roman	Stellar UV	X
4.183 UG	Jun 22	BRAZ.	S	U.Cal/Roman	Stellar X-Ray	P
18.32 UG	Jul 16	WI	S	U.Wisc/Roman	Stellar X-Ray	X
4.312 UG	Sep 10	WS	S	Cornell/Roman	Stellar Spectra	X
4.279 UG	Oct 3	WS	S	MIT/Roman	Stellar X-Ray	S
18.71 UG	Oct 4	WI	S	CIT/Roman	Stellar X-Ray	S
4.256 GG	Oct 16	WS	S	GSFC/Smith	Stellar Spectra	S
14.353 UG	Dec 5	WS	S	Dudley Obs./Roman	Stellar X-Ray	S
4.175 UG	Dec 5	WS	S	U.Wisc./Roman	Stellar X-Ray	S
4.252 GG-UG	Dec 13	WS	P	GSFC/Boggess	Stellar UV	P

Goddard Sounding Rocket Flights---Radio Astronomy

			1962			
11.02 UR	Sep 22	WI	S	U.Mich/Coates	Radio Astronomy	S*
			1964			
8.33 GR	Oct 23	WI	S	GSFC/Stone	Radio Astronomy	S
			1965			
11.03 UR	Jun 30	WI	S	U.Mich/Roman	Radio Astronomy	S
14.75 GR	Sep 9	WI	S	GSFC/Stone	Radio Propagation	S
			1966			
8.44 GR	May 20	WI	S	GSFC/Stone	Radio Astronomy	S
			1967			
16.03 GR	Aug 30	WI	S	GSFC/Stone	Radio Astronomy	X
			1968			
14.346 GR	Mar 28	WI	S	GSFC/Stone	Radio Astronomy	S
			1969			
16.06 GR	Oct 15	WI	S	GSFC/Weber	Radio Astronomy	S

*Sounding rocket performance: S = Successful; P = Partially Successful; X = Unsuccessful

+Overall flight results: Same code.

Goddard Sounding Rocket Flights---Biology

1961						
11.04 GB	Nov 15	PMR	S	GSFC/Campbell	BIOS I	X*
11.05 GB	Nov 18	PMR	P	GSFC/Campbell	BIOS I	X
1965						
4.150 GA-GI-GB	Sep 28	WS	S	GSFC/Berg	Micrometeroid, Ionospheres, Microorganisms	S
1967						
4.213 NB	Dec 5	WI	S	Wallops/Belleville	Gravity Preference	S
1968						
4.214 NB	Jun 24	WI	S	Wallops/Belleville	Gravity Preference	S
4.215 NB	Nov 21	WI	S	Wallops/Belleville	Gravity Preference	S

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*Sounding rocket performance: S = Successful; P = Partially Successful; X = Unsuccessful

+Overall flight results: Same code.

GODDARD SOUNDING ROCKET FLIGHTS---Special Projects

1960

1.03 GP	Sep 15	FC	S	GSFC/Baumann	AMPP	S*
1.05 GP	Sep 24	FC	S	GSFC/Baumann	AMPP	P
4.43 GP	Oct 5	FC	S	NRL/Baumann	AMPP	S

1961

4.38 NP	Feb 5	WI	S	LeRC/Gold	Hydrogen Zero-g	P
4.39 NP	Apr 21	WI	S	LeRC/Gold	Hydrogen Zero-g	S
1.04 GP	May 17	FC	S	GSFC/Baumann	AMPP	P
1.06 GP	May 19	FC	S	GSFC/Baumann	AMPP	S
4.42 NP	Aug 12	WI	S	LeRC/Plohr	Hydrogen Zero-g	P
4.40 NP	Oct 18	WI	S	LeRC/Regetz	Hydrogen Zero-g	S

1962

4.41 NP	Feb 17	WI	S	LeRC/Dillon	Hydrogen Zero-g	S
4.46 NP	May 8	WS	S	JPL/Brown	Radar	X
4.26 NP	Jun 20	WI	S	LeRC/Flagge	Hydrogen Zero-g	P
4.71 UP	Jun 29	WI	S	JHU/Depew	Airglow	S
4.72 UP	Jun 29	WI	S	JHU/Depew	Aigrlow	S

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*Sounding rocket performance: S = Successful; P = Partially Successful; X = Unsuccessful

+Overall Flight results: Same code

4.47 NP	Jul 10	WS	S	JPL/Brown	Radar	X
4.27 NP	Nov 18	WI	S	LeRC/Corpas	Hydrogen Zero-g	S
				1963		
4.66 NP	May 14	WS	S	LeRC/Kinard	Paraglider	X
4.28 NP	Jun 19	WI	S	LeRC/Corpas	Hydrogen Zero-g	P
4.32 NP	Sep 11	WI	S	LeRC/Corpas	Hydrogen Zero-g	S
				1964		
4.67 NP	Jun 10	WS	S	LeRC/Kinard	Paraglider	S
4.13 GP-GT	Sep 26	WI	S	GSFC/Busse	Rocket Test/Other	S
				1965		
4.105 NP	Jun 30	WS	S	JPL/Gaugler	High Altitude Radar	X
				1966		
4.106 NP	May 9	WS	S	JPL/Gaugler	High Altitude Radar	S
				1967		
15.13 UP	Jun 21	WI	X	Dudley Obs/Dubin	Chaff	X

Goddard Sounding Rocket Flights---Tests and Support

1959

2.01 GT	May 14	WI	X*	GSFC/Medrow	Rocket Test	S*
2.02 GT	May 15	WI	X	GSFC/Medrow	Rocket Test	S
2.03 GT	May 15	WI	X	GSFC/Medrow	Rocket Test	X
2.04 GT	Aug 7	WI	X	GSFC/Medrow	Rocket Test	X
2.05 GT	Aug 7	WI	X	GSFC/Medrow	Rocket Test	X
2.06 GT	Aug 7	WI	X	GSFC/Medrow	Rocket Test	S
8.01 GT	Dec 22	WI	S	GSFC/NRL/DRTE	X248 Vib. Test	S

1960

8.02 GT	Jan 26	WI	S	GSFC/NRL/DRTE	X248 Vib. Test	S
4.01 GT	Feb 16	WI	X	GSFC/Medrow	Rocket Test	X
4.12 GT	Mar 25	WI	S	GSFC/Medrow	Rocket Test	S
4.10 GT	Apr 23	WI	S	GSFC/Medrow	Rocket Test	S
5.01 GT	Jul 22	WI	S	GSFC/Sorgnit	Rocket Test	S
3.28 GT	Aug 9	WI	S	GSFC/Sorgnit	Rocket Test	S
5.02 GT	Oct 18	WI	S	GSFC/Sorgnit	Rocket Test	S
3.29 GT	Nov 3	WI	S	GSFC/Sorgnit	Rocket Test	S

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*Sounding rocket performance: S = Successful; P = Partially Successful; X = Unsuccessful

+Overall flight results: Same code.

1961

3.36 GT	Jan 17	WI	S	GSFC/Sorgnit	Rocket Test	S
5.03 GT	Jan 19	WI	X	GSFC/Sorgnit	Rocket Test	P
10.49 GT	Mar 15	WI	S	GSFC/Sorgnit	Cajun Fin Test	S
4.19 GT	Apr 14	WI	S	GSFC/Russell	Attitude Control	P
12.01 GT	May 2	WI	S	U.Mich./Spencer	Cone Test	S
14.01 GT	May 25	WI	S	GSFC/Sorgnit	Rocket Test	S
4.20 GT	Jun 26	WI	S	GSFC/Russell	Attitude Control	P
14.02 GT	Aug 16	WI	S	GSFC/Sorgnit	Rocket Test	S

1962

4.68 GT	Jan 13	WI	S	GSFC/Russell	Attitude Control	S
10.69 GT	Mar 1	WI	X	GSFC/Donn	Water Test	S
10.70 GT	Mar 2	WI	S	GSFC/Donn	Water Test	S
4.48 GT	May 25	WI	S	GSFC/Pressly	Sea Recovery	S
4.60 GT	Aug 8	WI	P	GSFC/Russell	Attitude Control	P
Ferdinand II*	Dec 14	NOR	S	Norway/--	NASA-Telemetry only	S

1963

16.01 GT	Apr 8	WI	X	GSFC/Sorgnit	Flight Test	X
4.87 GT	Jun 17	WS	S	GSFC/Russell	Attitude Control	S

*Nike Cajun

14.111 GT	Oct 31	WI	S	GSFC/Williams	Vibration Test	S

1964

4.88 GT	Jan 28	WS	S	GSFC/Russell	Attitude Control	S
14.28 GT	Feb 12	WI	S	GSFC/Sorgnit	Rocket Fin Test	S
12.03 GT-GI	Apr 15	WI	S	GSFC/Guidotti	Rocket Test-Ionospheres	S
4.13 GP-GT	Sep 26	WI	S	GSFC/Busse	Rocket Test/Other	S
16.02 GT	Oct 21	WI	S	GSFC/Sorgnit	Rocket Test	S
12.02 GT	Dec 11	WI	S	GSFC/Lane	Rocket Test	S

1965

17.01 GT	Jun 18	WI	S	GSFC/Lane	Rocket Test	S

1966

17.02 GT	Aug 17	WI	S	GSFC/Lane	Rocket Test	S
12.06 GT	Sep 20	WS	S	GSFC/Busse	Booster Test	S

1967

15.55 GT	Apr 20	WI	P	GSFC/Hudgins	Tone Ranging Test	S
14.343 GT-UA	Aug 5	WS	S	GSFC/Wood	Recovery System Test	X
12.07 GT	Sep 12	WS	P	GSFC/Busse	Aerobee Rail Launch Test	P
12.09 GT	Oct 3	WI	X	GSFC/Wood	Arcas Booster Test	S
4.201 NT	Dec 10	WS	S	Ames/Holtz	SPARCS Test	P

1968

12.08 GT	Feb 5	WI	S	GSFC/Sorgnit	Rocket Test	S
4.202 NT	Mar 19	WS	S	Ames/Holtz	SPARCS Test	S
12.10 GT	Apr 17	WI	S	GSFC/Wood	Rocket Test	S
14.363 GT	Jun 4	WS	S	GSFC/Wood	Recovery System Test	S
12.16 GT	Sep 20	WI	P	GSFC/Pedolsky	Launch Tube Test	S
12.13 GT-UG	Oct 26	WS	S	GSFC/Busse	Rocket Test	S

1969

12.04 GT	Feb 28	WI	S	GSFC/Rudmann	Black Brant III Test	S
12.15 GT	May 1	WI	S	GSFC/Rudmann	Black Brant III Test	S

Goddard Sounding Rocket Flights - Meteorology

1965

14.71 CM	Jun 23	WI	S	GCA/Smith	Luminescent Cloud	S
14.72 CM	Jun 23	WI	S	GCA/Smith	Luminescent Cloud	S
14.73 CM	Jun 23	WI	S	GCA/Smith	Luminescent Cloud	S
14.74 CM	Jun 23	WI	S	GCA/Smith	Luminescent Cloud	S
10.128 GM	Jul 23	WI	S	GSFC/Smith	Grenade	S
10.151 GM	Aug 7	PB	S	GSFC/Smith	Grenade	S
10.96 GM	Aug 7	FC	S	GSFC/Smith	Grenade	S
10.162 GM	Aug 7	PB	S	GSFC/Smith	Grenade	s
10.165 GM	Aug 7	FC	S	GSFC/Smith	Grenade	S
10.168 GM	Aug 7	WI	S	GSFC/Smith	Grenade	S
10.169 GM	Aug 8	WI	S	GSFC/Smith	Grenade	S
10.166 GM	Aug 8	FC	S	GSFC/Smith	Grenade	S
10.163 GM	Aug 8	PB	S	GSFC/Smith	Grenade	S
10.167 GM	Aug 8	FC	S	GSFC/Smith	Grenade	S
10.170 GM	Aug 8	WI	S	GSFC/Smith	Grenade	S
10.164 FM	Aug 9	PB	S	GSFC/Smith	Grenade	S
10.152 GM	Oct 13	PB	S	GSFC/Smith	Grenade	S
10.97 GM	Oct 13	FC	S	GSFC/Smith	Grenade	S
10.129 GM	Oct 13	WI	S	GSFC/Smith	Grenade	S

*Sounding rocket performance: S = Successful; P = Partially Successful; X = Unsuccessful

+Overall flight results: Same code.

10.177 GM	Oct 19	PB	S	GSFC/Smith	Grenade	S
10.98 GM	Oct 19	FC	S	GSFC/Smith	Grenade	S
10.174 GM	Oct 19	WI	S	GSFC/Smith	Grenade	S
10.178 GM	Oct 23	PB	S	GSFC/Smith	Grenade	S
10.175 GM	Oct 23	WI	S	GSFC/Smith	Grenade	S
10.172 GM	Oct 23	FC	S	GSFC/Smith	Grenade	S
10.176 GM	Oct 27	WI	S	GSFC/Smith	Grenade	S
10.179 GM	Oct 27	PB	S	GSFC/Smith	Grenade	S
10.173 GM	Oct 27	FC	S	GSFC/Smith	Grenade	S
14.168 UM	Nov 9	FC	S	U.Mich./Smith	Atm. Structure	S
14.169 UM	Nov 10	FC	X	U.Mich./Smith	Atm. Structure	X

1966

14.262 CM	Jan 17	WI	S	GCA/Smith	Sodium Vapor	S
14.263 CM	Jan 18	WI	S	GCA/Smith	Luminescent Cloud	S
14.264 CM	Jan 18	WI	S	GCA/Smith	Luminescent Cloud	S
14.265 CM	Jan 18	WI	S	GCA/Smith	Luminescent Cloud	S
14.266 CM	Jan 18	WI	S	GCA/Smith	Sodium Vapor	S
10.185 GM	Jan 24	FC	S	GSFC/Smith	Grenade	S
10.182 GM	Feb 1	PB	S	GSFC/Smith	Grenade	P
10.147 GM	Feb 1	WI	S	GSFC/Smith	Grenade	S
10.186 GM	Feb 2	FC	S	GSFC/Smith	Grenade	S
10.187 GM	Feb 10	FC	S	GSFC/Smith	Grenade	S

10.148 GM	Feb 10	WI	S	GSFC/Smith	Grenade	S
10.183 GM	Feb 10	PB	S	GSFC/Smith	Grenade	S
10.145 GM	Feb 10	FC	S	GSFC/Smith	Grenade	S
10.149 GM	Feb 10	WI	S	GSFC/Smith	Grenade	S
10.184 GM	Feb 10	PB	S	GSFC/Smith	Grenade	S
14.251 UM	Feb 27	ASC	S	U.Mich./Smith	Atm. Structure	S
14.252 UM	Feb 28	ASC	X	U.Mich./Smith	Atm. Structure	X
10.180 IM	Mar 24	PAK	S	G.Britain-Pakistan/	Grenade	S
14.165 IM	Mar 27	PAK	S	G.Britain-Pakistan/	Grenade	S
14.249 IM	Apr 26	PAK	S	G.Britain-Pakistan/	Grenade-Chemical Release	P
10.190 GM	May 1	PB	S	GSFC/Smith	Grenade	S
10.188 GM	May 2	WI	S	GSFC/Smith	Grenade	S
10.194 GM	May 2	BRAZ	S	GSFC/Smith	Grenade	S
10.192 GM	May 2	FC	S	GSFC/Smith	Grenade	S
10.191 GM	May 3	PB	S	GSFC/Smith	Grenade	S
10.193 GM	May 4	FC	S	GSFC/Smith	Grenade	S
10.189 GM	May 4	WI	S	GSFC/Smith	Grenade	S
10.195 GM	May 4	BRAZ	S	GSFC/Smith	Grenade	S
10.198 GM	Jun 17	FC	S	GSFC/Smith	Grenade	S
10.196 GM	Jun 17	PB	S	GSFC/Smith	Grenade	S
10.199 GM	Jun 23	FC	S	GSFC/Smith	Grenade	S
10.197 GM	Jun 23	PB	S	GSFC/Smith	Grenade	S
14.291 CM	Jul 17	WI	S	GCA/Smith	Luminescent Cloud	S

14.292	CM	Jul 17	WI	S	GCA/Smith	Luminescent Cloud	S
14.293	CM	Jul 17	WI	S	GCA/Smith	Luminescent Cloud	S
14.294	CM	Jul 17	WI	S	GCA/Smith	Luminescent Cloud	S
14.295	CM	Jul 17	WI	S	GCA/Smith	Luminescent Cloud	S
14.296	GM	Aug 7	WI	P	GSFC/Smith	Grenade	S
10.204	GM	Aug 7	BRAZ	S	GSFC/Smith	Grenade	S
10.202	GM	Aug 7	FC	S	GSFC/Smith	Grenade	S
14.289	UM	Aug 7	FC	S	U.Mich./Smith	Atm. Structure	S
10.203	GM	Aug 7	FC	S	GSFC/Smith	Grenade	S
10.206	GM	Aug 7	WI	S	GSFC/Smith	Grenade	S
10.205	GM	Aug 7	BRAZ	S	GSFC/Smith	Grenade	S
10.200	GM	Aug 14	PB	S	GSFC/Smith	Grenade	S
10.201	GM	Aug 15	PB	S	GSFC/Smith	Grenade	S
14.285	UM	Aug 26	WI	S	U.Mich./Smith	Atm. Structure	S
14.286	UM	Aug 28	WI	S	U.Mich./Smith	Atm. Structure	S
4.156	GM	Aug 29	WS	S	GSFC/Heath	Airglow; Electron Temperature and Density	S
10.146	GM	Sep 30	WI	S	GSFC/Smith	Grenade	S
14.217	GM	Sep 30	WI	S	GSFC/Smith	Grenade	S
10.209	GM	Oct 1	WI	S	GSFC/Smith	Grenade	S
10.211	GM	Oct 1	BRAZ	S	GSFC/Smith	Grenade	S
10.210	GM	Oct 1	WI	S	GSFC/Smith	Grenade	S
10.212	GM	Oct 1	BRAZ	S	GSFC/Smith	Grenade	S

10.213	GM	Oct	2	BRAZ	S	GSFC/Smith	Grenade	S
10.214	GM	Oct	2	BRAZ	S	GSFC/Smith	Grenade	S
10.215	GM	Oct	2	BRAZ	S	GSFC/Smith	Grenade	S
10.160	GM	Dec	9	WS	S	GSFC/Hilsenrath	Ozone	P

1967

10.207	GM	Jan	31	WI	S	GSFC/Smith	Grenade	S
14.319	UM	Jan	31	FC	S	U.Mich/Smith	Atm. Structure	S
14.310	CM	Jan	31	FC	S	GCA/Smith	Luminescent Cloud	S
10.216	GM	Jan	31	PB	S	GSFC/Smith	Grenade	S
14.315	UM	Feb	1	FC	X	U.Mich./Smith	Atm. Structure	X
14.311	CM	Feb	1	FC	S	GCA/Smith	Luminescent Cloud	S
10.217	GM	Feb	1	PB	S	GSFC/Smith	Grenade	S
14.317	UM	Feb	1	FC	S	U.Mich./Smith	Atm. Structure	S
14.312	CM	Feb	1	FC	S	GCA/Smith	Luminescent Cloud	S
10.218	GM	Feb	1	PB	S	GSFC/Smith	Grenade	S
14.318	UM	Feb	1	FC	S	U.Mich./Smith	Atm. Structure	S
14.313	CM	Feb	1	FC	S	GCA/Smith	Luminescent Cloud	S
10.219	GM	Feb	1	PB	S	GSFC/Smith	Grenade	S
14.316	UM	Feb	1	FC	S	U.Mich./Smith	Atm. Structure	S
14.323	CM	Feb	1	FC	S	GCA/Smith	Luminescent Cloud	S
10.220	GM	Feb	1	PB	S	GSFC/Smith	Grenade	S
14.314	CM	Feb	1	FC	S	GCA/Smith	Luminescent Cloud	
14.322	UM	Feb	1	FC	S	U.Mich./Smith	Arm. Structure	S

10.221 GM	Feb 1	PB	S	GSFC/Smith	Grenade	S
10.222 GM	Feb 3	WI	S	GSFC/Smith	Grenade	S
10.208 GM	Mar 31	WI	S	GSFC/Smith	Grenade	S
10.226 GM	Apr 4	PB	S	GSFC/Smith	Grenade	S
10.227 GM	Apr 10	PB	S	GSFC/Smith	Grenade	S
10.223 GM	Apr 11	WI	S	GSFC/Smith	Grenade	S
10.228 GM	Apr 18	PB	S	GSFC/Smith	Grenade	S
10.224 GM	Apr 20	WI	S	GSFC/Smith	Grenade	P
10.225 GM	Apr 29	WI	S	GSFC/Smith	Grenade	S
10.229 GM	Apr 30	PB	S	GSFC/Smith	Grenade	S
10.232 GM	May 4	WI	S	GSFC/Smith	Grenade	S
10.230 GM	May 9	PB	S	GSFC/Smith	Grenade	S
10.233 GM	May 11	WI	S	GSFC/Smith	Grenade	S
10.161 GM	May 11	WI	S	GSFC/Hilsenrath	Ozone	X
10.231 GM	May 15	PB	S	GSFC/Smith	Grenade	S
10.238 GM	Jun 24	BRAZ	S	GSFC/Smith	Grenade	S
10.237 GM	Jun 24	BRAZ	S	GSFC/Smith	Grenade	S
10.239 GM	Jun 25	BRAZ	S	GSFC/Smith	Grenade	S
14.337 CM	Jul 23	WI	S	GCA/Smith	Luminescent Cloud	S
14.97 UM	Aug 3	PB	S	U.Mich./Smith	Atm. Structure	S
14.290 UM	Aug 5	PB	S	U.Mich./Smith	Atm. Structure	S
14.338 CM	Aug 9	WI	S	GCA/Smith	Luminescent Cloud	S

14.339 CM	Aug 9	WI	S	GCA/Smith	Luminescent Cloud	S
14.340 CM	Aug 9	WI	S	GCA/Smith	Luminescent Cloud	S
14.342 CM	Aug 9	WI	S	GCA/Smith	Luminescent Cloud	S
14.341 CM	Aug 9	WI	S	GCA/Smith	Luminescent Cloud	S
10.240 GM	Aug 21	BRAZ	X	GSFC/Smith	Grenade	X
10.241 GM	Aug 26	BRAZ	S	GSFC/Smith	Grenade	S
10.242 GM	Aug 26	BRAZ	S	GSFC/Smith	Grenade	S
10.243 GM	Aug 28	BRAZ	S	GSFC/Smith	Grenade	S
14.334 UM	Sep 18	WI	X	U.Mich./Smith	Atm. Structure	X
10.248 GM	Oct 14	BRAZ	S	GSFC/Smith	Grenade	S
10.244 GM	Oct 15	BRAZ	S	GSFC/Smith	Grenade	S
10.245 GM	Oct 15	BRAZ	S	GSFC/Smith	Grenade	S
14.250 IM	Nov 29	PAK	S	Great Britain-Pakistan/--	Grenade Luminescent Cloud	S
10.249 GM	Dec 12	WI	S	GSFC/Smith	Grenade	S
10.246 GM	Dec 18	BRAZ	S	GSFC/Smith	Grenade	S
10.247 GM	Dec 19	BRAZ	S	GSFC/Smith	Grenade	S
10.250 GM	Dec 19	BRAZ	S	GSFC/Smith	Grenade	S
				1968		
18.62 GM	Jan 22	WI	S	GSFC/Heath	Airglow	P
10.264 GM	Feb 1	WI	S	GSFC/Smith	Grenade	S
10.259 GM	Feb 1	FC	S	GSFC/Smith	Grenade	S

10.255 GM	Feb 1	PB	X	GSFC/Smith	Grenade	X
10.260 GM	Feb 1	FC	S	GSFC/Smith	Grenade	S
10.261 GM	Feb 1	FC	S	GSFC/Smith	Grenade	P
10.262 GM	Feb 1	FC	S	GSFC/Smith	Grenade	S
10.263 GM	Feb 5	FC	S	GSFC/Smith	Grenade	S
10.234 GM	Feb 7	WS	S	GSFC/Rast	Ozone Parachute System Test	S
14.364 CM	Feb 22	WI	S	GCA/Smith	Luminescent Cloud	S
14.365 CM	Feb 22	WI	S	GCA/Smith	Luminescent Cloud	S
14.366 CM	Feb 22	WI	S	GCA/Smith	Luminescent Cloud	S
14.367 CM	Feb 22	WI	S	GCA/Smith	Luminescent Cloud	S
14.344 UM	Mar 17	PR	S	U.Mich./Smith	Atm. Structure	S
14.345 UM	Mar 17	PR	S	U.Mich./Smith	Atm. Structure	S
14.333 UM	Mar 18	PR	S	U.Mich./Smith	Atm. Structure	S
10.270 GM	Mar 24	BRAZ	S	GSFC/Smith	Grenade	S
10.271 GM	Mar 25	BRAZ	S	GSFC/Smith	Grenade	S
10.272 GM	Mar 25	BRAZ	S	GSFC/Smith	Grenade	S
12.11 GM	Apr 8	WI	X	GSFC/Smith	Rocket Test	X
14.356 UM	Apr 23	FC	X	U.Mich./Smith	Atm. Structure	X
10.258 GM	Jul 24	WI	S	GSFC/Smith	Grenade	S
10.265 GM	Jul 24	WI	S	GSFC/Smith	Grenade	S
10.266 GM	Jul 24	WI	S	GSFC/Smith	Grenade	S
14.187 UM	Aug 8	WI	S	U.Mich./Smith	Atm. Structure	P
14.357 UM	Aug 9	WI	S	U.Mich./Smith	Atm. Structure	S

10.281 GM	Sep 27	FC	S	GSFC/Smith	Grenade	S
10.287 GM	Oct 15	PB	S	GSFC/Smith	Grenade	S
10.288 GM	Oct 15	PB	S	GSFC/Smith	Grenade	S
10.251 GM	Oct 16	WI	S	GSFC/Smith	Grenade	S
10.252 GM	Oct 16	FC	S	GSFC/Smith	Grenade	S
10.293 GM	Nov 19	WI	S	GSFC/Smith	Grenade	S
14.386 UM	Nov 19	WI	S	U.Mich./Smith	Atm. Structure	S
10.283 GM	Nov 20	FC	S	GSFC/Smith	Grenade	S
10.284 GM	Nov 20	FC	S	GSFC/Smith	Grenade	S
10.289 GM	Nov 22	PB	S	GSFC/Smith	Grenade	S
10.290 GM	Nov 22	PB	S	GSFC/Smith	Grenade	S
10.294 GM	Dec 12	WI	S	GSFC/Smith	Grenade	S
10.295 GM	Dec 12	WI	S	GSFC/Smith	Grenade	S
10.285 GM	Dec 13	FC	S	GSFC/Smith	Grenade	S
10.291 GM	Dec 13	PB	S	GSFC/Smith	Grenade	S
10.286 GM	Dec 13	FC	S	GSFC/Smith	Grenade	S
10.292 GM	Dec 13	PB	S	GSFC/Smith	Grenade	S
				1969		
15.61 DM	Jan 31	WI	S	NOTS/Smith	Ozone	S
14.396 GM	Jan 31	WI	S	GSFC/Heath	Atm. Composition	S
10.268 GM	Jan 31	WI	X	GSFC/Smith	Grenade	X

10.300 GM	Feb 4	PB	S	GSFC/Smith	Grenade	S
10.304 GM	Feb 6	FC	S	GSFC/Smith	Grenade	S
15.62 DM	Feb 6	WI	S	NOTS/W. Smith	Ozone	S
10.267 GM	Feb 6	WI	S	GSFC/Smith	Grenade	S
14.397 CM	Feb 14	WI	S	GCA/Smith	Luminescent Cloud	S
14.399 CM	Feb 14	WI	S	GCA/Smith	Luminescent Cloud	S
14.400 CM	Feb 14	WI	S	GCA/Smith	Luminescent Cloud	S
14.401 CM	Feb 14	WI	S	GCA/Smith	Luminescent Cloud	S
14.398 CM	Feb 14	WI	S	GCA/Smith	Luminescent Cloud	S
14.402 CM	Feb 14	WI	S	GCA/Smith	Luminescent Cloud	S
10.309 GM	Mar 28	SP	S	GSFC/Smith	Grenade	S
10.296 GM	Mar 28	WI	S	GSFC/Smith	Grenade	S
10.310 GM	Mar 29	SP	S	GSFC/Smith	Grenade	S
10.308 GM	Mar 29	WI	S	GSFC/Smith	Grenade	S
14.431 UM	Aug 21	WI	S	U.Mich/Smith	Atm. Structure	S
14.445 CM	Dec 13	WI	S	GCA/Smith	Luminescent Cloud	S
14.446 CM	Dec 14	WI	S	GCA/Smith	Luminescent Cloud	S

GODDARD SOUNDING ROCKET PROJECTS
SUMMARY TABLE

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	11-year Total	% Success
Aerobee 100		4	8	2							0	14	92
Aerobee 150	4	1		3	12	22	23	24	31	35	33	188	96
Aerobee 150A		10	8	17	18	4	6	5	4	2	1	75	91
Aerobee 170											1	1	0
Aerobee 300/300A		3	2	1	2	2	1				0	11	100
Aerobee 350							1	1			1	3	100
Arcas							13	9	16	6	8	52	94
Arcon	6										0	6	0
Astrobee 1500					1	1			2	1	1	6	83
Black Brant IV										2	1	3	100
Iris		2	1	1							0	4	75
Javelin	1	5	8	2	2	7	7	6	9	4	1	52	94
Journeyman		1	2	1	1		2				0	7	100
Nike-Apache			5	11	36	76	92	57	48	50	35	410	95
Nike-Asp	5	10	8	3	1						0	27	63
Nike-Cajun		24	23	37	20	38	43	43	35	38	28	329	97
Nike-Tomahawk							3	12	15	30	13	73	97
Skylark			4								0	4	100
Special			1			2		1	2	6	3	15	87
Totals	16	60	70	78	93	152	191	158	162	174	126	1280	94

III. BRIEF DESCRIPTIONS OF CURRENT GODDARD SOUNDING ROCKETS

Sounding Rocket	Stages	Propellants	Thrust (lb)	Overall Length (ft)	Nominal* Payload Altitude (lb/miles)	Remarks
Aerobee 150/150A	1. Booster 2. Sustainer	Solid IRFNA/Aniline Furfuryl Alcohol	18,600 41,000	31	150/170	The 150A has four fins rather than three.
Aerobee 300/300A	1. Booster 2. Sustainer 3. Sparrow	Solid Same as 150 Solid	18,600 4,100 52	32	50/300	Also called a Spaerobee. The 300 is a 150 with a Sparrow third stage.
Aerobee 350	1. Nike 2. Sustainer (cluster 4-150s	Solid Same as 150	48,000 16,400	52	500/210	Developed by GSFC specifically for scientific payloads
Arcas	1. Booster	Solid	336	8	12/40	Primarily a meteorological rocket. Booster versions exist. Later Arcas rockets have two stages.
Astrobee 1500	1. Aerobee 100 plus two Recruits 2. Alcor	Liquid plus solid Solid	57,000 plus 8,000	34	75/1500	
Black Brant IV	1. 15KS-25,000 2. 9KS-11,000	Solid Solid	25,000 11,000	37	85/575	A Canadian-built rocket
Javelin (Argo D-4)	1. Honest John 2. Nike 3. Nike 4. X-248	Solid Solid Solid Solid	82,000 48,700 48,700 3,150	49	100/600	
Nike-Apache	1. Nike 2. Apache	Solid Solid	48,700 4,750	28	5/130	Very similar to Nike-Cajun
Nike-Cajun	1. Nike 2. Cajun	Solid Solid	48,700 7,850	28	75/100	
Nike-Tomahawk	1. Nike 2. Tomahawk	Solid Solid	48,700 11,000	30	125/200	More powerful version of Nike-Apache.

*Payload can be sacrificed for altitude and vice versa.

ORIGINAL PAGE IS OF POOR QUALITY

IV. BRIEF DESCRIPTIONS OF CURRENT GODDARD LAUNCH VEHICLES

Launch Vehicle	Stages and Engines	Propellants	Thrust (1000 lbs)	Maximum Diameter (ft)	Length (less payload) (ft)	Payload in 300 NM orbit	Remarks
	1. Algol II-B	Solid	100.9	3.3	29.8)		Used for small Explorer-
	2. Castor II	Solid	60.7	2.6	20.3) 64.4	300	class satellites.
Scout	3. Antares X-259	Solid	20.9	2.5	9.5)		
	4. Altair X-258	Solid	5.7	1.7	4.8)		
	4a. FW-4S	Solid	5.9			320	
	1. Thor (DM-21)	LOX/RP-1	172.	8.	59.6)		Used for medium-sized
Delta	2. AJ-10-118A	IRFNA/UDMH	7.5	4.56	16.4) 81.0	880	Explorers and some OSOs.
	3. Altair X-248	Solid	5.8	1.50	5.0)		Also in Tiros, Relay, and
							Syncom series.
TAD	1. Thor (DM-21) plus	LOX/RP-1 plus	170 plus	8.			Medium-sized Explorers.
(Thrust-	three XM-33s	Solids	162	33 in. each	90	1,300	The XM-33 solids are strap-ons.
Augmented	2. AJ-10-118A	IRFNA/UDMH	7.8	4.56			
Delta)	3. FW-4D	Solid	5.9	1.50			
TAID	1. Thor (MB3-3) plus	LOX/RJ-1 plus	172 plus	8.			Medium-sized Explorers,
(Thrust-	three TX-33-52s	Solids	162	33 in. each			ESSAs, Intelsats.
Augmented	2. AJ-10-118E	IRFNA/UDMH	7.8	4.56		1,190	
Improved	3. FW-4	Solid	5.7	1.6			
Delta							
Thor-Agena	1. Thor (DM-21)	LOX/RP-1	170			1,600 (ETR)	Used for the Alouettes,
	2. Agena	IRFNA/UDMH	16	8.	76	1,300 (WTR)	Echo and Nimbus series
TAT-Agena	1. Thor (DM-21) plus	LOX/RP-1 plus	170 plus	8.			Used for some OGOs.
	three XM-33s	Solids	162				
	2. Agena	IRFNA/UDMH	160	33 in. each	95.3	2,200 (ETR)	
			16	5		1,800 (WTR)	
Atlas-	1. Atlas (booster)	LOX/RP-1	388 plus				Launched ATS series, some
Agena	Atlas (sustainer)	LOX/RP-1	80	10	104	6,000	OGOs and OAO I.
	2. Agena	IRFNA/UDMH	16				
Atlas-	1. Atlas (booster)	LOX/RP-1 plus	388 plus				OAO II.
Centaur	Atlas (sustainer)	LOX/RP-1	80	10	117	9,900	
	2. Centaur	LOX/LH_2	30				

*Data from NASA Pocket Statistics except for TAID, which came from Aviation Week.

V. GODDARD TRACKING AND DATA ACQUISITION STATIONS

The two tables that follow summarize the two major NASA networks operated by Goddard Space Flight Center: STADAN (the Space Tracking and Data Acquisition Network) and the MSFN (the Manned Space Flight Network). The equipment installed at the sites listed varies with time and mission. On a longer time scale, stations themselves are phased out or introduced as NASA's requirements change.

Not shown in these tabulations are the millions of miles of communication links that tie the STADAN and MSFN stations (and, in addition, those of the DSN [the Deep Space Network]) to Goddard, to each other, and to NASA's various mission control centers. Collectively, these communication links and the associated switching centers are called NASCOM.

STADAN: THE SPACE TRACKING AND DATA ACQUISITION NETWORK

Station	Code	Telemetry			Command		Tracking			Remarks
		85-ft Dish	40-ft Dish	SATAN Rec.	SATAN Comm.	Yagis	Mini-track	MOTS	GR-ARR	
Barstow, Calif.	MOJAVE		1	2	1		1	1		Minitrack and MOTS not operational
Carnarvon, Aust.	CARVON					1			1	
Cooby Creek, Aust.	TOOMBA		1	1	1					
Darwin, Aust.	DARWIN					1				Mobile station, 14-ft. dish.
Fairbanks, Alaska	ALASKA	2	1	2	2		1	1	1	ESSA 85-ft dish included.
Fort Myers, Fla.	FTMYRS			1	1	3	1	1		
Johannesburg, R.S.A.	JOBURG		1	1	1	1	1	1		
Kauai, Hawaii	KAUAIH					1				Yagi telemetry antennas.
Lima, Peru	LIMAPU					1	1	1		Yagi telemetry antennas.
Orroral, Aust.	ORORAL	1		2		3	1	1		
Quito, Ecuador	QUITOE		1	1	1	3	1	1		
Rosman, N. C.	ROSMAN	2		3	3			1	1	
Saint Johns, Nfld.	NEWFLD					3	1	1		Yagi telemetry antennas.
Santiago, Chile	SNTAGO		1	2	1	1	1	1	1	
Tananarive, Mag. Rep.	MADGAR		1	2	2		1	1	1	
Winkfield, England	WNKFLD			1	1	1	1	1		14-ft dish.

SATAN = Satellite Automatic Tracking Antenna
MOTS = Minitrack Optical Tracking System
GRARR = Goddard Range and Range Rate System

MSFN: THE MANNED SPACE FLIGHT NETWORK

Station	NASA Code	12-ft Dish	30-ft Dish	85-ft Dish	C-Band Radar	Remarks
Ascension I.	ACN		1		1	DOD radar.
Antigua I.	ANG		1		1	DOD radar.
Bermuda	BDA		1		1	
Cape Kennedy, Fla.	CNV					
Carnarvon, Aust.	CRO		1		1	
Canary I.	CYI		1		1	
Corpus Christi, Tex.	TEX		1			
Goldstone, Calif.	GDS			1		DSN backup dish.
Grand Bahama I.	GBM		1		1	DOD radar.
Guam	GWM		1			
Guaymas, Mex.	GYM		1			
Honeysuckle Creek, Aust.	HSK			1		DSN backup 85-ft dish.
Kauai, Hawaii	HAW		1		1	
Madrid, Spain	MAD			1	1	DSN backup 85-ft dish.
Merritt I., Fla.	MIL		1		1	DOD radar.
Patrick AFB, Fla.	PAT				1	
Pretoria, R. S. A.	PRE				1	
S. Vandenberg, Calif.	CAL				1	
Tananarive, Malagasy Rep.	TAN				1	Site of STADAN Station.
White Sands, N. Mex.	WSMR					
USNS Huntsville	HTV	1			1	
USNS Mercury	MER		1		1	
USNS Range Tracker	RTK				1	
USNS Redstone	RED		1		1	
USNS Vanguard	VAN		1		1	
USNS Watertown	WTN	1			1	
Goddard Space Flight Center	NTFF					
Apollo Aircraft (ARIA)	----					

SATELLITE NAME INDEX

SATELLITE NAME INDEX
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SATELLITE NAME INDEX
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