DATA CATALOG SERIES FOR SPACE SCIENCE AND APPLICATIONS FLIGHT MISSIONS

Volume 3A

Descriptions of Low- and Medium-Altitude Scientific Spacecraft and Investigations
Categories of Spacecraft Used in This Series

PLANETARY AND HELIOCENTRIC

This category includes probes to the various planets of the solar system and probes designed to make measurements of the characteristics of interplanetary space. Included are also the probes which will pass out of the solar system into interstellar space.

METEOROLOGY AND TERRESTRIAL APPLICATIONS

This category includes geocentric spacecraft whose primary mission is to make remote sensing measurements of the earth and its atmosphere. Spacecraft which carry instrumentation to make geodesy and gravimetry measurements are also included. Technology, engineering, and communications spacecraft or investigations are not included because NSSDC does not archive such data.

ASTRONOMY, ASTROPHYSICS, AND SOLAR PHYSICS

This category consists of scientific satellites designed to conduct investigations of the sun, stellar objects, nonstellar sources, and interstellar phenomena. These satellites are geocentric except for the selenocentric RAE-B.

GEOSTATIONARY AND HIGH-ALTITUDE SCIENTIFIC

This category includes those satellites designed to conduct investigations of the characteristics of near-earth space from orbits with apogees near geostationary altitude and higher. Three of the spacecraft are selenocentric. Communications satellites are not included because NSSDC does not archive such data.

LOW- AND MEDIUM-ALTITUDE SCIENTIFIC

This category includes those spacecraft whose apogees are well below geostationary altitude and whose primary purpose is to conduct investigations in the near-earth environment.
AUTOMATIC END SEARCH BYPASS

SEARCH TITLE

DATE/FIELD 08-23-84/N

BEGIN SEARCH BYPASS

DATE/FIELD 08-23-84/D

PRIMARY DATA BASE ON LINF

SFT NO. OF NO. OF DESCRIPTION OF SFT

NO. FLC. OCC. (+=OR, *=AND, -=NOT)

1 3 3 UTP/CATALOG *+1 SERIES *+2 SPACE *+1 SCIENCE

DISPLAY 01/2/1

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MINS: / EARTH ATMOSPHERE/ ENVIRONMENT EFFECTS

ARA: Author

ARS: Earth orbits spacecraft whose apogees are well below geostationary

altitude and whose primary purpose is to conduct investigations in the

near-Earth environment are considered.
DATA CATALOG SERIES FOR SPACE SCIENCE
AND APPLICATIONS FLIGHT MISSIONS

Volume 3A

DESCRIPTIONS OF LOW- AND MEDIUM-ALTITUDE
SCIENTIFIC SPACECRAFT AND INVESTIGATIONS

Edited by

Richard Horowitz
John E. Jackson

May 1983

National Space Science Data Center (NSSDC)/
World Data Center A for Rockets and Satellites (WDC-A-R&S)
National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771
This volume is part of a series which will describe data sets and related spacecraft and investigations from space science and applications flight investigations. The series will describe the data sets held by the National Space Science Data Center (NSSDC), some of the data sets held by NASA-funded investigators, and some of those held by foreign investigators; and the series will serve as pointer documents for extensive data sets held and serviced by other government agencies.

We would like to thank the many investigators who have submitted their data for archiving at NSSDC. Their cooperation in supplying current status information is gratefully acknowledged. We are particularly indebted to the many past and present NSSDC personnel who interacted with the investigators in bringing to NSSDC the flight data and who provided the initial input for many of the descriptions appearing in this catalog. Thanks are also extended to the other NSSDC personnel, employees of the on-site contractor, Sigma Data Services Corporation, who have been involved in the information handling necessary to produce this volume. Special acknowledgment is given to Mary Elsen for her extensive editorial assistance.

The Data Center is continually striving to increase the usefulness of its data holdings, supporting indexes, and documentation. Scientists are invited to submit their space science data and related documentation to NSSDC. Their comments on and corrections to the present catalog will be greatly appreciated. Catalog recipients are urged to inform potential data users of its availability.

Richard Horowitz
John E. Jackson

May 1983
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Introduction
1.1 PURPOSE

The National Space Science Data Center (NSSDC) was established by the National Aeronautics and Space Administration (NASA) to provide data and information from space science and applications flight investigations in support of additional studies beyond those performed as the principal part of any flight mission. This volume is one of a series of eleven that will describe (1) the holdings from all spacecraft flight investigations for which NSSDC possesses data or can direct people to the data source, (2) all data sets held by NSSDC, (3) some of the data sets held and serviced by NASA-funded investigators, and (4) some of the data sets held and serviced by foreign investigators. The series will serve as pointer documents for extensive data sets held and serviced by other government agencies, particularly the National Oceanographic and Atmospheric Administration (NOAA). There is one major omission from this series: the extensive set of data obtained from the lunar missions conducted by NASA, supplemented by a few small photographic data sets from Soviet missions. These are described in the Catalog of Lunar Mission Data (NSSDC/WDC-A-R&S 77-02) and will not be repeated in this series, except for a few cases. The data from IMP-E, Apollo 15 subsatellite, and Apollo 16 subsatellite are included in the series, since these data are important to disciplines other than those connected with lunar studies. Some of the experiments of the Apollo ALSEP missions also yielded useful data for magnetospheric and interplanetary physics, but these are not included in the series, since the instruments were confined to the surface of the moon. Readers should consult the Catalog of Lunar Mission Data if they are interested in such data sets.

The series consists of (1) five volumes that describe the spacecraft and their associated investigations separated into various categories, (2) five corresponding volumes that describe the various orbital information and investigation data sets, and (3) a master index volume. The five categories of spacecraft are (i) Planetary and Heliocentric, which include planetary flybys and probes, (ii) Meteorology and Terrestrial Applications, (iii) Astronomy, Astrophysics, and Solar Physics, which are all geocentric except the selenocentric RAE-B, (iv) Geostationary and High-Altitude Scientific, and (v) Low- and Medium-Altitude Scientific. It is impossible to provide an organization of categories that separates the investigations cleanly into scientific disciplines, since many missions were multidisciplinary. With the above organization, that is partly discipline-oriented and partly orbit-oriented, it was found that in nearly all cases a given spacecraft belonged clearly to only one of the above five categories. The few exceptions encountered have resulted in some data sets appearing in more than one data set volume.

Each volume is organized in a way that is believed to be most useful to the user and is described for each such volume in the Organization Section. For the standard types of orbital information, given in the data set catalogs, i.e., predicted, refined, and definitive, the information will be given in a tabular form to avoid repeating the same brief description an inordinate number of times. The standard description of a data set from an investigation is a free text brief description, since the wide variety of instruments precludes using a tabular format in most cases.
This catalog series has been prepared following a two-year survey and
follow-up activity by NSSDC personnel to obtain information about the
completeness of the NSSDC holdings and to solicit the description of data sets
that will be archived by individual investigators; these latter data sets are
referred to as directory data sets. This survey was conducted only for NASA
missions launched after December 31, 1962, but it includes the majority of
NSSDC holdings. Of the 100 investigators surveyed, representing 346 inactive
(no longer associated with an active science working team or equivalent)
experiments, a small percentage failed to respond in 17 months of concerted
solicitation for information. Consequently, there are now 20 investigations
for which NSSDC has no data that will be dropped from this catalog series,
since it would be irresponsible for NSSDC to send requesters to a possible
data source that no longer has data or is nonresponsive. The surveyed
investigations that are being dropped from the NSSDC catalogs are identified
in the appropriate volumes in the series. A small, but nontrivial, number of
investigations were identified for which data no longer exist or for which the
instrument failed at launch. These investigations are included in the
spacecraft/investigation volumes so that users will know that it is fruitless
to try to obtain such data anywhere. Also included in the spacecraft/
investigation volumes are descriptions of recent spacecraft and investigations
from which NSSDC expects to receive data.

The main purpose of this series is to identify the data and the contact from
whom the data can be obtained within the scope previously defined. In
addition, we have tried to identify the personnel involved with the investi-
gation, and to provide their current affiliation so that a user will know whom
to contact for additional information relative to a given data set that NSSDC
archives. In some cases we know that people have retired or have gone into
different areas of endeavor. The latter case is treated by showing the last
affiliation of such an individual and denoting that he is no longer affiliated
by printing NLA after the individual's name. The spacecraft/mission personnel
are identified at the institution where they performed their relevant duties
since this is the place where the original project records are most likely to
be found. The term NLA is printed with the names of these personnel if they
are no longer associated with the given institution.

It is hoped that this series will serve for many years as the source documents
for data in the disciplines that NSSDC handles. The annual NSSDC Data Listing
will be used to update the time intervals for which data are available and to
identify in brief form the new data sets that become available in the future.
The annual Report of Active and Planned Spacecraft and Experiments will be
used to describe the new spacecraft and experiments which are placed in orbit.
This volume of the NSSDC Data Catalog Series deals with earth-orbiting spacecraft whose apogees are well below geostationary altitude and whose primary purpose is to conduct investigations in the near-earth environment. Section 2 contains descriptions of (1) investigations for which NSSDC has data sets, (2) investigations for which data sets are available elsewhere at a location known to NSSDC, and for which NSSDC has documentation, (3) investigations that have failed to yield data or for which data sets no longer exist, and (4) investigations from which NSSDC expects to receive data, either because the investigations were on recently launched spacecraft or because NSSDC received information during the preparation of this catalog that data were forthcoming.

The organization of the descriptions of the spacecraft in Section 2 is mainly alphabetical by the NSSDC spacecraft common name. Those few spacecraft whose names start with numbers are arranged numerically and placed before the alphabetical listing. Under each spacecraft heading, the appropriate investigation descriptions are arranged alphabetically by name of the original principal investigator.

Each spacecraft description entry in Section 2 includes the spacecraft alternate names, NSSDC ID number (see Appendix A), launch information (date, site, and vehicle), spacecraft weight, orbit parameters (type, epoch date, period, inclination, periapsis, and apoapsis), sponsoring country and agency, personnel (project manager, "PM", project scientist, "PS", and their affiliation at the start of the project), and a brief description concerning the mission. Additional information concerning the PM and PS codes is given in Appendix A. The "NLA" code that sometimes follows a person's name is explained in Appendix A.

Each investigation description entry in Section 2 includes the investigation name (as used by NSSDC), NSSDC ID number (see Appendix A), the NASA Headquarters investigative program code, the investigation discipline(s) and the names and current affiliations of the principal investigator (PI) and of the associated other investigator(s) (OI). The principal investigators are listed first, but the other investigators are not listed in any particular order. The designation "/CO-OP" under the investigative program indicates a cooperative effort between NASA and another agency. The investigation brief description is immediately below each heading.

The Index of Spacecraft and Investigations in Section 3 lists the spacecraft and investigations described in this volume. Spacecraft common names and alternate names are in numerical and alphabetical order. Included with each spacecraft common name are the sponsoring country and agency, launch date, orbit type, NSSDC ID number, and the page where the spacecraft description may be found in this volume. Grouped under each spacecraft name are the particular investigations for that spacecraft which are to be dealt with in this volume, arranged alphabetically by principal investigator's last name. Each of these entries also includes the investigation name, NSSDC ID number, and the page where the investigation description may be found in this volume.
Certain words, phrases, and acronyms used in this volume are defined in Appendix A.

In this volume the principal subject areas are aeronomy, ionospheric physics, radio physics, magnetospheric physics, and particles and fields, but the spacecraft selection is based on the orbit category. No attempt has been made here to reference investigations that are related to the above disciplines but that are described in other volumes of this series.
The National Space Science Data Center was established by the National Aeronautics and Space Administration to provide data and information from space science and applications investigations in support of additional studies beyond those performed by principal investigators. As part of that support, NSSDC has prepared this series of volumes providing descriptions of archived data, divided into five categories as presented in Section 1.1 (see also inside front cover). In addition to its main function of providing selected data and supporting information for further analysis of space science flight experiments, NSSDC produces other publications. Among these are a report on active and planned spacecraft and experiments and various users guides.

Virtually all the data available at or through NSSDC result from individual experiments carried on board individual spacecraft. The Data Center has developed an information system utilizing a spacecraft/investigation/data identification hierarchy. This catalog is based on the information contained in that system.

NSSDC provides facilities for reproduction of data and for onsite data use. Resident and visiting researchers are invited to study the data while at the Data Center. The Data Center staff will assist users with additional data searches and with the use of equipment. In addition to spacecraft data, the Data Center maintains some supporting information and other supporting data that may be related to the needs of the researchers.

The Data Center's address for information (for U.S. researchers) follows:

National Space Science Data Center
Code 601.4
Goddard Space Flight Center
Greenbelt, Maryland 20771
Telephone: (301) 344-6695
Telex No.: 89675
TWX No.: 7108299716

Researchers who reside outside the U.S. should direct requests for information to the following address:

World Data Center A for Rockets and Satellites
Code 601
Goddard Space Flight Center
Greenbelt, Maryland 20771 U.S.A.
Telephone: (301) 344-6695
Telex No.: 89675
TWX No.: 7108299716
NSSDC invites members of the scientific community involved in spaceflight investigations to submit data to the Data Center or to provide information about the data sets that they prefer to handle directly. The Data Center assigns a discipline specialist to work with each investigator or science working team to determine the forms of data that are likely to be most useful to the community of users that obtain data from NSSDC. The pamphlet Guidelines for Submitting Data to the National Space Science Data Center can be provided on request.
Spacecraft and Investigation Descriptions
SPACECRAFT COMMON NAME- 1963-030D
ALTERNATE NAMES- DASH-2, 00624
NSSDC ID- 63-030D
LAUNCH DATE- 07/19/63 WEIGHT- KG
LAUNCH SITE- VANDERBerg AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS
SPONSORING COUNTRY/AGENCY UNITED STATES
DO-USA

ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 08/06/63
ORBIT PERIOD- 167.9 MIN INCLINATION- 88.42 DEG
PERIAPSIS- 250, KM ALT APOAPSIS- 3745, KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
The Dash 2 satellite was a 2.5-m diameter balloon used to measure air densities at altitudes of approximately 3500 km. The area-to-mass ratio for the spacecraft was 40 sq cm/g. The orbits, originally circular, increased in eccentricity rapidly under the action of solar radiation pressure. Dash 2 reentered the earth's atmosphere on April 12th, 1971.

------------ 1963-030J-PRIOR-----------------

INVESTIGATION NAME- BALLOON ATMOSPHERIC DENSITY
NSSDC ID- 63-030D-01
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM
INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - E.J. PRIOR NASA-LARC

BRIEF DESCRIPTION
This experiment used the variations in orbit characteristics of the Dash 2 balloon satellite to deduce neutral air densities and to study the effect of solar radiation pressure. Other effects, such as terrestrial radiation pressure, lunar gravity, and solar gravity were also observable.

------------ 1963-030C-----------------------

SPACECRAFT COMMON NAME- 1963-030C
ALTERNATE NAMES- SN 79, 5E 1
NSSDC ID- 63-030C
LAUNCH DATE- 09/28/63 WEIGHT- 59, KG
LAUNCH SITE- VANDERBerg AFB, UNITED STATES
LAUNCH VEHICLE- THOR
SPONSORING COUNTRY/AGENCY UNITED STATES
DO-NAVY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 10/11/63
ORBIT PERIOD- 107.4 MIN INCLINATION- 89.9 DEG
PERIAPSIS- 1075, KM ALT APOAPSIS- 1126, KM ALT

PERSONNEL
PM - J. DASSOULAS
PS - C.J. BOSTRON

BRIEF DESCRIPTION
The magnetically aligned 1963-030C spacecraft was designed to measure energetic charged particles, magnetic fields, and the solar spectrum and to acquire geodetic data. After August 1965, the satellite, which attained a nearly circular polar orbit, sampled its environment only infrequently. The last data were transmitted during November 1974. The mission was highly successful.

--------- 1963-030C, BOSTRON--------------

INVESTIGATION NAME- ENERGETIC ELECTRON AND PROTON DETECTORS
NSSDC ID- 63-030C-01
INVESTIGATIVE PROGRAM
NAVIGATION TECHNOLOGY
INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - C.J. BOSTRON APPLIED PHYSICS LAB
OJ - D.J. WILLIAMS APPLIED PHYSICS LAB

BRIEF DESCRIPTION
The charged particle experiment on 1963-030C consisted of an array of solat-state detectors. One electron spectrometer consisting of five detectors measured the directional intensity of electrons with energies greater than 92 keV, 1.2 MeV, and 3.6 MeV. Each of two proton spectrometers utilized two sensors and three electronic discrimination levels in various combinations to measure the directional intensity of protons in the energy ranges 1.2 to 2.2 MeV, 2.2 to 4.2 MeV, 6.2 to 10 MeV, and 10 to 20 MeV. These confocal detectors measured the sum of electronic and proton intensities (i.e. and Ip) in each bin according to the following: 1e (E=22 keV) plus Ip (E=22 keV), 1e (E=44 keV) plus Ip (E=22 keV), and 1e (E=22 keV) plus Ip (E=44 keV). The electron spectrometer and one proton spectrometer were oriented with the axes parallel to the spacecraft spin axis. The other detector was parallel to the field looking upward when in the northern hemisphere. Most detectors were sampled every 2.5 days per satellite. The lowest energy proton detector was sampled every 5.7 days per minute. For the greater than 3 MeV electron spectrometer detector, which had been unusable most of the time due to noise, and one of the proton spectrometers, which was intermittent for periods during the first month, the experiment has worked well through the spacecraft lifetime. After August 1969 data were acquired only infrequently and on special experimenter request. Very little data were acquired after 1975.

--------- 1964-083C-----------------

SPACECRAFT COMMON NAME- 1964-083C
ALTERNATE NAMES- SE 5, 00659
NSSDC ID- 64-083C
LAUNCH DATE- 12/13/64 WEIGHT- 75, KG
LAUNCH SITE- VANDERBerg AFB, UNITED STATES
LAUNCH VEHICLE- THOR
SPONSORING COUNTRY/AGENCY UNITED STATES
DO-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/24/64
ORBIT PERIOD- 106.3 MIN INCLINATION- 89.9 DEG
PERIAPSIS- 1025, KM ALT APOAPSIS- 1054, KM ALT

PERSONNEL
PM - S.J. DASSOULAS
PS - J.J. DASSOULAS

BRIEF DESCRIPTION
The scientific objectives of this USAF-MPL spacecraft were to accurately map the earth's magnetic field over the regions covered by the satellite orbits to map the celestial sphere in the ultraviolet region, to study the solar spectrum, and to determine the attenuation rates of selected metals. This magnetically aligned and polar-orbiting spacecraft was powered with solar cells and nickel-cadmium batteries. There were three transmitters-two were used for tracking, and the third was used for the transmission of analog and digital data. The digital data were transmitted at 195,000 bits only under the control of data were acquired from the satellite. Because of power limitations, it was necessary to switch the power from experiment to experiment in order to use the transmitters with the experiments turned off. The satellite provided good quality data until June 1965.

--------- 1964-083C, ZMUDA-----------------

INVESTIGATION NAME- RUBIDIUM VAPOR MAGNETOMETER
NSSDC ID- 64-083C-01
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM
INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - A.J. ZMUDA(DECESSED)

BRIEF DESCRIPTION
The purpose of this experiment was to map the intensity of the magnetic field over the satellite's orbit and to look for magnetic effects of currents in the ionosphere and to determine the magnetic field. The detector system consisted of a single cell, optically coupled self-oscillating, rubidium gas vapor magnetometer. The magnetometer was mounted at the center of a boom that extended along the magnetically aligned axis of the satellite. The optical axis of the detector was set at an angle of 45 deg to the boom, thus providing a maximum signal to noise ratio and allowing data to be received over the entire sphere with the single magnetometer. The detector output was counted to the nearest 0.01 s with successive intervals separated by 0.01 s. During these periods the satellite traversed latitudinal areas of 0.6 and 4.6 km. The boom did not extend to its full length in orbit, but in-flight calibration (available on command) allowed determination of the bias field at the magnetometer.
Instrumental effects precluded the measurement of field magnitudes greater than 3.16 mT. Thus, data coverage was restricted to latitudes below about 60 degrees. The experiment provided useful data with an accuracy of plus or minus 16 mT for the periods December 17 to 31, 1964, and April 16 to June 24, 1965. For detailed discussion of the instrumentation and some of the results, see A. J. Zndor et al., "The scalar magnetic field at 1100 kilometers: Its mid-latitude latitudes," J. Geophys. Res., v. 73, pp. 2495-2503, April 1968.

**SPACECRAFT COMMON NAME**: 1972-032A  
**ALTERNATE NAMES**: 05033 SESP 71-3  
**NSSDC ID**: 72-032A  
**LAUNCH DATE**: 04/19/72  
**WEIGHT**: 2000 KG  
**LAUNCH SITE**: VANZENBERG AFB, UNITED STATES  
**LAUNCH VEHICLE**: THOR  
**SPONSORING COUNTRY/AGENCY**: UNITED STATES  
**CODE**: USAF  

**INITIAL ORBIT PARAMETERS**  
**ORBIT PERIOD**: 88.85 MIN  
**PERIAPSIS**: 155.5 KM ALT  
**APOAPSIS**: 271.9 KM ALT  

**PERSONNEL**  
PM = UNKNWN  
PS = UNKNWN  

**BRIEF DESCRIPTION**  
This spacecraft contained two known experiments, the neutral density gauge and nightglow photometers. Little information is available on the spacecraft, but orbit adjustments (presumably by firing an onboard rocket) were made to extend the satellite's lifetime. Three-axis stabilization was required to keep the density gauge aperture perpendicular to the velocity vector.

--- 1972-032A CARTER

**INVESTIGATION NAME**: NEUTRAL DENSITY (MAGNETRON) GAUGE  
**NSSDC ID**: 72-032A-01  
**INVESTIGATIVE PROGRAM**: SPACE TEST PROGRAM  
**INVESTIGATION DISCIPLINE(S)**  
**AERONOMY**  

**PERSONNEL**  
PM = W.L. CARTER (LAE)  
PS = R.F. FELDGUIER (AE)  

**BRIEF DESCRIPTION**  
The objective of this experiment was to significantly increase the amount of neutral density data available over a wide range of positions and times and also over a range in variation/activity of the sun, aurora, geomagnetic fields, and particle flux. Noon-midnight observations were taken during the spring. Observations were made with a Nodake gauge, which measures ion current to a collector after incoming particles have been ionized just inside the entrance aperture. Details of instrument configuration and calibration are in S. A. Luhé, et al., "Uphor and neutral density inferred from magnetorad data from the satellite 1972-032A," Aerospace Corp., TN-007/4500-10, El Segundo, California, April 1974.

--- AD-8 CARTELL

**SPACECRAFT COMMON NAME**: AD-4  
**ALTERNATE NAMES**: EXPLORER 19  
**NSSDC ID**: 63-0534  
**LAUNCH DATE**: 12/19/63  
**WEIGHT**: 7 KG  
**LAUNCH SITE**: VANZENBERG AFB, UNITED STATES  
**LAUNCH VEHICLE**: SCOLT  
**SPONSORING COUNTRY/AGENCY**: UNITED STATES  
**CODE**: USA-055A  

**INITIAL ORBIT PARAMETERS**  
**ORBIT PERIOD**: 116.3 MIN  
**PERIAPSIS**: 550.9 KM ALT  
**APOAPSIS**: 2394 KM ALT  

**PERSONNEL**  
PM = D.W. COFFEY, JR.  
PS = R.F. FELDGUIER (R)  

**BRIEF DESCRIPTION**  
Explorer 19 was the second in a series of 3.66-m inflational. The first satellite in the series was still active, so that densities in two different portions of the atmosphere were sampled simultaneously. The satellite consisted of alternating layers of aluminum foil and plastic film, uniformly distributed over the aluminum outer surface were 51-cm dots of white paint for thermal control. A 116.620-MHz tracking beacon, which was powered by four solar cells and was mounted on the spacecraft skin, used the electrically separated hemispheres of the balloon as an antenna. The spacecraft was successfully orbited, but its apogee was lower than planned. The experiment did not have sufficient power to be received by ground tracking stations, making it necessary to rely solely on the scan Baker-Num camera network for tracking.

--- AD-8, JACCHIA

**INVESTIGATION NAME**: NONSYSTEMATIC CHANGES OF AIR DENSITY  
**NSSDC ID**: 63-0534-01  
**INVESTIGATIVE PROGRAM CODE**: EE-8, SCIENCE  
**INVESTIGATION DISCIPLINE(S)**  
**AERONOMY**  

**PERSONNEL**  
PM = L.G. JACCHIA  
PS = S.O. JACCHIA  

**BRIEF DESCRIPTION**  
This spacecraft was designed to determine nonsystematic changes of the upper atmospheric density by conducting studies of the drag on a 3.66-mm diameter low-density sphere caused by short-term variations in solar activity. Density values near perigee were deduced from sequential observations of the spacecraft position using optical (Baker-Num camera network) and radio/radar tracking techniques. The general techniques used to deduce density values from satellite drag data can be found in L. G. Jacchia and J. Stlovey, "Accurate drag determination for eight artificial satellites of atmospheric densities and temperatures."

--- AD-8, JACCHIA

**INVESTIGATION NAME**: NONSYSTEMATIC CHANGES OF AIR DENSITY  
**NSSDC ID**: 64-076A-01  
**INVESTIGATIVE PROGRAM CODE**: EE-8, SCIENCE  
**INVESTIGATION DISCIPLINE(S)**  
**AERONOMY**  

**PERSONNEL**  
PM = L.G. JACCHIA  
PS = S.O. JACCHIA  

**BRIEF DESCRIPTION**  
Explorer 24 was placed in orbit together with Explorer 25 from a single launch vehicle. Explorer 24 was identical in configuration to the previously launched balloon satellites Explorer 9 and 19. The spacecraft was 3.6 m in diameter and was mounted on a structure of aluminum foil and plastic film, and was covered uniformly with 5.1-cm white dots for thermal control. It was designed to yield atmospheric density near perigee as a function of space and time from sequential observations of the sphere's position in orbit. To facilitate ground tracking, the satellite carried a 126-MHz tracking beacon. The satellite reentered the earth's atmosphere on October 18, 1968.
SPACECRAFT COMMON NAME- AE-4
ALTERNATE NAMES- EXPLORER 17, S 6

WEIGHT- 184.4 KG

LAUNCH DATE- 04/03/63
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA
SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-GSFC

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEODETIC ORBIT PERIOD- 94.59 MIN EPHEMERIS DATE- 04/03/63 PERIAPSIS- 255, KM ALT INCLINATION- 57.6 DEG

PERSONNEL
PM - C.A. REBER NASA-GSFC

BRIEF DESCRIPTION
Two identical double-focusing magnetic mass spectrometers were used to measure the concentrations of neutral particle constituents of the upper atmosphere mainly atomic and molecular oxygen, atomic and molecular nitrogen, helium, and water vapor. These neutral particles were monitored by electron bombardment. Measurements were made sequentially for 4 s in high sensitivity and 4 s in low sensitivity. A period of 64 s was required for the entire measurement cycle. Included in the cycle was an operation to correct for the zero
voltage level in the output signal. One spectrometer produced useless data due to a malfunction. The other detector system experienced intermittent degeneration of the amplifier outputs and, consequently, the data were good only during certain periods. This degeneration was not a result of instrument malfunction but of an unexpected spatial attitude which oriented the sensor toward the sun and caused it to overheat. A more complete description of the experiment, the instrumentation and the calibration procedures can be found in C. A. Reber et al., Planet. Space Sci., v. 13, n. 7, p. 617, 1965. NSCCID has all the useful data that exist from this investigation.

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SPACECRAFT COMMON— AE-B
ALTERNATE NAMES— S-64, ATMOSPHERE EXPLORER-B
EXPLORER 32, 2083
NSCCID ID— 66-0444
LAUNCH DATE— 05/25/66
WEIGHT— 225 KG
LAUNCH SITE— CAP CANAVERAL, UNITED STATES
LAUNCH VEHICLE— DELTA
SPACELAB COUNTRY/AGENCY
UNITED STATES— NASA-GSSA
INITIAL ORBIT PARAMETERS
ORBIT TYPE— GEOCENTRIC}
CIRCULAR— 66, MIN.
INCLINATION— 66+67 DEG
PERIGEUS— 276, KM ALT
APOGEUS— 2725, KM ALT
PERSONNEL
PP— D.W. GRIMES (NASA)
P— L.W. BRECE (NASA)
BRIEF DESCRIPTION
Explorer 32 was an aeronomy satellite which was designed to directly measure temperature composition densities and pressures in the upper atmosphere on a global basis. The satellite was a stainless steel, vacuum-sealed sphere 0.06 m in diameter. The experimental payload included one ion and two neutral mass spectrometers, three magnetometer gauges, and two electricstatic probes. Additional equipment included optical and magnetic aspect sensors, magnetic altitude and spin rate control systems, and a tape recorder for data acquisition at locations remote from ground receiving stations. Power was supplied by silver-zinc batteries and a solar cell array mounted on the satellite exterior. Two identical pulse-modulated telemetry systems and a cantilever antenna were employed. The two neutral-particle mass spectrometers failed about 6 days after launch. The remaining experiments operated satisfactorily and provided useful data for most of the 10-month satellite lifetime. The spacecraft ceased to function due to battery failures which resulted from depressurization of the sphere.

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INVESTIGATION NAME— ELECTRON TEMPERATURE AND DENSITY
NSCCID ID— 66-0444-05
INVESTIGATIVE PROGRAM
CODE EC-B— SCIENCE
INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES
IONOSPHERES
PERSONNEL
PP— L.W. BRECE
O1— J.A. FINDLEY
NASA-GSSA
BRIEF DESCRIPTION
The objective of this experiment was to measure the distribution of electron temperature and densities from 10 to 10,000 electrons/cc using a swept voltage electron probe. Geophysical data were published. The data base no longer exists.

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INVESTIGATION NAME— ION MASS SPECTROMETER
NSCCID ID— 66-0444-01
INVESTIGATIVE PROGRAM
CODE EC-B— SCIENCE
INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY
PERSONNEL
PP— H.C. BRINTON
O1— H.A. TAYLOR, JR.
NASA-GSSA
O1— R.R. PICKETT (NASA)
NASA-GSSA
BRIEF DESCRIPTION
This experiment was designed to obtain a description of the concentrations of the ion species in the topside ionosphere (principally atomic hydrogen, helium, nitrogen, and oxygen) as a function of time, location, and solar wind geomagnetic activity. The experiment operated nominally. The data were acquired in real time by 33 ground stations and over remote areas by use of a space-borne ion mass spectrometer. The useful satellite lifetime of 10 months permitted a global study of the diurnal variation of the atmosphere during nearly two complete diurnal cycles. In addition the orbit plane was perturbed once a month, with the data obtained from selected studies were undertaken including: (1) the diurnal and seasonal variation of atmospheric ion composition (2) the effect of atmospheric winds on the atomic hydrogen-atomic oxygen ion transition level, (3) the density and temporal variation of thermospheric atomic hydrogen, and (4) the altitude variation of ion composition in the midlatitude trough region. The instrument flown was in D design to ion spectrometers flown on the Orbiting Geophysical Observatory (OGO) satellite series. The spectrometer sensor consisted of a 5-5 cycle ceramic tube with 5-mm grid spacing and an external guard ring assembly. Two RF frequencies, 3.7 and 9.0 MHz, were used with a trapezoidal-shaped swept window to cover the ion mass range 2 to 18, and 1 and atomic mass units (with assurance of detection of the primary far constituents of the topside ionosphere. An experiment turn-on consisted of one complete mass scan in 208 s followed by recycling of the sweep window and a second measurement of the high mass range. The stopping potential and the guard ring potential controlled the sensitivity of the spectrometer, and each window was commandable from the ground. The ion current reaching the spectrometer was measured by a series of five- decade amplifiers with a particle sensitivity range of from 10 to 1,667 ions/sec/keV automatic calibration routine during each turn-on to support two known signals to the amplifier system and to the sweep monitor. A total of 1,000 calibration signals was accumulated from the on-board sensors to these pulses. The spectrometer tube was mounted on the equator of the almost spherically shaped spacecraft. The spacecraft spin period and attitude were magnetically controlled so that the spin axis remained essentially normal to the orbit plane and, consequently, the spectrometer sensor and the earth's velocity vector were tilted by the attitude roll each rotation. The spin rate was 29 plus or minus 1 rpm. Since the mass range was so broad the results were compared with the solar wind peak in the ion spectrometer was modulated at the spin frequency, with the ion current maxima occurring when the angle between the spectrometer axis and velocity vector for a given mass was orthogonal.

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INVESTIGATION NAME— PRESSURE GAUGES
NSCCID ID— 66-0444-04
INVESTIGATIVE PROGRAM
CODE EC-B— SCIENCE
INVESTIGATION DISCIPLINE(S)
AERONOMY
PERSONNEL
PP— G.P. NEWTON
NASA HEADQUARTERS
BRIEF DESCRIPTION
Three cold cathode magnetron type density gauges (Redhead forward detectors) each with its own high voltage input and output electron, were flown to measure the density of the neutral atmosphere as a function of altitude. The output was recorded on magnetic tape. One gauge was designated as NRC-258 and the other two as GCA-45 reflect different off the ground mounted on the spacecraft equator. The two were given each designation, with the third gauge mounted 55 deg above the equator. The metal-ceramic GCA-45 gauges had an internal stainless steel cylinder of about 0.12 cm and about 0.002 cm thick material deposited on the anode to permit operation at low atmospheric densities (less than 10,000 particles cm), with the anode potential fixed at 3500 V. The GCA-45 equatorially mounted gauge had a linear range switchable electronic output and high-resolution current measurements were obtained. The two remaining two gauge outputs were through logarithmic electrometers. All electrometers were calibrated once each turn. The time resolution of the measurement was 2 sec which was equal to the satellite spin period and corresponded to a spatial resolution of 10 km along the orbit path. For details regarding the experiment operation can be found in G. P. Newton et al., "Direct in situ measurements of wave propagation in the neutral atmosphere over 100 kV, 74th Ann. Rep. 1966. Data from this investigation no longer exist. The geophysical results were published.
PERSONNEL
PI - C.A. REBER NASA-GSFC
OI - J.C. COOLEY NASA-GSFC

BRIEF DESCRIPTION
The electron-focusing magnetic mass spectrometers were used to measure the composition of the neutral atmosphere between 200 and 500 km. One was mounted on the equator of the spherical satellite normal to the spin axis, and the other was mounted on the top of the satellite parallel to the spin axis. The neutral particles were located by electron bombardment, separated according to mass-to-charge ratio (M/Q) in the analyzer section of the instrument. There was one collector cup for each of the different ion species. An electron multiplier, which had two sensitivity ranges differing by a factor of 100, sampled the seven collectors sequentially, dwell time on a mass-to-charge sensitivity range 2.4 s. The first four of the fifteen 2.4 s steps of a cycle were devoted to correcting any zero drift of the electron multiplier and to recording the low- and high-sensitivity zero levels. The ion currents were then measured in high sensitivity for M/Q equal to 20 kg/mol, the high sensitivity for M/Q equal to 50 kg/mol, the high sensitivity for M/Q equal to 200 kg/mol, 32 molecular oxygen, 16 atomic oxygen, and 16 water vapor. The time for one complete scan was 36 s. Real-time data were obtained in programmed 4-min turn-ons. The experiment was also operated for 4-min turn-off in a tape recorder mode at about 10 remote locations. Electronic malfunctions of the logic of the two spectrometers caused one instrument to fail after 4 days in orbit and the other after 7 days. NSDC has all the useful data that exist from this investigation.

--------- AE-C BARTH---------

INVESTIGATION NAME= SATELLITE DRAG ATMOSPHERIC DENSITY
NSDC ID = 73-101A-13
INVESTIGATIVE PROGRAM CODE EE-6-C00-04-0
INVESTIGATION DISCIPLINE(S) AERODYNAMICS

PERSONNEL
PI - C.A. BARTH U OF COLORADO
OI - L. G. GROSSI SAC

BRIEF DESCRIPTION
This investigation used a two-channel dielectric grating Ebert-Fastie spectrometer that measured the airglow in the 0.30 micrometer band in a 15.9 degree region centered at 2149 A. The observed intensity was produced by resonance fluorescence of helium, oxygen, and water molecules in the instrument's field of view. The intensity profiles obtained yielded altitude profiles of nitrile-oxide density. The time of the experiment was the time when the satellite was measured along the track of the satellite at times when it was on the sunlit side of the earth. The remote sensing character of the NSDC experiment permitted nitrile-oxide to be made at altitudes both above and below satellite perigee. As a result, the spacecraft's orbit, which was about 90 degrees to the orbit of the satellite, repeatedly had its field of view carried down through the atmosphere onto the earth's limb and altitude profiles of the emitted airglow intensity were obtained. Below about 2 km altitude the measured signal at 2149 A was contaminated by Rayleigh-scattered sunlight. To correct for this contamination, a second channel measured only scattered light intensity in a 12-4 degree region centered at 2190 A. The two channels were optically and electrically independent. Nitrile-oxide airglow intensity was determined by subtracting the difference between these two measurements. The sensor's single slit was 2.50 micrometers, and the effective slit length, and focused incident light on the entrance slit of the spectrometer. From this slit the light struck one half of the Ebert-Fastie grating and was collimated onto the grating. The 360 lines-per-mm grating returned it collimated to the other half of the mirror, and the light was focused on two exit slits. The spectrometer field of view was 3 deg X 14 deg with the long axis parallel to the spacecraft's spin axis, and therefore parallel to the viewed limb. In normal operation each channel was integrated for 20.8 s and was read out alternately at 16.4-s intervals. The instrument was protected against contamination from ground scattering of off-axis undispersed light. More experiment details can be found in C. A. Borth et al. Radio Sci., v. 4, p. 279, 1969. NSDC has all the useful data that exist from this investigation.

--------- AE-C, BRACE---------

INVESTIGATION NAME= CYLINDRICAL ELECTROSTATIC PROBES (CEP)
NSDC ID = 73-101A-01
INVESTIGATIVE PROGRAM CODE EE-6-C00-04-0
INVESTIGATION DISCIPLINE(S) IDIOPHONES AERODYNAMICS

PERSONNEL
PI - L. H. BRACE NASA-GSFC
OI - R. A. THEIS NASA-GSFC

BRIEF DESCRIPTION
The CEP consisted of two identical instruments designed to measure electron temperatures, electron and ion concentrations, and ionization potential of the probe. The probe was oriented along the spin axis of the spacecraft normally perpendicular to the orbit plane, and the other radially so that it could observe the direction of the velocity vector once each 15.9 s period. Each instrument was a retarding potential Langmuir probe device that produced a current-voltage (I-V) curve for each measurement. The probe was biased at a fixed voltage (V - 50 volts) and with the making-cooling coordinated measurements of reacting constituents and the solar input. The AE-C spacecraft was a multi-scaled platform with a diameter of approximately 1.4 m. It weighed about 660 kg including 85 kg of instrumentation. The initial elliptical orbit existed only a few days after the first of the means by an onboard propulsion system employing a 3.5-lb thruster. The initial orbit was in a month's time, and orbital maneuvers were made to reach 2 km altitudes. During the first year, the latitude of perigee moved from about 10 deg to 60 deg north and then down to about 60 deg south. During this period about two cycles through all local times were completed. The spacecraft could be operated in either of two modes: scanning at a nominal 4 rpm or despun to 1 revolution per orbit. The spin axis was perpendicular to the solar cell array. The spacecraft used a PC4 telemetry data system that operated in real time or in a tape recorder mode. The spacecraft included an instrument for the measurement of solar UVI, the composition of positive ions and neutral particles; the detection and location of auroral arcs, and the measurement of ionospheric electron emissions, photoelectron energy spectra, and electron and proton energy distributions. More experiment details can be found in C. A. Colburn et al. Radio Sci., v. 4, p. 279, 1969. NSDC has all the useful data that exist from this investigation.
In this experiment was flown to measure, throughout the 4C
orbits, the individual concentrations of all thermal ion spec-
ies in the mass range of 1 to 72 atomic mass units (u) and in the
ambient density range from 0.11 to 5.5 ions/cm. Any
concentration of the following three mass ranges expressed in u,
were selected by ground command: range A = range B = 1.7
to 16 and range C = 16 to 72. Each mass range was divided into
17 steps (approximately 12 km along orbit). Normal operation
consisted in sequence 4C-2641 to 12 (u) in 5.1 s. Laboratory
and in-flight determination of electron impact loss and
plasma discrimination permitted direct conversion of measured
temperature and mass flow rates to ambient concentrations.
The experiment's four primary mechanical components were quarc ring and ion-analyzer
tube, collector and preamplifier assembly, vent, and main
electronics. The output was normally ground potential, but it could be placed at 6 V by
command if desirable. The peak-to-peak RF voltage was varied with the mass range measured:
range A, 10 mV; range B, 5 mV; and range C, 2.5 mV. Primary analog instrument output was a compressed ion current
spectrum which displayed the full dynamic range of the
amplifier system on a single telemeter channel. Onboard data
processing provided a readout of principal experimental data in the
form of two digital words for each peak in the ion spectrum.
One 8-bit word indicated peak amplitude (current) and the other
8-bit word identified peak position, i.e., species identification. More complete details can be found in M. C.
Brinton et al. Radio Sci., 18, N. 4, p. 833, 1983. NSSDC has all the useful data that exist from this investigation.

In this experiment was designed to determine vector ion
drift velocities, ion concentration and temperatures and
spacecraft potentials. An ionospheric irregularity index was also obtained from the ion concentration sensor. The
experiment consisted of a retarding potential analyzer with four sensor heads. The upper sensor heads and spacecraft
measurements was co-located with another heads and all were spaced nearly equally, looking outward from the
equatorial plane. Since the sensor position was not part of the orbit plane, these heads could sense the plasma
velocity vector in all directions from the spacecraft. The primary objective of this experiment was to
provide accurate ion temperatures with other measurements being of secondary importance. The sensor heads were
similar. They had two grounded entrance grids, two retarding grids, a suppressor grid, a shield grid, and a collector. A
linear sweep voltage (0 to 0.5 s) was normally applied to the retarding grids in 0.75 s. Interpretation of the resulting current-voltage profiles provided the ion concentration, temperature, and electron concentration, some ion composition information, vehicle potential and plasma drift
velocity parallel and perpendicular to the velocity vector. Two of the three
similar sensors had an additional grid between the entrance and retarding grids in order to protect inner grids from
bombardment during electron measurements. The other
significant feature of these two sensors was that a small
positive collector bias could be applied to assure adequate
access of thermal electrons to the collector. With the retarding grids at constant zero volts, current changes could be observed to 0.5 periods of ion concentration. Electron parameters were measured in a manner similar to that for ions in mass ranges 1 to 16 and greater than 40 atomic mass units could be identified. The
fourth sensor head was for the lon-drift velocity measurements. Each consisted of four grounded grids, a
negatively biased suppressor grid, a second collector bias could be applied to assure adequate access of thermal electrons to the collector. With the retarding grids at constant zero volts, current changes could be observed to 0.5 periods of ion concentration. Electron parameters were measured in a manner similar to that for ions in mass ranges 1 to 16 and greater than 40 atomic mass units could be identified. The
fourth sensor head was for the lon-drift velocity measurements. Each consisted of four grounded grids, a
negatively biased suppressor grid, a second collector bias could be applied to assure adequate access of thermal electrons to the collector. With the retarding grids at constant zero volts, current changes could be observed to 0.5 periods of ion concentration. Electron parameters were measured in a manner similar to that for ions in mass ranges 1 to 16 and greater than 40 atomic mass units could be identified.
INVESTIGATION NAME: VISIBLE AERIAL PHOTOMETER (VAE)

NSSDC ID: 73-1014-14

INVESTIGATIVE PROGRAM
CODE EE-8-SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - H. R. HAYES
01 - G. G. SHEPHERD
U OF MICHIGAN Y U

BRIEF DESCRIPTION
This experiment contained a filter photometer designed to measure various aerglow and auroral features in the spectral range between 3500 and 7500 A. The primary information obtained from this experiment was the rates of excitation of the atomic and molecular constituents of the earth's atmosphere. For the AE-C mission, the following six specific lines and bands were chosen for study since they play an important role in the photochemical energy balance of the atmosphere expressed in Angstroms: 3371, 4270, 5200, 5577, 6300, and 7319. The emissions were measured in patts 5577 and 6300, 7319 and calibration, 3371, 5577, 5200, and 7319, 4270 and 3371, calibration, and 5200, and 6300 and 4270. Two optical systems viewed at right angles to each other. Each one employed a combination of a simple objective lens and a field stop to define the field of view, and each contained a multistage light baffle. The wide-angle high-sensitivity system (designated channel 2) had a field of view of 3 deg half-angle, and was used to measure the nightglow dimmed above the satellites, and other weak emission features. The less sensitive system (designated channel 1) had a field of view of approximately 3/4 deg. The system was used for a long-range measurement as well as for auroral features which showed strong spatial gradients. Both optical channels had a diameter of 0.1 mm, and were opened in a filter wheel that contained six interference filters at the wavelengths identified above, and two zero position. One was a dark position for noise measurements, and the other was a calibrate position. The dynamic range of the instrument was 1:1E16 photons per s sq m (1.E6 RAYLEIGHTS). In order that the sensors would respond in a fraction of a second to large changes in surface brightness without any noticeable enhancement in the background count rate, each one contained a 1/100 attenuator and a chart circuit to back-excite the cathode. With these protective features it was possible to measure a dark feature with no apparent enhancement in background within 120 ms after a direct view of the sun. Photons reaching the cathode were recorded using a pulse-counting system. For more experiment details see P. B. Hays et al., Radio Sci., v 8 n 4 p 361. 1973.

NSSDC has all the useful data that exist from this investigation.

--- AE-Cs HAYES ---

INVESTIGATION NAME: EXTREME SOLAR UV MONITOR (ESUM)

NSSDC ID: 73-1014-05

INVESTIGATIVE PROGRAM
CODE EE-8-SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PHYSICS

PERSONNEL
PI - J. F. OSANTOWSKI
01 - J. F. OSANTOWSKI
NASS-SCFC

BRIEF DESCRIPTION
The Extreme Solar Ultraviolet Monitor (ESUM) made absolute and broadband spectro-radiometric measurements of the solar EUV flux from 200 A to Lyman-alpha at 1216 A and made precise measurements of the temporal variability -approximately one percent per solar rotation. The instrument consisted of two identical windowsless ELV photodiodes with aluminum oxide cathodes and a filter wheel containing sets of unbaked metallic filters (S/C) and an open position. A visible light diode measured the riddle transmittance of the filters and a diode light background. The tilt angle of the instrument relative to the E-A spacecraft axis was optimized for the maximum viewing time of the sun in both the long-wavelength and short-wavelength filters. The instrument viewing angle was 60 deg. The nominal bandwidths (for 50% of signal) were 270 to 550 A, 570 to 594 A, 600 to 925 A, and 1216 A. More experiment details can be found in D. F. HAYES AND J. F. OSANTOWSKI, Radio Sci., v 8 n 4 p 361. 1973. NSSDC has all the useful data that exist from this investigation.

--- AE-Cs HAYES ---

INVESTIGATION NAME: SOLAR EUV SPECTROPHOTOMETER (SEUS)

NSSDC ID: 73-1014-06

INVESTIGATIVE PROGRAM
CODE EE-8-SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY
PHYSICS

PERSONNEL
PI - H. R. HAYES
01 - D. F. HAYES
NASA-SCFC
01 - J. M. BENNETT
NASA-ERL
01 - J. H. BURCH
SOUTHWEST RESEARCH INST

BRIEF DESCRIPTION
The Extreme Ultraviolet Spectrometer (EUS) was used to observe the variations in the solar EUV from 140 to 1850 A and the atmospheric attenuation at various fixed wavelengths. This provided quantitative atmospheric structure and composition data. The instrument consisted of 24 grating-incidence gratings monochromators using parallel-slit systems for entrance collimation and photoelectric detectors at the exit slits. Twelve of these monochromators had wavelength-scan capability, each with 128 selectable wavelength positions, which could also automatically step scan through these positions. The other 12 monochromators operated at fixed wavelengths with fields of view smaller than the full solar disk to aid in the atmospheric absorption analysis. The spectral resolution varied from 2 to 54 A depending upon the particular instrument. The field of view varied from 60 x 60 arc min down to 3 x 6 arc min. All 24 monochromator-entrance axes were co-aligned parallel. A solar pointing system could point to 256 different positions, executing a 16-step one-dimensional scan or a full 256-degree raster. The time resolution varied from 1.0 s for observing 12 fixed wavelengths up to 256 s for programming the EUS through all possible modes. More details can be found in H. R. HAYES ET AL., Radio Sci., v 8 n 4 p 361. 1973. NSSDC has all the useful data that exist from this investigation.

--- AE-Cs HAYES ---

INVESTIGATION NAME: MAGNETIC ION-MASS SPECTROMETER (MIMS)

NSSDC ID: 73-1014-10

INVESTIGATIVE PROGRAM
CODE EE-8-SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PHYSICS

PERSONNEL
PI - J. H. HOFFMANN
U OF TEXAS DALLAS

BRIEF DESCRIPTION
A magnetic ion-mass spectrometer was flown to measure in situ the concentrations of the ambient ion species in the mass range from 1 to 90 atomic mass units (amu). It was mounted on the satellite equator normal to the spin axis, and the entrance aperture faced forward when the spacecraft was in the despun node. The electric and magnetic fields were arranged to provide a mass spectrometer Gouy focusing the magnetic analyzers. Three slits were placed along the focal plane in appropriate places to simultaneously collect ions in the mass ratios 1 to 4. Ions in the mass ratios were accelerated into the analyzer system by a negative voltage that varied from -1060 to -225 V. The three mass ranges measured simultaneously were 1 to 4, 4 to 16, and 16 to 91. Following each slit was an electron multiplier and a logarithmic electromagnet position detector. The output signal could be measured directly for an analog output, or it could be fed to a peak circuit that determined the amplitude of each peak in the mass spectrum. Only the amplitude of each peak was telemetered in the primary peaks mode, and in this mode the time required to simultaneously sweep all three mass ranges was 1.5 s. After operation of the analog modes, the three mass ranges were swept in 5 s, alternating with 1-s "peaks" mode scans. An 8-s sweep was required in the analog long mode, again alternating with 1-s peaks mode scan. An option existed in the linked modes to continuously measure any set of mass numbers in the ratio 1 to 4 to 16 to give high spatial resolution. More experiment details can be found in J. H. HOFFMANN ET AL., Radio Sci., v 8 n 4 p 315. 1973. NSSDC has all the useful data that exist from this experiment.

--- AE-Cs HAYES ---

INVESTIGATION NAME: LOW-ENERGY ELECTRONS (LENS)

NSSDC ID: 73-1014-12

INVESTIGATIVE PROGRAM
CODE EE-8-SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - R. A. HOFFMANN
NASA-SCFC
01 - D. F. HAYES
NASA-ERL
01 - J. H. BURCH
SOUTHWEST RESEARCH INST
BRIEF DESCRIPTION

This experiment provided direct measurements of the energy input into the upper atmosphere due to electrons and protons in the energy range of 0.2 to 25 keV. The experiment consisted of two measuring detectors that were separated by 90 degrees and had angular distribution. There were two detectors measuring electrons and protons from 0.2 to 25 keV in 16 logarithmically spaced steps, and one detector measuring the electrons continuously. Each detector consisted of a cylindrical steel thermal vacuum chamber with a one-meter diameter and a Symmetron electron multiplier for particle detection. Energy distributions were obtained by analyzing different fixed or stepped voltages to determine the deflection angle. Positions in angle were measured using the spacecraft spin and the actual output positions on the spacecraft. In the descent modes, measurements were obtained at 45 deg to the spacecraft equator, and radially away from the earth. Detector look angles were chosen to be 30 and 70 deg magnetic pitch angles (C) when the spacecraft was moving either poleward or equatorward. All detectors were identical in construction and used 1- x 6-mm entrance apertures. Counts were accumulated over 5.72 µs and read out in each main telemetry frame (62.5 µs). The two stepped detectors moved one energy step each main frame with the same accumulation time, requiring about 1 s for a complete cycle of steps. More complete details of this experiment may be found in R.A. Hoffman et al., Radio Sci., 8, 287, 1973. NSDC has all the useful data that exist from this investigation.

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INVESTIGATION NAME- OPEN-SOURCE NEUTRAL MASS SPECTROMETER (OSNS)

NSDC ID- 73-1014-07 INVESTIGATIVE PROGRAM CODE EE-8; SCIENCE INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - A.O. NIER
01 - F.J. HEIDER
01 - A. MAUSERBERGER
01 - A.K. KIMBER
U OF MINNESOTA
U OF MINNESOTA
U OF MINNESOTA
U OF MINNESOTA

BRIEF DESCRIPTION

The objective of this experiment was to contribute to a study of the chemical, dynamic, and energetic processes that control the structure of the thermosphere and lower ionosphere, and in situ measurements of both major and minor neutral atmospheric constituents and their changes with altitude. The measurements were made in two main mass regions: first, masses 1 to 6 u and 6 to 48 u. In the ion source the neutral species were ionized by means of electron impact. At altitudes greater than 380 km, ion currents were measured with an electron multiplier counting individual ions. Counts were accumulated for 1/20 s before automatically switching to a different mass number. While complete mass spectra could be obtained in a given mass region, the major emphasis was on measuring mass 48 atomic mass units (u). A double-focusing Mattauch-Herzog magnetic deflection mass spectrometer with an impact ion source was flown. Two ion collectors were included to measure ions differing in mass by a factor of 2. In general, the two mass ranges covered were 1 to 48 u, and 6 to 48 u. In the ion source the natural species were ionized by means of electron impact. Complete mass spectra could be obtained in the ion source. The mass spectrometer had a 97% mass resolving power, which was not high enough to resolve the negative space charge potential holding the ions in the beam. Different ion sources that did not strike the ion source retained the negative space charge potential for several seconds after ionization and escaped into the accelerating region of the analyzer. The electron accelerating potential was 75 eV in normal mode operation and 25 eV in the fly-through mode. In another operating mode, the instrument switched automatically to a sequence of 123 such operating modes. Additional details can be found in A.O. Nier et al., Radio Sci., 8, 287, 1973. NSDC has all the useful data that exist from this investigation.

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INVESTIGATION NAME- CLOSED-SOURCE NEUTRAL MASS SPECTROMETER

NSDC ID- 73-1014-08 INVESTIGATIVE PROGRAM CODE EE-8; SCIENCE INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - O.T. PELZ(PII)
01 - G.A. REVER
01 - G.R. CARIGNAN
N A S A - G S F C
N A S A - G S F C
U OF M I C H I G A N

BRIEF DESCRIPTION

This experiment provided direct measurements of the energy input into the upper atmosphere due to electrons and protons in the energy range of 0.2 to 25 keV. The experiment was conducted by using two detectors that were separated by 90 degrees and had angular distribution. There were two detectors measuring electrons and protons from 0.2 to 25 keV in 16 logarithmically spaced steps, and one detector measuring the electrons continuously. Each detector consisted of a cylindrical steel thermal vacuum chamber with a one-meter diameter and a Symmetron electron multiplier for particle detection. Energy distributions were obtained by analyzing different fixed or stepped voltages to determine the deflection angle. Positions in angle were measured using the spacecraft spin and the actual output positions on the spacecraft. In the descent modes, measurements were obtained at 45 deg to the spacecraft equator, and radially away from the earth. Detector look angles were chosen to be 30 and 70 deg magnetic pitch angles (C) when the spacecraft was moving either poleward or equatorward. All detectors were identical in construction and used 1- x 6-mm entrance apertures. Counts were accumulated over 5.72 µs and read out in each main telemetry frame (62.5 µs). The two stepped detectors moved one energy step each main frame with the same accumulation time, requiring about 1 s for a complete cycle of steps. More complete details of this experiment may be found in R.A. Hoffman et al., Radio Sci., 8, 287, 1973. NSDC has all the useful data that exist from this investigation.

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INVESTIGATION NAME- NEUTRAL ATMOSPHERE TEMPERATURE (NATE)

NSDC ID- 73-1014-09 INVESTIGATIVE PROGRAM CODE EE-8; SCIENCE INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - W.W. SPENCER
01 - G.R. CARIGNAN
N A S A - G S F C
U OF M I C H I G A N

BRIEF DESCRIPTION

This experiment measured the kinetic temperature of the neutral atmosphere by determining the ionization potential of molecular nitrogen in a spherical chamber exposed to the upper atmosphere through a knife-edged orifice. Analysis of the mass spectrometer information on the ionization potential of molecular nitrogen revealed a temperature dependence relationship with a knowledge of the satellite's motion and orientation led to a determination of the ambient temperature. Independent of satellite motion, the measurement of the ambient gas density was also obtained. An alternate measurement of neutral temperatures was used, the D1/D2 ratio was measured on the earth's surface by a rocket-launched instrument mounted on the side of the rocket. The rocket-launched instrument was made in such a way to interrupt the particle stream seen by the rocket. These chamber density variations were interpreted to yield the neutral gas kinetic temperature. A dual-film ion source sampled the thermalized molecular nitrogen in the chamber and produced an ion beam density oscillating during the nitrogen chamber density. From the sources this ionized nitrogen beam was directed from a quadrupole analyzer, tuned to pass those particles whose mass-to-charge ratio was 28 to 48 u, to an electron multiplier. The output pulses were amplified and measured in a 16-bit accumulator. The experiment also provided measurements of neutral atmospheric composition, when commanded into the appropriate mode and, for the first time measured the local wind (vertical motions). The wind velocities were determined by measurement of the "stream" position relative to the satellite velocity. When the spacecraft was in the desired mode, the nitrogen density was measured when the particle stream was interrupted by the baffle. The sensor was then released prior to launch and opened to the atmosphere after the spacecraft was in orbit. More complete details can be found in W.W. Spencer et al., Radio Sci., 8, 287, 1973. NSDC has all the useful data that exist from this investigation.
INVESTIGATION NAME - CYLINDRICAL ELECTROSTATIC PROBE (CEP)

ASSDC ID - 75-0964-01

INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S) ZIONOPHYS E AERONOMY

PERSONNEL
PI - L. W. BRACE
OI - R. F. THIES
OI - A. DALGARNO

NASA-GSFC

BRIEF DESCRIPTION
The CEP consisted of two identical instruments designed to measure electron temperatures, electron and ion concentrations, ion mass and spacecraft potential. One probe was oriented along the spin axis of the spacecraft (nearly perpendicular to the orbit plane) and the other radially so that it could observe in the direction of the velocity vector once each 15-s spin period. Each instrument was a retarding potential Langmuir probe device that produced a current-voltage (I-V) curve for a known voltage pattern placed on the collector. Electrometers were used to measure the current. There were two systems of operation (one with two modes and another with three modes) using collector voltage patterns between plus and minus 5 volts. Most modes involved an autotune or fixed adjustment of collector voltage limits (and/or electrometer outputs) such that the region of interest on the I-V profile provided high resolution. Each system was designed for use with only one of the probes but they could be interchanged to provide backup redundancy. The best measurements in the most favorable modes provided one second-time resolution; electron temperature variations were below 1% (1σ accuracy); ion density by 1% and 1.5 electron/second cm<sup>-2</sup>/sec; and 1.5-4.5 ions/cm<sup>3</sup> for electron beam and ion densities above 1.5 x 10<sup>4</sup> ions/cm<sup>3</sup>. Each probe had a collector electrode extending from the central cylinder through the shield guard ring. The shield guard ring was at the end of a 25 cm boom and the collector extended another 7.5 cm beyond the guard ring. The boom, guards and collector were 1 m in diameter. Important information can be found in L. W. Brace et al., Radio Sci., v. 8, n. 4, p. 277, 1973. The NSSDC has all the useful data that exist from this investigation.

----- AE-0 BRACE -----

INVESTIGATION NAME - ATMOSPHERIC DENSITY ACCELEROMETER (MDA)

ASSDC ID - 75-0964-02

INVESTIGATIVE PROGRAM CODE EE-8/60-0P, SCIENCE

INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - K. W. CHAMPION
OI - F. A. MARCOS

USAF GEOPHYS LAB

BRIEF DESCRIPTION
The Miniature Electrostatic Analyzer (MDA) obtained data on the radial density profile at an altitude range of 120 to 400 km by the measurements of satellite deceleration due to the Earth's magnetic field. The instrument consisted of three single-axis accelerometers mounted mutually at right angles in the spacecraft's X, Y, Z axes. The instrument determined the applied acceleration from the electrostatic force required to center a proof mass. The output of the device was a digital pulse rate proportional to the measured acceleration. The sample time of the measurement was 0.25 s. The measurements allowed determination of the electron density and the neutral atmosphere. The average of the orbit-adjustment system (OAPS), determined the satellite minimum altitude, measured spacecraft roll, and provided some attitude-sensing information. Spacecraft rotations of less than 0.01 degree were monitored. The instrument had three sensitivity ranges: 1-5-3 earth's gravity (0.5 cm/s<sup>2</sup> in OAPS model) and 1-5-10 cm/s<sup>2</sup> (10-30 cm/s<sup>2</sup>) in OAPS model. The spacecraft was 12 m in diameter and carried 40 kg of mass. The accelerometer system was used with the instrument to sample the mean 0.5% of full scale. More detail can be found in K. W. Champion et al., Radio Sci., v. 8, n. 4, p. 297, 1973. The NSSDC has all the data that exist from this investigation.

----- AE-0 DOERING -----

INVESTIGATION NAME - PHOTOELECTRON SPECTROMETER (PES)

ASSDC ID - 75-0964-03

INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S) ZIONOPHYS E AERONOMY

BRIEF DESCRIPTION
The Miniature Electrostatic Analyzer (PES) obtained data on the radial density profile at an altitude range of 120 to 400 km by the measurements of satellite deceleration due to the Earth's magnetic field. The instrument consisted of three single-axis accelerometers mounted mutually at right angles in the spacecraft's X, Y, Z axes. The instrument determined the applied acceleration from the electrostatic force required to center a proof mass. The output of the device was a digital pulse rate proportional to the measured acceleration. The sample time of the measurement was 0.25 s. The measurements allowed determination of the electron density and the neutral atmosphere. The average of the orbit-adjustment system (OAPS), determined the satellite minimum altitude, measured spacecraft roll, and provided some attitude-sensing information. Spacecraft rotations of less than 0.01 degree were monitored. The instrument had three sensitivity ranges: 1-5-3 earth's gravity (0.5 cm/s<sup>2</sup> in OAPS model) and 1-5-10 cm/s<sup>2</sup> (10-30 cm/s<sup>2</sup>) in OAPS model. The spacecraft was 12 m in diameter and carried 40 kg of mass. The accelerometer system was used with the instrument to sample the mean 0.5% of full scale. More detail can be found in K. W. Champion et al., Radio Sci., v. 8, n. 4, p. 297, 1973. The NSSDC has all the data that exist from this investigation.
PERSONNEL

PI - R.K. MASON
OI - D.E. DEERING
OI - G.R. CARIGNAN
OJ - J.G. ARMSTRONG (DECASED)

INVESTIGATION NAME - RETARDING POTENTIAL ANALYZER/DIFFR METER (RPD)

NSSC ID - 75-0964-04 INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINES (AERONOMY)

PERSONNEL

PI - W.R. HANSON
OI - D.E. DEERING
OI - S. SANANTU
OI - G.R. CARIGNAN

BRIEF DESCRIPTION

This experiment was designed to determine vector ion drift velocities, ion concentration and temperature and spacecraft potential. An ionospheric irregularity index was also obtained from the Bean effect. The experiment consisted of a retard ing potential analyzer with four planar sensor heads. The sensor heads were mounted on the spacecraft and were separated by 90°. The distance between the sensor heads was 2270 cm. The sensor heads were used to determine the vector drift velocities of the ions in the plasma sheet. The sensor heads were separated by 90° and the distance between the sensor heads was 2270 cm.

NSSC ID - 75-0964-13 INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINES (AERONOMY)

PERSONNEL

PI - R.B. HAYS
OI - G.B. SHEEFDOR
OI - G.R. CARIGNAN
OJ - J.C. GIBS

BRIEF DESCRIPTION

The visible airglow experiment provided valuable emission rates for several dayglow components. The experiment was conducted at night and during the daytime. The instrument consisted of a spectrometer, a photometer and a filter wheel. The spectrometer was used to measure the emission rates of the nightglow components. The photometer was used to measure the emission rates of the dayglow components. The filter wheel was used to select the emission lines of interest. The experiment was conducted during the daytime and during the night. The instrument was used to measure the emission rates of the nightglow components. The photometer was used to measure the emission rates of the dayglow components.

NSSC ID - 75-0964-08 INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINES (AERONOMY)

PERSONNEL

PI - W.R. HANSON
OI - D.E. DEERING
OI - G.R. CARIGNAN

BRIEF DESCRIPTION

This experiment measured the spatial distribution and temporal changes of the concentrations of the neutral atmospheric species. In addition, new insights into situ measurement techniques were obtained from these measurements, as well as from other onboard experiments. The experiment consisted of a mass spectrometer and a time-of-flight mass spectrometer. The mass spectrometer was used to measure the concentrations of the neutral atmospheric species. The time-of-flight mass spectrometer was used to measure the temporal changes of the concentrations of the neutral atmospheric species.

NSSC ID - 75-0964-07 INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINES (AERONOMY)

PERSONNEL

PI - W.R. HANSON
OI - D.E. DEERING
OI - G.R. CARIGNAN

BRIEF DESCRIPTION

This experiment measured the spatial distribution and temporal changes of the concentrations of the neutral atmospheric species. In addition, new insights into situ measurement techniques were obtained from these measurements, as well as from other onboard experiments. The experiment consisted of a mass spectrometer and a time-of-flight mass spectrometer. The mass spectrometer was used to measure the concentrations of the neutral atmospheric species. The time-of-flight mass spectrometer was used to measure the temporal changes of the concentrations of the neutral atmospheric species.

NSSC ID - 75-0964-04 INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE
INVESTIGATION NAME= SOLAR EUV SPECTROMETER (EUVS)

NSSDC ID= 75-0964-06

INVESTIGATIVE PROGRAM CODE: EE-6, SCIENCE

INVESTIGATIONAL DISCIPLINES:
- ISOCHROMES
- AERONOMY
- SOLAR PHYSICS

PERSONNEL
- PI: H. E. HOFFMAN
- OI: L. A. HALL
- OI: C. W. CHAGNON
- OI: J. L. HANSON (RETIRED)
- USAF GEOPHYS LAB

BRIEF DESCRIPTION

The Extreme Ultraviolet Spectrometer (EUVS) was designed to observe the variations in the solar EUV flux in the wavelength range from 140 to 1850 Å in the atmosphere at various fixed wavelengths. This provided quantitative data for atmospheric structure and composition. The instrument consisted of 24 grazing-incidence gratings monochromators, using parallel-slit systems for entrance collimation and a photomultiplier at the exit slit. Twelve of these monochromators had wavelength scan capabilities, each with 125 selectable wavelength positions, which could also be scanned automatically. The other 12 monochromators operated at fixed wavelengths with fields of view smaller than the full solar disk to avoid in the atmospheric absorption. The spectral resolution varied from 2 to 10 Å as a function of the particular instrument. The field of view varied from 50 × 40 arc min down to 3.6 × 3.6 arc min. A retarding monochromator entrance axis was co-aligned perpendicularly. A solar point source could point to 256 different positions, execute a 16-sector-on-slit sampling, or full 256-sector mapping. This time resolution varied from 0.5 s for observing 12 fixed wavelengths up to 256 s for programming the EUVS through all possible modes. More details can be found in H. E. HOFFMAN et al., Radio Sci., v. 8, n. 4, p. 349, 1973.

-------- AE-3 NIER -------

INVESTIGATION NAME= MAGNETIC ION-MASS SPECTROMETER (MIMS)

NSSDC ID= 75-0964-10

INVESTIGATIVE PROGRAM CODE: EE-6, SCIENCE

INVESTIGATIONAL DISCIPLINES:
- ISOCHROMES
- AERONOMY

PERSONNEL
- PI: J. W. HOFFMAN
- OI: W. B. MANSON
- OI: C. W. LIPPERCOTT

U OF TEXAS DALLAS
NOAA-ERL
U OF TEXAS DALLAS
U OF TEXAS DALLAS

BRIEF DESCRIPTION

A magnetic ion-mass spectrometer was flown to measure in situ the concentrations of the ambient positive ion species in the mass range from 1 to 90 atomic mass units (amu) in the satellite equator normal to the spin axis, the entrance aperture faced forward when the spacecraft was in the deep nonionosphere. Magnetic and electric fields were arranged to produce a mass spectrum along the focal plane following the magnetic analyzer. Three slits were placed along this plane in appropriate places to simultaneously collect ions in the mass ratio 1:4:16. Ionospheric ions were introduced into the analyzer by a negative ion analyzer. The mass range was limited to 1 to 4, 4 to 16, and 16 to 72 amu. Following each slit was an electron multiplier and a photomultiplier. The detector output was fed into an analog output, or was supplied to a "peaking" circuit that determined the amplitude of each peak in the spectrum. Only the largest of each peak was measured in the "peaking" mode, and in this mode the time resolution was simultaneously swept all three mass ranges was 1 s. Other modes of operation were possible. In the analog output mode, the three mass ranges were swept in 2 s, alternating with a 1 s "peaking" mode scan. An 8 s sweep time was required in the analog long mode, alternating with a 4 s "peaking" mode scan. An option existed in the "peaking" mode to continuously measure any set of mass numbers in the ratio 1:4:16 to give high spatial resolution. More details can be found in J. W. HOFFMAN et al., Radio Sci., v. 8, n. 4, p. 319, 1973. NSSDC has all the useful data that exist from this investigation.

-------- AE-3 NIER -------

INVESTIGATION NAME= NEUTRAL ATMOSPHERE TEMPERATURE (NATE)

NSSDC ID= 75-0964-09

INVESTIGATIVE PROGRAM CODE: EE-6, SCIENCE

INVESTIGATIONAL DISCIPLINES:
- AERONOMY

PERSONNEL
- PI: N. W. SPENCER
- OI: C. W. CARMAN
- OI: H. E. NIEUW

U OF MICHIGAN
NASA-GSFC
U OF MICHIGAN

BRIEF DESCRIPTION

This experiment furnished direct measurements of the energy input into the upper atmosphere due to particles and electrons (ions). The energy range 0.2 to 25 keV was investigated. The flux of ions and electrons was measured with cylindrical electrostatic analyzers and Spintronic electron multipliers. There were 15 silicon, one torr energy analyzers, and two electron stopped analyzers mounted at different angles. In addition, there were 16 fixed energy electron detectors that obtained high-time-resolution angular distributions. The spacecraft one revolution-per-orbit mode at five energies between 0.72 and 18 keV. Details can be found in N. W. SPENCER et al., Radio Sci., v. 8, n. 4, p. 319, 1973. NSSDC has all the useful data that exist from this investigation.

-------- AE-3 NIER -------
BRIEF DESCRIPTION

The experiment was designed to measure the kinetic temperature of the neutral atmosphere over an extended period of time. The instantaneous density of molecular nitrogen in a spherical chamber was coupled to the atmosphere through a knife-edge orifice. Analysis of the measured molecular nitrogen density variation over a 5-hour cycle with a knowledge of the satellite's motion and orientation led to a determination of the ambient temperature, independent of scale height. The NADT also provided measurements of the neutral composition, when combined into the appropriate pole. Values for the zonal wind were obtained from measurement of the stream position relative to the satellite's motion. In another measurement of neutral temperature also was undertaken, using a baffle inserted in front of the orifice to intercept a portion of the gas sampled by the stream entering the sphere. When the satellite was in the descent mode, the baffle was made to oscillate in an on-off fashion in order to interrupt the stream seen by the orifice chamber. These chamber density variations were interpreted to yield the neutral gas kinetic temperature also. A dual-channel ion source sampled the thermally excited molecular nitrogen in the chamber and produced an ion beam density proportional to the nitrogen chamber density. From the sources the ionized beam was directed to a quadrupole analyzer, tuned to pass those particles whose mass-to-charge ratio (m/q) was 20. This ionized nitrogen beam then passed on to an electron multiplier. The output pulses were amplified and counted in a 16-bit accumulator. The sensor was vacuum-sealed prior to launch and opened to the atmosphere after the spacecraft was in orbit. More experiment details can be found in N. W. Spencer et al., Radio Sci., v. 8, n. 4, p. 287, 1973. NSDC has all the useful data that exist from this investigation.

-------------- AE-E ---------------

SPACETIME COMMON NAME- AE-E
ALTERNATE NAMES- AE-E, ATMOSPHERIC EXPLORER-E, EXPLORER-5, AE-5
NSCD ID- 75-1074
LAUNCH DATE- 11/25/75
WEIGHT- 735, KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA
SPONSORING COUNTRY/AGENCY
UNITED STATES NASA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEODESIC
ORBIT PERIOD- 117.29 MIN
INCLINATION- 138.5 DEG
PERIGEE- 156.2 KM ALT
APOGEE- 298.3 KM ALT

PERSONNEL
PM- J.W. CARRIGAN
PM- D.W. GRIGINSLEN
PS- N.W. SPENCER

BRIEF DESCRIPTION

The purpose of the AE-E mission was to investigate the chemical processes and energy transfer mechanisms that control the structure and behavior of the Earth's atmosphere in the region of high absorption of solar energy at low solar latitudes. The simultaneous sampling at higher latitudes was carried out by the AE-E spacecraft until its failure on January 29, 1976, and then by AE-5 until it re-entered on December 18, 1976. In addition the spacecraft as AE-5 was used, and the payload consisted of the same types of instruments as on the AE-E spacecraft except that the ion energy detector and UV nitric oxide experiments were deleted and a backscatter UV spectrometer was added to monitor the ozone content of the atmosphere. The experimental data collected from the two experiments described in this investigation and are more appropriate for the high-latitudes regions. The perigee swept through eight of the full latitude cycles and two local time cycles during the first year after launch when the orbit was elliptical and the perigee height was varied from 130 and 400 km. The circularization of the orbit around 390 km was made on November 20, 1976 and the spacecraft was raised to this height whenever it would decay to about 250 km. AE-5 re-entered on June 10, 1976. A complete description can be found in J. L. Dalgarno et al., Radio Sci., v. 8, n. 4, p. 265, 1973.

-------------- AE-E, BRACE ---------------

INVESTIGATION NAME- SPHERICAL ELECTROSTATIC PROBE (SEP)
NSCD ID- 75-1074-01
INVESTIGATIVE PROGRAM CODE EE-97, SCIENCE
INVESTIGATIVE DISCIPLINE(S)
AERONOMY, IONOSPHERES

PERSONNEL
PM- J.W. BRACE
PM- R.F. THIES
PS- A. DALGARNO

BRIEF DESCRIPTION

The SEP consisted of two identical instruments designed to measure the electron temperature and electron density at the indicated altitude range of 120 to 400 km, by the measurements of satellite deceleration due to the atmospheric drag acting on the probe. The instrument determined the applied acceleration from the electromagnetic force on the probe mass. The output of the device was a digital pulse rate proportional to the applied acceleration. The single time of each instrument was 0.05 s. The measurements were completed by the data visualization that monitored the neutral atmosphere. A detailed description can be found in J. L. Dalgarno et al., Radio Sci., v. 8, n. 4, p. 265, 1973.
INVESTIGATION NAME: PHOTOELECTRON SPECTROMETER (PES)

NSSDC ID: 75-1074-03
INVESTIGATIVE PROGRAM CODE EE-H SCIENCE
INVESTIGATION DISCIPLINE(S): AERONOMY
IONOSPHERES

PERSONNEL
PI: J.P. DOERING
OI: J.O. BOSTROM
APPLIED PHYSICS LAB

BRIEF DESCRIPTION
This experiment was designed to provide information on the intensity, angular distribution, energy spectrum, and net flow along field lines of electrons in the thermosphere with energies between 1 and 500 eV. The instrument consisted of two identical oppositely directed hemispherical electrostatic analyzers, and contained 35 operating modes. Each spectrometer had a relative energy resolution of plus or minus 2.5% and a gain factor on the order of 0.001 for SR = 1. Three range channels were measured: 0 to 25, 0 to 100, and 0 to 500 eV. Measurements from the two spectrometers could be referred to four different data channels: one 64-point spectrum, or four 16-point spectra in one second. The longest 10 second cycle of data involved observations using theoretical velocity steps for the lowest, middle, and highest energy ranges in that order for 1 second. A repeat for data was established each cycle. The detailed description of this experiment is found in J. P. Doering et al., Radio Sci. 5, 86-94, p. 387, 1973.

----- AE-E: HEATH -----

INVESTIGATION NAME: RETARDING POTENTIAL ANALYZER/DYERETRIFT (RPA)

NSSDC ID: 75-1074-04
INVESTIGATIVE PROGRAM CODE EE-H SCIENCE
INVESTIGATION DISCIPLINE(S): AERONOMY
IONOSPHERES

PERSONNEL
PI: W.B. HANSON
OI: D.R. ZUCCARD
U OF TEXAS DALLAS
OI: S. SANATANI
U OF TEXAS DALLAS
OI: C.R. LIPPINCOTT
U OF TEXAS DALLAS

BRIEF DESCRIPTION
The experiment was designed to determine electron drift velocities, electron concentration and temperatures total ion concentration, roughness of the earth's atmosphere, and spacecraft potential. The experiment consisted of a retarding potential analyzer with four planar sensor heads. The sensor heads were spaced nearly equally around the satellite equator. Since the satellite spin axis was perpendicular to the orbit plane, these heads could observe along the spacecraft velocity vector in either the spin or despun modes of the spacecraft. The drift potential was measured for several cases. Two grounded entrance grids, two retarding grids, a suppressor grid, a shields grid, and a collector grid. A difference (30 cm 002 20 cm) was normally applied to the retarding grids in 0.75 s. Interpretation of the resulting current-voltage profiles provided ion temperature and electron concentration for complete ion and electron measurements. Ion flux measurements were made in a manner similar to ions. The mass range from 0.5 to 14, 14 to 30, 30 to 50 and greater than 50 atomic mass units was identified. The electron mass spectrometer, consisting of four grounded grids, a suppressor grid, a biased suppressor grid, and the collector grid, was designed to detect the electrons. Differences in the collector segments' current profiles provided data on the location of the detector unit. The instrument was used to measure the space plasma temperature and electron density.
INVESTIGATION NAME- NEUTRAL ATMOSPHERE COMPOSITION (NACE)

NSCC ID- 75-107A-05
INVESTIGATIVE PROGRAM
CODE EE-9A SCIENCE
INVESTIGATION DISCIPLINE(S) AEONOMY

PERSONNEL
PI - L.G. MEIN
DI - C.A. REGER
DI - G.R. CARIGAN
U OF MICHIGAN

BRIEF DESCRIPTION
This experiment was designed to measure the kinetic temperature of the neutral atmosphere by determining the instantaneous density of molecular nitrogen in a spherical chamber coupled to the atmosphere through a knife-edged orifice. Analysis of the measured molecular nitrogen density variation over a solar cycle with a knowledge of the satellite motion and orientation led to a determination of the ambient temperature independent of scale height. Measurements of the ambient neutral composition were performed by scanning the instrument orifice to cover various spectrometer slit positions. Further detail can be found in N.W. Spencer et al., Radio Sci., v. 8, n. 4, p. 271, 1973.

---- AE-4, HINTEREGGER

INVESTIGATION NAME- SOLAR EUV SPECTROPHOTOMETER (EUVS)

NSCC ID- 75-107A-06
INVESTIGATIVE PROGRAM
CODE EE-AE0-CF SCIENCE
INVESTIGATION DISCIPLINE(S) SOLAR PHYSICS IONOSPHERES

PERSONNEL
PI - H.G. HINTEREGGER
DI - D.J. RECO
DI - L.A. MALLE
DI - W.A. CHADSON
USAF GEOPHYS LAB

BRIEF DESCRIPTION
The Extreme Ultraviolet Spectrometer (EUVS) was used to observe the variations in the solar EUV wavelength range from 140 to 1950 A and the atmospheric attenuation at various fixed wavelengths. This provided quantitative atmospheric observations in a region of the spectrum where the atmosphere was recovered. The instrument consisted of 24 grazing-incidence grating monochromators using parallel-slit systems for entrance collimation and photomultiplier detectors at the exit slit. Twelve of these monochromators had wavelength scan capability, each with 128 selectable wavelength positions, which could also automatically step scan through these positions. The other 12 monochromators operated at fixed wavelengths with fields of view smaller than the solar disk, to aid in the atmospheric electron analysis. The spectral resolution varied from 2 to 5 A depending upon the particular instrument. The field of view varied from 60 x 60 down to 3 x 3 arc min. All 24 monochromator-entrance axes were co-aligned parallel. A solar pointing system could point to 256 different positions, execute a 16-step one-dimensional scan or a full 256-step raster. The time resolution varied from 0.5 s for observing 12 fixed wavelengths up to 256 s for programming the EUVS through all possible nodes. Further details can be found in N. W. Spencer et al., Radio Sci., v. 8, n. 4, p. 271, 1973.

---- AE-4, NICER

INVESTIGATION NAME- OPEN-SOURCE NEUTRAL MASS SPECTROMETER (OSNS)

NSCC ID- 75-107A-07
INVESTIGATIVE PROGRAM
CODE EE-9A SCIENCE
INVESTIGATION DISCIPLINE(S) AEONOMY

PERSONNEL
PI - A. DESCAMER
DI - J.R. POTTER
DI - K. MAERSBERGER
U OF MINNESOTA

BRIEF DESCRIPTION
The objective of this experiment was to contribute to a study of the chemical dynamic and energetic processes that control the structure of the thermosphere by providing direct in situ measurements of both major and minor neutral atmospheric constituents having masses in the range from 1 to 48 atomic mass units (u). A double-focusing, Mattauch-Herzog magnetic-deflection mass spectrometer with a high-vacuum source was flown. Two ion collectors were included to measure ions differing in mass by a factor of 81 between the two mass ranges covered were 1 to 6 and 6 to 48 u. In the ion source the neutral species were ionized by means of electron impact. The electron energies were selectable at 75 ev for the high-end and 25 ev for the low-end mode. At altitudes greater than 300 km, ion currents were measured with an electron multiplier. Counts were accumulated for 1/200 s before automatically switching to a different mass number. While complete mass spectra could be swept in the common mode of operation peak stepping was employed resulting in principal peaks in the mass spectrum were repeated approximately every 0.5 s. Counts not detected in this mode were measured using an electron multiplier. In addition to the peak stepping mode, there were several other operating modes which were selected by ground command. In the fast-through mode ambient particles striking the ion source retained energies less than 0.1 ev which was not high enough to overcome the negative space charge potential, holding the ions in the ion source. The instrument particles that did not strike the ion source retained their incoming energy of several ev after ionization and escaped into the acceleration region of the analyzer. Further experiments details can be found in A. D. N. et al., Radio Sci., v. 8, n. 4, p. 271, 1973.

---- AE-4, SPENCER

INVESTIGATION NAME- NEUTRAL ATMOSPHERE TEMPERATURE (NATE)

NSCC ID- 75-107A-09
INVESTIGATIVE PROGRAM
CODE EE-9A SCIENCE
INVESTIGATION DISCIPLINE(S) AEONOMY

PERSONNEL
PI - H.G. SPENCER
DI - G.R. CARIGAN
DI - W.A. NIEUWEN
U OF MICHIGAN

BRIEF DESCRIPTION
This experiment was designed to measure the kinetic temperature of the neutral atmosphere by determining the instantaneous density of molecular nitrogen in a spherical chamber coupled to the atmosphere through a knife-edged orifice. Analysis of the measured molecular nitrogen density variation over a solar cycle with a knowledge of the satellite motion and orientation led to a determination of the ambient temperature independent of scale height. Measurements of the ambient neutral composition were performed by scanning the instrument orifice to cover various spectrometer slit positions. The other 12 monochromators operated at fixed wavelengths with fields of view smaller than the solar disk, to aid in the atmospheric electron analysis. The spectral resolution varied from 2 to 5 A depending upon the particular instrument. The field of view varied from 60 x 60 down to 3 x 3 arc min. All 24 monochromator-entrance axes were co-aligned parallel. A solar pointing system could point to 256 different positions, execute a 16-step one-dimensional scan or a full 256-step raster. The time resolution varied from 0.5 s for observing 12 fixed wavelengths up to 256 s for programming the EUVS through all possible nodes. Further details can be found in N. W. Spencer et al., Radio Sci., v. 8, n. 4, p. 271, 1973.

---- AE-4, NICER

INVESTIGATION NAME- SOLAR IONOSPHERE CLUSTER (SIK)

NSCC ID- 75-107A-07
INVESTIGATIVE PROGRAM
CODE EE-9A SCIENCE
INVESTIGATION DISCIPLINE(S) AEONOMY

PERSONNEL
PI - J.S. MOUNT
DI - G.R. CARIGAN
DI - W.A. NIEUWEN
U OF MINNESOTA

BRIEF DESCRIPTION
The objective of this experiment was to contribute to a study of the chemical dynamic and energetic processes that control the structure of the thermosphere by providing direct in situ measurements of both major and minor neutral atmospheric constituents having masses in the range from 1 to 48 atomic mass units (u). A double-focusing, Mattauch-Herzog magnetic-deflection mass spectrometer with a high-vacuum source was flown. Two ion collectors were included to measure ions differing in mass by a factor of 81 between the two mass ranges covered were 1 to 6 and 6 to 48 u. In the ion source the neutral species were ionized by means of electron impact. The electron energies were selectable at 75 ev for the high-end and 25 ev for the low-end mode. At altitudes greater than 300 km, ion currents were measured with an electron multiplier. Counts were accumulated for 1/200 s before automatically switching to a different mass number. While complete mass spectra could be swept in the common mode of operation peak stepping was employed resulting in principal peaks in the mass spectrum were repeated approximately every 0.5 s. Counts not detected in this mode were measured using an electron multiplier. In addition to the peak stepping mode, there were several other operating modes which were selected by ground command. In the fast-through mode ambient particles striking the ion source retained energies less than 0.1 ev which was not high enough to overcome the negative space charge potential, holding the ions in the ion source. The instrument particles that did not strike the ion source retained their incoming energy of several ev after ionization and escaped into the acceleration region of the analyzer. Further experiments details can be found in A. D. N. et al., Radio Sci., v. 8, n. 4, p. 271, 1973.

---- AE-4, SPENCER

INVESTIGATION NAME- NEUTRAL ATMOSPHERE TEMPERATURE (NATE)

NSCC ID- 75-107A-09
INVESTIGATIVE PROGRAM
CODE EE-9A SCIENCE
INVESTIGATION DISCIPLINE(S) AEONOMY

PERSONNEL
PI - H.G. SPENCER
DI - G.R. CARIGAN
DI - W.A. NIEUWEN
U OF MICHIGAN

BRIEF DESCRIPTION
This experiment was designed to measure the kinetic temperature of the neutral atmosphere by determining the instantaneous density of molecular nitrogen in a spherical chamber coupled to the atmosphere through a knife-edged orifice. Analysis of the measured molecular nitrogen density variation over a solar cycle with a knowledge of the satellite motion and orientation led to a determination of the ambient temperature independent of scale height. Measurements of the ambient neutral composition were performed by scanning the instrument orifice to cover various spectrometer slit positions. The other 12 monochromators operated at fixed wavelengths with fields of view smaller than the solar disk, to aid in the atmospheric electron analysis. The spectral resolution varied from 2 to 5 A depending upon the particular instrument. The field of view varied from 60 x 60 down to 3 x 3 arc min. All 24 monochromator-entrance axes were co-aligned parallel. A solar pointing system could point to 256 different positions, execute a 16-step one-dimensional scan or a full 256-step raster. The time resolution varied from 0.5 s for observing 12 fixed wavelengths up to 256 s for programming the EUVS through all possible nodes. Further details can be found in N. W. Spencer et al., Radio Sci., v. 8, n. 4, p. 271, 1973.
**AEROS, SCHMIDTKE**

**INVESTIGATION NAME: SOLAR EUV RADIATION**

**NSSDC ID: 72-1004-04**

**INVESTIGATIVE PROGRAM:**
CODE EE+VCD-OP, SCIENCE

**INVESTIGATION DISCIPLINE(S):**
AERONOMY
SOLAR PHYSICS

**PERSONNEL**

PI: J. SCHMIDTKE

OI: W. SCHWEIZER

**BRIEF DESCRIPTION**

This experiment consisted of a grating spectrometer, a solar collimator, and a photomultiplier. It operated in 2 channels, 150 to 100 Å and 300 to 1070 Å, and was used to measure the flux and spectral distribution of the solar EUV radiation. The spacecraft was spin-stabilized at 10 rpm and oriented with the spin axis toward the sun. The purpose of the mission was to study the spectral and temporal variations of the solar EUV radiation. An onboard calibration device was included. A description of the instrument can be found in G. Schöffkte et al., J. Geophys. Res., 40, p. 5774, 1974. NSSDC has all the useful data that exist from this investigation.

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**AEROS, SPENCER**

**INVESTIGATION NAME: NEUTRAL GAS TEMPERATURE IN THE THERMOSPHERE**

**NSSDC ID: 72-1004-05**

**INVESTIGATIVE PROGRAM:**
CODE EE+VCD-OP, SCIENCE

**INVESTIGATION DISCIPLINE(S):**
AERONOMY

**PERSONNEL**

PI: J. SPENCER

O1: D. PELZLNL

O2: G. P. NEWTON

O3: R. D. COGAN

O4: H. W. NIEUW

**BRIEF DESCRIPTION**

This experiment was designed primarily to make in situ measurements of the temperature, density, and composition of neutral gas at high altitudes. The spacecraft was placed in an elliptical orbit, with the sun behind it. The instrument measured the temperature and density of neutral gas in the thermosphere. The data were obtained using a specialized instrument designed to measure the temperature and density of the neutral gas in this region. The data were collected using a cold-filament ion source and were analyzed to determine the temperature and density of the neutral gas. The data were then used to verify the models of the thermosphere and to understand the physical processes that govern its behavior. NSSDC has all the useful data that exist from this investigation.

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**AEROS, SPENCER**

**INVESTIGATION NAME: SOLAR EUV RADIATION**

**NSSDC ID: 74-055A-04**

**INVESTIGATIVE PROGRAM:**
CODE EE+VCD-OP, SCIENCE

**INVESTIGATION DISCIPLINE(S):**
AERONOMY
SOLAR PHYSICS

**PERSONNEL**

PI: J. SPENCER

O1: W. SCHWEIZER

**BRIEF DESCRIPTION**

This experiment consisted of a grating spectrometer, a solar collimator, and a photomultiplier. It operated in 2 channels, 150 to 100 Å and 300 to 1070 Å, and measured the flux and spectral distribution of the solar EUV radiation. The spacecraft was placed in a geocentric orbit, with the sun behind it. The instrument measured the temperature and density of neutral gas in the thermosphere. The data were obtained using a cold-filament ion source and were analyzed to determine the temperature and density of the neutral gas. The data were then used to verify the models of the thermosphere and to understand the physical processes that govern its behavior. NSSDC has all the useful data that exist from this investigation.
**INVESTIGATIVE PROGRAM**

**INVESTIGATION DISCIPLINES**

**PERSONNEL**

**BRIEF DESCRIPTION**

This experiment was flown to provide in situ measurements of the kinetic temperature of molecular nitrogen in the thermosphere, the total gas density, and the molecular nitrogen density. The sensor mounted at the spacecraft periphery was a quadrupole mass spectrometer whose ion source was coupled through a high conductivity path to a spherical stainless steel anode chamber, which was open to the atmosphere through a circular knife-edge orifice. The measurement system was designed to provide a digital output that was proportional to the instantaneous density of neutral molecular nitrogen in the spherical anode chamber. Analysis of the measured molecular nitrogen density variation over a spin cycle, with a knowledge of the satellite motion and orientation, led to a determination of ambient temperature independent of scale height. The voltages were periodically changed to permit the measurement of the concentrations of the other neutral gas species, so that the total gas density could be determined. The sensor was vacuum sealed prior to launch and opened in orbit. The electronic system included a pulse counter, data processor, power supplies, and logic. Because of the failure of the on-board tape recorder only 3 weeks of useful data were obtained. The limited data analyzed for AEROS 2 is published in G. Chandra et al. Geophys. Res. Letts. 8, 1267-1270, 1978, and in G. Chandra et al., J. Geophys. Res. 84, 8451, 1979.

-------- AEROS 2, SPINNER ---------

**INVESTIGATION NAME- ENERGY DISTRIBUTION OF IONS AND ELECTRONS**

**NSSDC ID- 74-0054-02**

**INVESTIGATIVE PROGRAM**

**INVESTIGATION DISCIPLINES**

**PERSONNEL**

**BRIEF DESCRIPTION**

A retarding potential analyzer measured the energy distribution of electrons and ions, the corresponding temperatures were derived from these distributions. The experiment operated in an electron mode and in an ion mode. The instrument was essentially a collector shielded by parallel plate sections with the retarding voltage of the grids, the energy spectra of the ionospheric charged particles were obtained. The particles only passed through the grids and reached the collector if their kinetic energy exceeded the retarding potential.

----------- ALLOUETTE 1 ---------------

**SPACECRAFT COMMV NAME- ALLOUETTE 1**

**ALTERNATE NAME- 1962 BETA ALPHA 1a, S 27**

**NSSDC ID- 62-0494**

**LAUNCH DATE- 09/29/62**

**WEIGHT- 145.7 KG**

**LAUNCH SITE- VANDELBERG AFB, UNITED STATES**

**LAUNCH VEHICLE- Thor**

**SPONSORING COUNTRY/AGENCY**

**CANADA**

**UNITED STATES**

**NASA-0554**

**INITIAL ORBIT PARAMETERS**

**ORBIT TYPE- GEOCENTRIC**

**ORBIT PERIOD- 93.5 MIN**

**ORBIT RADIUS- 996, 996 KM**

**INCLINATION- 85.8 DEG**

**PERIAPSIS- 1025, KM ALT**

**PERIAPSIS- 1025, KM ALT**

**PERSONNEL**

**PM- J.E. JACKSON**

**PM- R.E. BRIELEN**

**PS- J.E. JACKSON**

**PS- E.S. WARENDE EASE**

**INVESTIGATION NAME- VLF RECEIVER**

**NSSDC ID- 62-0494-03**

**INVESTIGATIVE PROGRAM**

**INVESTIGATION DISCIPLINES**

**PERSONNEL**

**BRIEF DESCRIPTION**

The purpose of the VLF experiment was to investigate the propagation characteristics of VLF and c.w. VLF signals. This experiment was a wideband high-gain receiver with a bandwidth from 0.4 to 10 kHz using only the longest (457 MHz) sounding antenna. The receiver outputs which sensed the electric field component of the signal strength were maintained constant by means of an AGC Loop. The standard VLF data form was a sonegram (graph) showing signals as a function of time and frequency. Whistlers and radio noise of various origins were observed in this region of radio frequencies. Performance had been normal since launch, except for interference from the sounder which had not prevented observation of useful data. The sounding operation was most frequent but a small percentage of observations were VLF only or both VLF and sounder.

-------- ALLOUETTE 1, MARTZ ---------

**INVESTIGATION NAME- COSMIC RADIO NOISE**

**NSSDC ID- 62-0494-04**

**INVESTIGATIVE PROGRAM**

**INVESTIGATION DISCIPLINES**

**PERSONNEL**

**BRIEF DESCRIPTION**

This experiment utilized the ionosonde receiver automatic gain control (AGC) voltage to measure the galactic radio noise levels. The sweep-frequency receiver covered the range from 0.5 to 12 MHz in 18 steps, but below 5 MHz the system response dropped off rapidly. The receiver had a noise figure of 15 db, a bandwidth of 33 kHz, and a dynamic range of 50 db. The antennas were two orthogonal dipoles, 45.7 and 22.6 MHz, located orthogonal to the spacecraft spin axis. The experiment functioned satisfactorily, providing relatively good frequency resolution with relatively poor flux resolution.

----------- ALLOUETTE 1, MIDIAIMID ---------------

**INVESTIGATION NAME- ENERGETIC PARTICLES DETECTORS**

**NSSDC ID- 62-0494-02**

**INVESTIGATIVE PROGRAM**

**INVESTIGATION DISCIPLINES**

**PERSONNEL**

**BRIEF DESCRIPTION**

This experiment consisted of six detectors whose objectives were to determine the intensity structure of the line-of-sight component of the energetic particle fluxes and measure the intensity changes associated with solar and geophysical phenomena, particularly auroras. The first six months of operation was flown in a latitude range of 3.5-3.5 degrees, and was used only for omnidirectional measurements of protons and electrons with energies greater than 33 and 2.8 MeV.

26
respectively. An Anton 223 Geiger counter, which pointed 10 deg off the spacecraft spin axis, responded directionally to electrons and protons with energies greater than 40 and 350 keV, respectively. A second Anton 223 Geiger counter, pointed parallel to the spacecraft spin axis and coupled to a magnetic baffle, responded directionally to electrons and protons with energies greater than 250 and 300 keV. Coincidently, both Geiger counters were tuned to electrons and protons with energies greater than 2.8 and 33 MeV, respectively. The fourth detector, a silicon junction, was collimated to look off the spacecraft spin axis and responded directionally to electrons and protons with energies greater than 1.3 and 7.4 keV. Coincidently, the silicon junction responded to protons in the energy range 55 to 60 MeV. The last two detectors, a Geiger telescope consisting of two tracts of polonium-210, and a scintillating screen and a plastic scintillator located between the two Geiger counter tracts of the telescope, were placed perpendicular to the spacecraft spin axis. These detectors had only directional responses to protons and alpha particles with energies greater than 100 and 400 MeV, respectively. This experiment performed well initially and was turned off on January 29, 1969, still performing normally. No alpha particle data were obtained from this experiment.

**ALOETTE 1, WAVERECORDING**

**INVESTIGATION NAME: SWEEP-FREQUENCY SOUNDER**

**NSDC ID: 62-099A-01**

**INVESTIGATIVE PROGRAM CODE: CE-66**

**INVESTIGATION DISCIPLINE(S): IONOSPHERES AND RADIO PHYSICS**

**PERSONNEL**

| PI | L.J. WARENMUDE | DOC-CRC |
| PI | D.B. MULDER | DOC-CRC |
| PI | J.R. WHITAKER | DOC-CRC |
| PI | L.E. JACOBY | NASA-GSRC |
| PI | L. COLIN | NASA-ARC |
| PI | R. KING | RUTHERFORD/APPLON LAB |
| PI | R.W. KNIGHT | NAV BUREAU OF STD |
| PI | G.L. NELMS | DOC-CRC |

**BRIEF DESCRIPTION:** The purpose of the sweep frequency sounder was to conduct synoptic measurements of the electron density distribution in the ionosphere at altitudes between 300 and 1000 km. The investigation consisted of a radio transmitter/receiver that recorded the time delay between a transmitted and returned radio pulse. A continuum of frequencies between 0.5 and 15 MHz was used every 10 s. Variations of the time delay were observed for each frequency due to ground reflections, plasma response, and the propagation path. The standard data form was an ionogram (graph) showing time (vertical distance of signal reflection from the satellite) vs frequency. Variations were recorded for about 6 h per day. The experiment provided data for 10 full years.

**ALOETTE 2, BACRECORDING**

**SPACECRAFT COMMON NAME: ALOETTE 2**

**ALTERNATE NAMES: ALOETTE-II, S JEB**

**NSDC ID: 65-099A**

**LAUNCH DATE: 11/27/65**

**WEIGHT: 146 KG**

**LAUNCH SITE: VANENBURG AFB, UNITED STATES**

**LAUNCH VEHICLE: IMOR**

**SPONSORING COUNTRY/AGENCY**

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**INITIAL ORBIT PARAMETERS**

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**PERSONNEL**

| PI | J.R. WARENMUDE | NASA-GSRC |
| PI | D.B. MULDER | DRD-DRTN |
| PI | L.E. JACOBY | DRD-DRTN |
| PI | J.L. NELMS | NASA-GSRC |

**BRIEF DESCRIPTION:** ALOETTE 2 was a small ionospheric observatory instrumented with a sweep-frequency ionospheric sounder and a VLF receiver on two directional responses to protons and alpha particles, and an electrostatic probe. The spacecraft used two dipole antennas (73 MHz to 22 kHz, respectively) for the sounder and VLF and cosmic noise experiments. The satellite was spin-stabilized at about 2.25 rpm after antenna deployment.
INVESTIGATION NAME- ENERGETIC PARTICLE DETECTORS

NSSDC ID- 65-DPYA-04

INVESTIGATIVE PROGRAM
CODE EC-4: SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - I. B. MCDIARMID

BRIEF DESCRIPTION
The purpose of the energetic particle experiment was to
investigate the Van Allen radiation belt at high latitudes.
The Alouette 2 energetic particle experiment was composed of
seven detectors. Four of these were Geiger-Mueller (GM) tubes.
The first responded to electrons greater than 3.5 MeV and
protons greater than 40 MeV. The second had a magnetic screen
and responded to electrons greater than 250 keV and protons
greater than 500 keV. The third responded to electrons greater
than 40 keV and protons greater than 500 keV. The five GM
tubes were perpendicular to the spin axis. The fourth GM tube
was 40 deg from the spin axis and responded to electrons
greater than 40 keV and protons greater than 500 keV. The
fifth detector was a silicon junction that detected protons and
alpha particles with minimum energies of 1 and 5 MeV
respectively, and maximum energies of 8 and 24 MeV
respectively. The sixth detector was a Geiger telescope that
detected protons greater than 150 MeV. The seventh detector
was a plastic scintillator that determined the proton spectra
in the energy range from 100 to 600 MeV. Particles associated
with auroral and solar events were studied. No alpha particle
data were obtained from this experiment.

ALOUETTE 2, WARREN

INVESTIGATION NAME- SWEET-FREQUENCY SOUNDER

NSSDC ID- 65-DPYA-01

INVESTIGATIVE PROGRAM
CODE EC-4: SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - E. J. WARRENOODEACSON

BRIEF DESCRIPTION
The purpose of the sweet-frequency sounnder experiment was
to extend the Alouette 1 measurements to higher altitudes
(3000 km) and to a different period of the solar cycle. The Alouette
2 sounnder was also designed to provide greatly improved
observations of plasma resonances. The sweet-frequency
sounnder was a radio transceiver/receiver that recorded the
time delay between a transmitted and received radio frequency
signal. A continuum of frequencies between 6.12 and 14.5 MHz
were sampled once every 30 s. A multiplicity of delay times
was usually observed due to interference of the ionosphere,
nonvertical propagations, ground echoes, plasmasphere
resonances, etc. Delay time was primarily a function of distance
to the satellites, electron density along the propagation path
and mode of propagation. The standard data form is an
ionogram (graph) showing delay time (virtual distance of signal
depletion). The electron density, the electron temperature,
and/or virtual height values of characteristic ionospheric
features and computations of electron density profiles.

ARIEL II

SPACECRAFT COMMON NAME-ARIEL II

ALTERNATE NAMES- S 51.

NSSDC ID- 62-015A

LAUNCH DATE- 26/7/62
WEIGHT- 62.2 KG

LAUNCH SITE- CAPE CAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA/GSFC

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
ORBIT PERIOD- 105.86 MIN
PERIAPSIS- 138.565 X 10^6
APOAPSIS- 112.1 X 10^6

PERSONNEL
PI - H. ELLIOT

BRIEF DESCRIPTION
The experiment was designed to study the primary cosmic-ray
energy spectrum with 204 and 205Ag using a cylindrical
Cerenkov counter and an Anton type 322 Geiger tube detector
used for background counting. The detector accumulators
were read every 31.5 s. The initial spacecraft spin period
was 1.37 s. The experiment performed normally from launch to July 31, 1962,
after which it was lost. The detector was reconditioned, and
投产于 1962, after which no further information was received. For
further details, see A. J. Dorney et al., "Energy spectrum of the

ARIEL II

INVESTIGATION NAME- RADIO FREQUENCY CAPACITANCE PROBE

NSSDC ID- 62-015A-01

INVESTIGATIVE PROGRAM
CODE EC-4: SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - P. J. SAYERS

BRIEF DESCRIPTION
This experiment consisted of a capacitance probe used to
observe the density of thermal electrons in the ionosphere.
The probe consisted of two flat circular wire mesh plates
placed parallel to each other. It could observe electron
number densities from 1,000 to 3,000 electrons/cm^3.
The performance was nominal until July 9, 1962, after which time
the instrument failed and was not collected and of degraded quality.
The last useful data were received on
July 31, 1962, prior to failure of the tape recorder.
Ariel 3 was designed to continue and extend the previous UK satellite investigations in space. The spacecraft consisted of a 57-cm-high, 12-sided prism with 6.6 cm between any pair of parallel sides. A 24.2-cm-high central structure bearing various antennas was mounted on the lower end of the prism, four paddles extended diagonally downward at an angle of 25 deg from the spin axis normal. Two solar cells were arranged on the outer end of the paddles. The paddles also served as mounts for some of the instruments. Solar cells for power generation were also wired in on the sides of the prism and the paddles. The spacecraft was initially spin stabilized at about 30 rpm and slowed to about 12 rpm by the end of the first year. In one flight the spin rate was raised to 59 rpm. The tape recorder was included to obtain data for global surveys of observed various phenomena. Experiment output for one orbit could be recorded in a low-speed mode, with one complete set of sensor data each 0.5 s. A high-speed mode of operation provided for recording a complete set of sensor data every 30 s. The data were dumped in 140 s in the high-speed mode. On October 24, 1967, the tape recorder began to malfunction. It operated sporadically until its complete failure on February 6, 1968. Real-time operation provided data until a satellite power failure in December 1968 restricted operation to daylight hours only. By April 1969, operations had decreased to about 15 passes per week, and observations were made only from Winfield, England. At this time the satellite spin had decayed to 1 rpm. The satellite was turned off in September 1969 and decayed on December 14, 1970.

-------- ARIEL 3 SAWERS -----------

INVESTIGATION NAME- LAMUER PROBE

NSSDC ID- 67-042A-01

INVESTIGATIVE PROGRAM

CODE EE-6 SCIENCE

INVESTIGATION DISCIPLINE(S)

IODPHENES AND AERONOMY

PERSONNEL

PI - J. R. SAWERS

U OF BIRMINGHAM

BRIEF DESCRIPTION

Electron temperatures were determined by employing an extension of the Langmuir probe technique. Two identical rhodium-plate spherical probes, 2.2 cm in diameter and with a 6.4 cm center-to-center distances were linearly swept from 6.0 to 16.2 Hz in 5.0 Hz. The sweep voltage was modulated by a low-voltage sine wave which caused a significant change in the ion temperature. However, the measurements were of slight potentials with respect to the spacecraft. The differential currents to each probe were compared and automatically kept in a fixed ratio by adjustment of this voltage difference between the two probes. Under these conditions, the electron temperature was a function of this known ratio and the value of the voltage difference as the probes were swept. For the recording region the experiment was operated for 5.2 s and then turned off at approximately the same amount of time while the electron density experiment was turned on. The experiment operated normally, and useful data were obtained. A more detailed explanation of the experiment can be found in J. R. Wagner, "University of Birmingham electron temperature and temperature experiments on the satellite Ariel 3", Radio and Electronic Engineering, Vol. 35, 1st. pp. 55-62, January 1966.

-------- ARIEL 3 SAWERS -----------

INVESTIGATION NAME- RATIONAL FREQUENCY CAPACITANCE PROBE

NSSDC ID- 67-042A-06

INVESTIGATIVE PROGRAM

CODE EE-6 SCIENCE

INVESTIGATION DISCIPLINE(S)

IODPHENES AND AERONOMY

PERSONNEL

PI - J. R. SAWERS

U OF BIRMINGHAM

BRIEF DESCRIPTION

Electron density determinations were made by measuring the permittivity across a parallel-plate capacitor. The capacitor, composed of two circular grids 7.6 cm in diameter and 5.1 cm apart, was operated for 29.9 MHz. The electron density could be obtained from the observed permittivity when these grids were at space potentials. At the time the potential on the grids would be equal to the space potential, a linear sweep voltage from 0 V to 6 V was applied to the sensor in order to determine the space potential, when the area between the grids was filled with ambient electrons, was measured in terms of the current flowing between the two electrodes. The experiment was operated for 5.2 s and
then turned off for the same amount of time as the electron experiment was turned on. There were two outputs: one, low speed to a tape recorder and the other high speed real time, available on one channel only, while on the other channel the maximum values of each sweep were tape recorded while the entire sweep could be read out in real time. The experiment operated normally and useful data were obtained. A more detailed explanation of the experiment can be found in J. H. Wagner, University of Birmingham electron density and temperature experiments on the satellite Ariel 3." Radio and Electronic Engineering, 35. 3. 1. pp. 55-63. January 1968.

----- ARIEL 5, STEWART-----

INVESTIGATION NAME- MOLECULAR OXYGEN DISTRIBUTION
NSSDC ID- 67-0423-03 INVESTIGATIVE PROGRAM CODE EE-6, SCIENCE
INVESTIGATION DISCIPLINE(s) AERONOMY
PERSONNEL PI = K. H. STEWART METEOROLOGICAL OFFICE

BRIEF DESCRIPTION
The experiment was designed to measure the concentration of molecular oxygen in the earth's atmosphere at heights from 100 km to about 300 km, with wide geographic coverage. At these heights, solar ultraviolet light (1425 to 1490 Å) is strongly absorbed by molecular oxygen and relatively unaffected by any other atmospheric gas. Hence, by measuring the attenuation of solar ultraviolet light as the satellite entered and left the earth, the distribution of molecular oxygen in the atmosphere could be deduced. The sensors consisted of a high sensitivity, high-fidelity photomultiplier tube that was fed to the geometrical telescope. The instrument was mounted on the top of the satellite with the solar panel attached at right angles to each other so that the light beam from each sensor could be placed into the high-fidelity photomultiplier. The experiment was a success in spite of the radio degradation of the sensors under the action of solar radiation. The observed half-life of 20 days was the first predicted as a result of the observations made by the satellite. For a further description of the experiment see K. H. Stewart and P. L. Wilson. "Preliminary results of molecular oxygen measurements from the Ariel III satellite." Proc. Roy. Soc. A. 311, pp. 591-603. 1969.

-------- ARIEL 4, FRANK--------

INVESTIGATION NAME- LOW ENERGY PROTON AND ELECTRON DIFFERENTIAL ENERGY ANALYZER (LEPEDEA)
NSSDC ID- 71-1094-04 INVESTIGATIVE PROGRAM CODE EE-8/CO-06, SCIENCE
INVESTIGATION DISCIPLINE(s) PARTICLES AND FIELDS
PERSONNEL PI = L. A. FRANK U OF IOWA
01 = J. C. CRANEY U OF IOWA
02 = O. W. YEAGER (NL) U OF IOWA
03 = H. A. SCHIELD U OF IOWA

BRIEF DESCRIPTION
A Low-Energy Proton and Electron Differential Energy Analyzer (LEPEDEA) measured the differential energy spectra of protons and electrons in the energy range 5 keV to 50 keV, at low altitudes within the outer radiation zone and over the auroral zones and polar caps. The angular distribution and temporal variations of these particles were also considered. The data obtained were correlated with data from the onboard VL and plasma experiments. The LEPEDEA was composed of curved plate electrostatic analyzers and continuous channel multipliers and had 45 energy channels. The detector also had an Ion Type 213 Geiger-Mueller tube with collimated field of view directed parallel to those of the LEPEDEA to provide background measurements for the LEPEDEA channels and to survey directional intensities of protons (350 keV) and electrons (150 keV). The experiment operated properly from start to April 29, 1972, when a transistor failure caused certain energy levels and experiment mode identification to be lost in the high-speed telemetry. However, all but one of the details of the high-energy electron intensities were lost due to the lower temporal resolution.

-------- ARIEL 4, KAISSER--------

INVESTIGATION NAME- VLF-ELF RECEIVER
NSSDC ID- 71-1094-03 INVESTIGATIVE PROGRAM CODE EE-8/CO-06, SCIENCE
INVESTIGATION DISCIPLINE(s) IDSOPHONICS AND RADIO PHYSICS
PERSONNEL PI = T. R. KAISSER U OF SHEFFIELD

BRIEF DESCRIPTION
Seven low-noise band-pass amplifiers (channels) were used to measure very low frequency (VLF) propagation. Three channels, each of 1 kHz bandwidth, were centered on 3.25 kHz and 16 kHz. Another channel centered on 16 kHz with a 100 Hz bandwidth was used to study the continuous wave signal strength from the Rugby transmitter in Great Britain. Two channels were centered on 2.75 and 2.25 kHz, each with a bandwidth of 0.50 kHz. A seventh channel at 17.8 kHz (continuum reading) was found suitable for observation of the NAA propagation. Some channels, peaks, means, and minimum intensities were measured in successive 28-s sampling intervals. A multturn receiving antenna was included.

-------- ARIEL 4, SMITH--------

INVESTIGATION NAME- MW BAND NOISE (E FIELD)
NSSDC ID- 71-1094-02 INVESTIGATIVE PROGRAM CODE EE-8/CO-06, SCIENCE
INVESTIGATION DISCIPLINE(s) IDSOPHONICS AND RADIO PHYSICS
PERSONNEL PI = F. C. SMITH U OF CAMBRIDGE
01 = A. DALZIEL RIVOUTH/RAD/APP/ATLAB
02 = D. JAMES U OF MANCHESTER

BRIEF DESCRIPTION
A radio receiver operated either at a fixed frequency, 2.1 MHz, or in a sweep frequency mode, 2.25-4.30 MHz, 16-s sweep rate, recorded the galactic radio noise received by a 15-meter dipole.

-------- ARIEL 4, WILLMORE--------

INVESTIGATION NAME- LANGMUIR PROBE
NSSDC ID- 71-1094-01 INVESTIGATIVE PROGRAM CODE EE-8/CO-06, SCIENCE
INVESTIGATION DISCIPLINE(s) AERONOMY IDSOPHONICS
BRIEF DESCRIPTION

The electron density measurements were obtained using a double Langmuir probe (capacitance probe) consisting of two planar, rectangular grids operated at a probing frequency of 39 MHz. The dc potential of the grids was swept relative to the satellite potential. Two logarithmic amplifiers were used, and electron densities were measured from 10^6 to 10^11 electrons/cubic meter. Further details can be found in C. V. Goddard et al., “Topside ionosphere electron density measurements on Ariel 4,” Occ. Royal Soc. vs A349, p. 189, 1975. The electron temperature measurements were based on a modified Langmuir probe technique. Two probes were used. A constant ratio of current difference between the probes was maintained by automatic adjustment of the voltage difference between the probes.

*************** COSMOS 49 ****************

SPACECRAFT COMMON NAME= COSMOS 49
ALTERNATE NAMES- 00913
NSDC ID- 64-069A
LAUNCH DATE- 10/24/64
WEIGHT= 400, KG
LAUNCH SITE- KAPUTIN YAR, U.S.S.R.
LAUNCH VEHICLE= B-1
SPONSORING COUNTRY/AGENCY
U.S.S.R.

INITIAL ORBIT PARAMETERS

ORBIT TYPE- GEODETIC
ORBIT PERIOD- 91.8 MIN
PERIAPSIS- 264, KM ALT

PERSONNEL
PM = UNKNOWN
PS = UNKNOWN

BRIEF DESCRIPTION

Cosmos 49 was instrumented with proton magnetometers to map the earth's magnetic field. This spacecraft, along with Cosmos 26, represented a U.S.S.R. contribution to the 1965 World Magnetic Survey. The corresponding U.S. measurements were performed by BGS 2 and CBG 4. The shape of the spacecraft was almost an ellipsoid and measured 1.5 m long and 1.2 m in diameter. A boom 3.3 m long was attached to one end of the spacecraft to the magnetometers. The performance of the spacecraft was satisfactory.

------- COSMOS 49, DOLGINOV----------

INVESTIGATION NAME- PROTON PRECEDENTIAL MAGNETOMETERS

NSDC ID- 64-069A-01
INVESTIGATIVE PROGRAM
SCIENCE
INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI = SM. SM. DOLGINOV
01 = V.L. NALIVAYKO

BRIEF DESCRIPTION

The Cosmos 49 spacecraft carried two proton magnetometers with the axes of their polarized-coils oriented perpendicular to each other. An onboard timer turned on the two magnetometers alternately and a measurement was obtained every 32.76 s. The magnetometer signals were digitized by measuring the number of cycles from a 100-kHz reference quartz oscillator, which occurred during 512 cycles of the proton precession signal. The measured scalar total field values along with time signals were stored in a memory device, which stored up to 800 min of data. The data were then read out as the spacecraft flew over the receiving stations. The experiment performed satisfactorily, and the reported accuracy of the data was within 2 nT (gammas).

*************** COSMOS 321 ****************

SPACECRAFT COMMON NAME= COSMOS 321
ALTERNATE NAMES- 04358
NSDC ID- 70-006A
LAUNCH DATE- 01/20/70
WEIGHT= 400, KG
LAUNCH SITE- PLESETSK, U.S.S.R.
LAUNCH VEHICLE= B-1

SPONSORING COUNTRY/AGENCY
U.S.S.R.

BRIEF DESCRIPTION

This experiment measured trapped electrons and protons using two different energy spectrometers. One proton detector with an angular aperture of 60 deg (geometric factor of 0.3 sq cm sr) covered the energy range 1 to 3 MeV and the other proton detector with a 15-deg angular aperture (geometric factor of 0.008 sq cm sr) covered the range 85 to 130 keV. The electron detector with an angular aperture of 15 deg (geometric factor of 0.033 sq cm sr) covered the range 85 to 125 keV. The angle between the two detectors was 0.5 deg or minus 10 deg.
SPACECRAFT COMMON NAME- DISCOVERER 25
ALTERNATE NAMES- 1961 XI 1, 0108

NSSDC ID- 61-0144
LAUNCH DATE- 06/16/61
WEIGHT- 1150 KG
LAUNCH SITE- VANSDERG AFRL, UNITED STATES
LAUNCH VEHICLE- TITAN

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD- USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 06/17/61
ORBIT PERIOD- 95.87 MIN
INCLINATION- 82.15 DEG
PERIAPSE- 222. KM ALT
APOAPSE- 45.5 KM ALT

PERSONAL
PI- UNKNOWN
PS- UNKNOWN

BRIEF DESCRIPTION

Discoverer 25 was launched by the U.S. Air Force Ballistic Missile Division (AFMD) as part of a program to evaluate spacecraft design changes and to provide a stable platform for developing and testing various space experiments. The spacecraft carried instrumentation on board to measure cosmic radiation, atmospheric pressure, and micrometeoroid impacts. The spacecraft also contained samples of both rare earth and common metals in order to study the effects of cosmic radiation on various materials. The spacecraft consisted of a cylindrical section (approximately 6 m long and 1.5 m in diameter) equipped with a liquid propellant rocket engine, propellant tanks, and several cone-shaped telescopes. Once in orbit, the satellite could be reoriented in a nose-down position facing earthwards. The nose cone could be separated from the spacecraft while in orbit. The cone was equipped with retro-rockets to slow it down and allow for reentry. The spacecraft performed normal maneuvers after launch. The nose cone separated on orbit number 33 (June 16, 1961) and was successfully recovered in the ocean that same day. The satellite itself was burned up during reentry on July 12, 1961.

********** DISCOVERER 25, PC0105AC **********

INVESTIGATION NAME- AEROSPACE DENSITY (DENSIY GAUGE)

NSSDC ID- 61-0144-03
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM
INVESTIGATION DISCIPLINE(S)
AERODYN

PERSONAL
PI- J.P. MCISAAC
PS- USAF GEOPHYS LAR

BRIEF DESCRIPTION

The Discoverer 25 Aerospace density experiment was designed to yield atmospheric pressure and densities between approximately 125 to 250 km above the earth's surface. The experiment consisted of a single manometer gauge and associated telemetry. The experiment performed successfully and produced good data during the spacecraft's 2-day lifetime.

********** DME-4 **********

SPACECRAFT COMMON NAME- DME-4
ALTERNATE NAMES- EXPLORER 31, IS5-X, 01086, S 30A

NSSDC ID- 65-0988
LAUNCH DATE- 11/29/65
WEIGHT- 99.0 KG
LAUNCH SITE- VANSDERG AFB, UNITED STATES
LAUNCH VEHICLE- TITAN

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 11/30/65
ORBIT PERIOD- 24.4 MIN
INCLINATION- 79.0 DEG
PERIAPSE- 505.0 KM ALT
APOAPSE- 2978.0 KM ALT

PERSONAL
PM- E. W. NELSON
PS- J.J. JACKSON

BRIEF DESCRIPTION

Explorer 31 was a small ionospheric observatory instrumented to make direct measurements of selected ionospheric parameters at the spacecraft. It carried seven experiments: Thermal Ion, Ion Energy, Experiment; a thermal electron experiment; an electrostatic probe, an electron temperature probe; a spherical mass spectrometer, an energetic electron current monitor, and a magnetic ion mass spectrometer. Since the spacecraft had no tape recorder, data could be observed at the spacecraft only normally when the spacecraft was in sight of the telemetry station and when commanded. Experiments were operated either simultaneously or sequentially as desired. The satellite was spin-stabilized with the spin axis perpendicular to the orbit plane. Spin rate and spin axis were controlled by an onboard magnetic torquing system. The attitude and spin rate information were observed by a sun sensor and a three-axis magnetometer. Satellite performance was satisfactory except for a partial power failure in May 1966, which reduced data acquisition time to about half the normal amount. Some difficulties were encountered in obtaining attitude information that was necessary for the reduction of the experiment observations. On July 11, 1969, the satellite's data observations were terminated with five of the seven experiments operating. Responsibility for standby was passed on to the state-of-the-art ionosphere from the telemetry station at Boulder, Colorado, on July 8, 1965. During this standby operation, experiment data were collected only once on October 11, 1969, for 9 min from the electrostatic probe. In studying a red arc event. On January 15, 1971, no response was received from a variety of satellite commands, and the satellite was abandoned.

********** DME-6 BRAKE **********

INVESTIGATION NAME- CYLINDRICAL ELECTROSTATIC PROBES

NSSDC ID- 65-0988-02
INVESTIGATIVE PROGRAM
CODE EE-6, SCIENCE
INVESTIGATION DISCIPLINE(S)
AERODYN

PERSONAL
PI- J.L. DONLEY
PS- NASA-GSFC

BRIEF DESCRIPTION

The cylindrical electrostatic probes were used to measure electron temperature and density in the ionosphere. Each sensor was basically a Langmuir probe consisting of a collector electrode and an extension from the central axis of a cylindrical guard ring. The grid rings extended 25 cm from the spacecraft and the collector electrode extended 46 cm. The two sensors were mounted on opposite sides of the satellite and were perpendicular to the spin axis and in the orbit plane. Data sets are no longer available from this experiment.

********** DME-6 DONLEY **********

INVESTIGATION NAME- THERMAL ION PROBE

NSSDC ID- 65-0988-01
INVESTIGATIVE PROGRAM
CODE EE-6, SCIENCE
INVESTIGATION DISCIPLINE(S)
AERODYN

PERSONAL
PI- J.W. MAIER
PS- NASA-GSFC

BRIEF DESCRIPTION

The purpose of the thermal ion probe experiment was to measure ion density, temperatures, and composition at the satellite. The sensor consisted of a planar ion trap with three circular mesh grids and a collector, with the innermost suspension grid maintained at -15 V to exclude electrons and the middle retarding grid swept from 0 to -6.3 V. The resultant ionic current-voltage characteristics were interpreted to obtain ion temperature, ion composition, and density. Determination of these parameters was made by curve matching during various ion energies and assuming that the model with the least rms residual was correct. The associated electronics were shared with experiment 65-0988-06. Further details are given in J.L. Donley, "The thermal ion and electron trap experiments on the Explorer XXI satellites" Proc. IEEE, v. 57, n. 6, pp. 1061-1067. June 1969, NSSDC has all the useful data that exist from this investigation.

********** DME-6 DONLEY **********

INVESTIGATION NAME- THERMAL ELECTRON PROBE

NSSDC ID- 65-0988-26
INVESTIGATIVE PROGRAM
CODE EE-6, SCIENCE
INVESTIGATION DISCIPLINE(S)
AERODYN

PERSONAL
PI- J.W. MAIER
PS- NASA-GSFC

BRIEF DESCRIPTION

The purpose of the thermal electron probe experiment was to measure the electron density and temperature at the satellite. The instrumentation was a modified Langmuir probe in which unwanted ion and photo-current components were eliminated through the use of a grid with appropriate bias. The grid was mounted flush with the satellite surface and it received a sweep voltage of from -5 to +4 V. The collector was biased at +25 V. From the measured current-voltage data the electron density could be obtained with an accuracy of about
206. The electron temperature could normally be obtained with an accuracy of about 150 deg K but a computer curve-fitting analysis improved the accuracy to about 10 deg K. The associated electronics were shared with experiment 65-0980-01.

Further details can be found in J. L. Conley, "The thermal ion and electron temperature experiments on the Explorer X11I satellite," Proc. IEEE 57, 6a pp. 1061-1067, June 1969. NSDC has all the useful data that exist from this investigation.

-------- DME-A HOFFMAN-----------

INVESTIGATION NAME- MAGNETIC ION-MASS SPECTROMETER
NSDC ID- 65-0980-05
INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE
INVESTIGATION DISCIPLINE(S) - AERONOMY

PERSONNEL
PI - J.L. HOFFMAN
U OF TEXAS, DALLAS

BRIEF DESCRIPTION
A magnetic sector field mass spectrometer was used to measure the abundances of the ionospheric positive ion species in the mass range 1 to 20 atomic mass units. The mass range was swept every 3 s by an exponentially increasing accelerating voltage, which varied from 400 to 1500 volts. The ions were separated according to mass-charge ratio in the magnetic analyzer section of the spectrometer. A particular ion species, depending on the accelerating voltage, was then passed through the analyzer into an electron multiplier. The output ion current from the multiplier was measured by a logarithmic amplifier and converted to a voltage. The experiment operated normally and yielded useful data from launch on November 29, 1965, until about April 1967. Then low battery voltage resulted in a voltage regulator problem. The experiment provided useful data only intermittently after that, and it failed in March 1968. NSDC has all the useful data that exist from this investigation.

-------- DME-A MAIER-----------

INVESTIGATION NAME- ENERGETIC ELECTRON CURRENT MONITOR
NSDC ID- 65-0980-07
INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE
INVESTIGATION DISCIPLINE(S) - AERONOMY

PERSONNEL
PI - J.L. MAIER
NASA-GSFC

BRIEF DESCRIPTION
The purpose of this experiment was to measure the electron energy spectrum in the suprathermal energy range of 0.2 to 2000 eV. The two-grill retarding potential analyzers were used, one providing analog data in the 0.2 to 2000 eV range and the other providing digital data in the 0.2 to 2000 eV range. The two analyzers had separate power supplies and associated electronics. The instrumentation for the energy measurement included an electron multiplier and a digital pulse counter system. Because of moisture contamination of the detector for the analog monitor prior to launch, the gain of the electron multiplier was so degraded that no geophysical measurements could be obtained. The instrumentation for the analog measurement included an electron multiplier. The analog data were plots of the measured current-voltage function. The analog experiment yielded excellent data for 4 months, after which the experiment deteriorated because of radiation damage to its circuitry. Further details of the analog and digital instruments are presented in J. L. Maier. "Explorer X11I total current monitor experiments," Proc. IEEE, v. 57, n. 6, pp. 1068-1071, June 1969. NSDC has all the useful data that exist from this investigation.

*************** DYNAMICS EXPLORER 1 **************

SPACECRAFT COMMON NAME - DYNAMICS EXPLORER I
ALTERNATE NAMES- DE-A, DE 1
DYNAMICS EXPLORER- 1

NSDC ID- 81-0724
LAUNCH DATE- 06/08/81
WEIGHT- 404, KG
LAUNCH SITE- VANCOUVER AFB, UNITED STATES
LAUNCH VEHICLE- DELTA
SPONSORING COUNTRY/AGENCY- UNITED STATES
SPONSORING AGENCY- NASA-CSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
ORBIT PERIOD- 149.8 MIN
PERIODS- 567.6 KM ALT

EPHEMERIS- 6/08/81
INCLINATION- 90.9 DEG
APOLLYS- 23284, KM ALT

PERSONNEL
PM = J.P. CORRIGAN
PM = J.A. HOFMANN
PS = J.L. HOFFMAN

INVESTIGATION NAME- MAGNETOSPHERIC PHYSICS
INVESTIGATION DISCIPLINE(S) - PARTICLES ANDATMO.

PERSONNEL
PI = J.L. BURCH
PI = J.L. WINGHAM
PI = J.D. KLUKMAN
PI = J.M. REIFF

INVESTIGATION NAME- HIGH ALTITUDE PLASMA INSTRUMENT
INVESTIGATION DISCIPLINE(S) - MAGNETOSPHERIC PHYSICS

PERSONNEL
PI = J.L. BURCH
PI = J.D. WINGHAM
PI = J.D. KLUKMAN
PI = J.M. REIFF

BRIEF DESCRIPTION
The High Altitude Plasma Instrument (HAPI) consisted of an array of five electrostatic analyzers capable of making measurements of the phase-space distributions of electrons and positive ions in the energy range from 5 KeV to 2 keV as a function of pitch angle. This investigation provided data contributing to the solution of (1) the total and energy density of the solar wind and energy of the solar wind, (2) the dynamic configuration of high-altitude magnetic field lines, (3) auroral particle source regions, and solar wind interactions, (4) the role of the solar wind and solar wind interactions, (5) the sources and the effect of the solar wind on the auroral clefts, (6) the transport of plasma within and through the magnetosphere, (7) wave-particle interactions, and (8) hot-plasma plasma interactions. This instrument consisted of five identical detector heads, each having an electrostatic analyzer of the ISIS 2 type and two sensors (one electron channel and one ion channel). The detector heads were mounted on the main body. One of the detector heads was mounted in the spin plane, the other offset by plus and minus 120 and two were offset by plus and minus 45 deg. One detector swept within a few deg of the feld line due to the rotation of the spacecraft; the magnetometer field was greatly deviated from its meridian plane. The basic mode of operation provided a 32-point energy spectrum for each of the two sensors. The electrostatic analyzers were programmable to allow for operation over limited portions of the energy spectrum, or at higher line interactions, with reduced energy resolution. The energy resolution was 32%. The angular resolution was 2.5 deg Full W (in the plane of the detector), by 10 deg in the plane. The data collected were found in J. L. Burch et al., Space Sci. Instrum. v. 5, n. 4, p. 455, 1981.
The spatial resolution of a pixel (picture element) at auroral altitudes in the nadir direction was 28 km at a spacecraft altitude of 1 earth radius (Re). At this altitude the spatial resolution was 109 km. For each photometer, the time resolution was minutes per image. For visible wavelengths, the photometers had a wide-angle scanning mirror; a mirror-drive motor; a quartz field lens; an imaging-assembly field-stop; pinhole and collimating lens; a narrow-band interference filter; and a small photomultiplier tube with an extended red photocathode. The vacuum ultraviolet (VUV) photometer was a spin-scan Newtonian telescope. The first optical element was an aluminum scanning mirror with a MgF2 overcoat. The collimation and steering mirrors were similar to the mirror used in the visible imaging photocathode. A filter wheel with MgF2, CaF2 and RbF filters allowed global imaging from 1370 to 1700 Å, at 1350, 1550, and 1536 Å. A G1 detector was a photomultiplier tube with a CsI photocathode and a MgF2 window. Additional details are found in A. Frank et al., Space Sci. Instrum., v. 5, n. 4, p. 369, 1981.
INVESTIGATION NAME: PLASMA WAVES

NSSDC ID: 81-0704-02

INVESTIGATIVE PROGRAM CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERIC AND RADIO PHYSICS PARTICLES AND FIELDS MAGNETOSPHERIC PHYSICS

PERSONNEL
P1 - T. EvAN SHAWAN U OF IOWA
P2 - D.A. GURNEY U OF IOWA

BRIEF DESCRIPTION
The Plasma Wave Instrument (PWI) measured electric field fluctuations in the frequency range from 1 Hz to 2 MHz and an amplitude of 0.03 microvolt per meter to 100 millivolts per meter. Magnetic field measurements were made from 0 to 50 kHz. A dipole antenna is oriented approximately 100° off range. The objectives of this investigation were to measure the spatial, temporal, spectral, and wave characteristics of the Poincaré vector component along the magnetic field line and the wave polarization for extremely low-frequency (ELF), very-low-frequency (VLF), and high-frequency (HF) noise phenomena. Of special interest were the auroral kilometric radiation (AKR) and a variety of electrostatic waves that may cause field-aligned acceleration of particles. The investigation made use of the long dipole antennas in the spin plane and 2 sets of a magnetic loop antenna. A single-satellite search coil magnetometer and a short electric antenna were included for low-frequency measurements and electrostatic noise analysis. In the waveband, three wideband magnetic antennas and four phase detectors were swept 100 Hz to 450 kHz. In 32 s, and giving the phase between magnetic and electric components of the field, a 2-sweeps frequency-lower correlator containing two receiver electronics and phase detectors, eight filters in the range 1.76-100 kHz were used. The receiver electronics measured the voltage difference between the two sets of long dipole antennas and a linear wideband receiver selectable from 1.5, 20, 3 to 64, or 1 to 16 kHz bands. The wideband receiver was flown to transmit wideband waveforms to the ground via an analog transmitter with high gain. The detailed high-frequency-time analysis could be performed. More details are found in S. C. Shuman et al., Space Sci. Inst. Instr., v. 5 n. 4, p. 555-561, 1981.

INVESTIGATION NAME: NOT PLASMA COMPOSITION

NSSDC ID: 81-0704-06

INVESTIGATIVE PROGRAM CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERIC PARTICLES AND FIELDS MAGNETOSPHERIC PHYSICS

PERSONNEL
P1 - E.G. SHEELY
Q1 - R.J. JOHNSON
Q2 - R.G. SHARP
Q3 - J. GEISS
Q4 - P.X. EBENROTH
Q5 - M. BALSIGER
Q6 - A. GHEIDELMETTI
Q7 - B.A. WALEN

BRIEF DESCRIPTION
The Energetic and Ion Composition Spectrometer (EICS) had high sensitivity and high resolution and covered the energy range from 0 to 17 keV per unit charge and the mass range less than 125 atomic mass units/charge. This investigation provided data used in investigating the strong coupling mechanism between the magnetosphere and the ionosphere that results in a high energy flux of energetic 0+ ions being accelerated from the ionosphere and injected into the magnetosphere due to magnetic storms. The properties of the minor ions species such as He+ and He++ relative to the major constituents of the energetic magnetosphere plasma were also studied in order to evaluate the relative importance of the different sources of the plasma and of various energization, transports, and loss processes that may be energy- or charge-dependent. One of the primary objectives was to measure the energy and pitch angle distributions of the principal mass constituents (0+ and He+) and the loss processes that may be energy- or charge-dependent. A second objective was to measure the energy and pitch angle distributions of the principal mass constituents (0+ and He+) and the loss processes that may be energy- or charge-dependent. A second objective was to study the energy and pitch angle distributions of the principal mass constituents (0+ and He+) and the loss processes that may be energy- or charge-dependent. A second objective was to study the energy and pitch angle distributions of the principal mass constituents (0+ and He+) and the loss processes that may be energy- or charge-dependent. A second objective was to study the energy and pitch angle distributions of the principal mass constituents (0+ and He+) and the loss processes that may be energy- or charge-dependent. A second objective was to study the energy and pitch angle distributions of the principal mass constituents (0+ and He+) and the loss processes that may be energy- or charge-dependent. A second objective was to study the energy and pitch angle distributions of the principal mass constituents (0+ and He+) and the loss processes that may be energy- or charge-dependent. A second objective was to study the energy and pitch angle distributions of the principal mass constituents (0+ and He+) and the loss processes that may be energy- or charge-dependent.
DYNAMICS EXPLORER 2: CARIGNAN

INVESTIGATION NAME: NEUTRAL ATMOSPHERE COMPOSITION SPECTROMETER

NSSDC ID: 81-0708-03

INVESTIGATIVE PROGRAM

CODE CE-8, SCIENCE

INVESTIGATION DISCIPLINES

AERONOMY IONOSPHERES

PERSONNEL

PI - J.P. CARIGNAN
U OF MICHIGAN

01 - M.W. SPENCER
NASA-GSFC

01 - C.A. REBER
NASA-GSFC

01 - A.J. MUEHLE
U OF MICHIGAN

01 - B.P. BLOCK
U OF MICHIGAN

01 - J.C. MAURER
U OF MICHIGAN

BRIEF DESCRIPTION

The Neutral Atmosphere Composition Spectrometer (NACS) was designed to obtain, in situ, measurements of the neutral atmosphere composition and to study the variations of the neutral atmosphere in response to energy coupled in from the magnetosphere. Because temperature enhancements, large-scale circulation cells, and wave propagation are produced by energy input from the magnetosphere, it was felt that, in order to characterize the composition of the neutral atmosphere with particular emphasis on variability in constituent densities driven by interaction in the atmosphere, ionosphere, and magnetosphere, the gadzoo-like mass spectrometer used was a nearly identical follow-on to those flown on the AE-C, -D, and -E missions. The electron-impact ion source was used in a closed mode. Aromatic particles entered an anode chamber through an electrode, where they were then implanted to the instrument temperature. The ions with the selected charge-to-mass ratios were then scattered through the hyperboloid electric field, exited the analyzer, and entered into the detection system. An off-axis parallel-aperture dynamo multiplier operating at a gain of 2x16 provided an output pulse of electrons for each ion arrival. The detector output had a pulse rate proportional to the neutral density in the ion source of the selected mass. The instrument also included two baffles that scanned across the input orifice for optimal measurement of the horizontal and vertical components of the wind. The mass select system provided for 256 masses between 0 and 51 atomic mass units (amu) or each 0.2 au. It was possible to scan all of these mass numbers in each of eight 0.016 second intervals. This sequence was repeated every 0.128 sec. More details are found in P. B. Carignan et al., Space Sci. Instrum., v5, n 4, p. 429, 1981.

DYNAMICS EXPLORER 2: HAYS

INVESTIGATION NAME: FABRY-PEROT INTERFEROMETER

NSSDC ID: 81-0708-25

INVESTIGATIVE PROGRAM

CODE CE-8, SCIENCE

INVESTIGATION DISCIPLINES

AERONOMY IONOSPHERES

PERSONNEL

PI - P.B. HAYS
U OF MICHIGAN

01 - J.A. ROBLE
NAI CTR FOR ATMOS RES

01 - G.M. CARIGNAN
U OF MICHIGAN

01 - A.F. HAGY
U OF MICHIGAN

01 - D. REES
U OF LONDON

01 - T.M. DONAHUE
U OF MICHIGAN

BRIEF DESCRIPTION

The Fabry-Perot Interferometer (FPI) was a high-resolution remote sensing instrument designed to measure the thermospheric temperature, electron wind, and density of the following metastable atomic oxygen (singlet 5 and D) and the [2 1] state of atomic neon (NeII). The FPI performed a wavelength analysis on the light detected from the thermospheric emission features by spatially scanning the interferometer fringe plane with a multichannel array detector. The wavelength analysis characterized the Doppler line profile of the emitting species. The Fabry-Perot interferometric scans were performed by a moveable scan mirror reflected by a positionable scan mirror. The Fabry-Perot interferometer was used to study the dynamic response of the thermosphere to the energy sources caused by magnetospheric electric fields and the absorption of solar ultraviolet light in the thermosphere. The instrument was based on the Visible and Infrared Experiment (VIE) used on the Space Shuttle. In the addition of a scanning slit, the Fabry-Perot etalon, an image plane detector, and a calibration lamp were the principal differences. Interference filter slits isolated lines at 3957, 6300, 7520, 5896, and 7320. The FPI had a field of view of 0.53 deg (half-difference angle). More details are found in P. B. Hays et al., Space Sci. Instrum., v5, n 4, p. 395, 1981.
The Ion Drift Meter (IDM) measured the bulk motions of
the ionospheric plasma perpendicular to the satellite velocity vector. The measured parameters, horizontal and vertical
corotational velocities, had an expected range of plus or minus 4
km/s. The accuracy of the measurement was expected to be plus
or minus 50 m/s for the anticipated 0.5 deg accuracy in vehicle
tilt angle determination. The nominal tilt resolution of the
measurement was 1/32 x. This investigation yielded information
on (1) the corotation (electric field) and (2) a breathing of the
magnetospheric plasma, the flow of plasma along
coronographic field lines within the plasmasphere, which determines
whether there is a dissipation of solar wind energy. Further, the
plasma flow pattern shows a rarefied region of this region after a storm or an
interhemispheric transport of plasma (3) the thermal ion energy inputs to the corotational currents (4) the electric potential energy
fields associated with small-scale phenomena that are important
at both low and high latitudes, and (5) the temperature and
variation of the total concentration along the flight path.
The Ion Drift Meter measured the plasma motion parallel to the
sensor face by using a gridded collector and multiple
collectors to determine the direction of arrival of the plasma.
The instrument geometry was very similar to that used on the
Atmosphere Explorer satellites. Each sensor consisted of a
square entrance aperture that served as collimator, some
electrostatically isolating grids and a segmented planar collector.
The angle of arrival of the ions with respect to the sensor
was determined by measuring the ratio of the currents to the
different collector segments. This was done by taking the
difference in the logarithms of the currents. Two techniques
were used to determine this ratio. In the Standard Drift Sensor (SDS) the collector segments were connected in pairs to two
Logarithmic amplifiers. The second technique, called the
Universal Drift Sensor (UDS), allowed simultaneous measurement
of the different collector segments. Here, the collector segment was
permanently connected to a logarithmic amplifier and two
different UDS amplifiers were used to determine the horizontal and
tangential arrival angles simultaneously. The IDM consisted of
two sensors, one providing the SDS output and the other providing
the UDS output. The details are described in the paper by Heeley et al., Space Sci. Instrum., v. 5, n. 4 p. 211 1981.

-------- DYNAMICS EXPLORER 2- MAYNARD---------

INVESTIGATOR NAME= LOW ALTITUDE PLASMA INVESTIGATION HIGH
ANGULAR RESOLUTION

NASSC ID= 81-0700-13

INVESTIGATIVE PROGRAM= CODE EE-E, SCIENCE

INVESTIGATIVE DISCIPLINE(S)= PARTICLES AND FIELDS

AERONOMY

IONOSPHERES

PERSONNEL

PI = R.A. HOFFMAN NASA-GSFC
DI = J.L. BURCH U. OF TEXAS, DALLAS
DI = J.A. MAYNARD U. OF TEXAS, DALLAS

BRIEF DESCRIPTION

This investigation used the suprathermal particle
distribution functions measured by both the high-(81-0700-05)
and low-(81-0700-06) Altitude Plasma Instruments. The
objectives were (1) to study the properties and angular
acceleration mechanisms; (2) to determine the nature
and distribution of electric fields parallel to the magnetic
dipole field; (3) to identify the charge carriers of the major
electric current systems coupling the magnetosphere and
ionosphere; and (4) to determine the convection electric field and auroral light
elevation patterns.

-------- DYNAMICS EXPLORER 2- MAYNARD---------

INVESTIGATOR NAME= ELECTRIC FIELD INVESTIGATIONS

NASSC ID= 81-0700-02

INVESTIGATIVE PROGRAM= CODE EE-E, SCIENCE

INVESTIGATIVE DISCIPLINE(S)= AERONOMY

PARTICLES AND FIELDS

PERSONNEL

PI = J.A. MAYNARD NASA-GSFC
DI = J.A. HEPPER NASA-GSFC
DI = J.A. MAYNARD NASA-GSFC

BRIEF DESCRIPTION

The Vector Electric Field Instrument (VEFI) used
eight gridded double balances, with 20-m baselines, to obtain
measurements of dc electric fields. This electric field
investigation had the following objectives: (1) to obtain
vertical and horizontal dc electric field measurements at ionospheric altitudes in order to refine the
basic spatial patterns, (2) to obtain the large-scale features of these patterns, and study the small-scale temporal and spatial
variations within the overall pattern(s) (2) to study the degree
to which and in what region the electric field projects to the
equatorial plane; (3) to obtain measurements of extreme low frequency (ELF) and lower frequency irregularity structures
and the noise levels; and (4) to study the nature of scattering. The instrument consisted of six cylindrical elements 11 m long and
28 m in diameter. Each antenna was insulated from the plasma
except for the single wire dipole, which was placed at the mid-points of these 2-m active elements was 15 m. The
antennas were interlocked along the edges to prevent
oscillation and to increase their rigidity against drag forces.
The basic electronic system was very similar in concept to that
used on IMP-J and was modified for a three-axis system
measurement on a nonspinning spacecraft. At the core of
the system were the high-sensitivity (1-12 Hz) preamplifiers, whose
outputs were accurately subtracted and digitized (14-bit) and
converted for sensitivity to about 0.1 microvolt/m to
maintain high resolution. For subsequent processing, the
cross-product of the vectors V and E in data processing. This
provided the basic dc measurements. Other circuitry was used to
datalog the dc data and to measure rapid variations in
the signals detected by the antennas. The planned dc
electric field was plus or minus 1 mV/m, the planned
resolution was 0.1 mV/m and the varietaland quantities of electric
drfield was measured from 10 Hz to 10 Hz. The dc electric field was
measured at 16 samples/s. The inclination electric field was
measured from 1 mV/m to 10 mV/m. Additional details are
found in N. C. Maynard et al., Space Sci., Instrum., v. 5, n. 4 p. 211 1981.

-------- DYNAMICS EXPLORER 2- MAYNARD---------

INVESTIGATOR NAME= ATMOSPHERIC DYNAMICS AND ENERGETICS

INVESTIGATION

ASSN 1D= 81-0700-12

INVESTIGATIVE PROGRAM= CODE EE-E, SCIENCE

INVESTIGATIVE DISCIPLINE(S)= AERONOMY

PARTICLES AND FIELDS

IONOSPHERES

PERSONNEL

PI = J.A. MAYNARD NASA-GSFC
DI = J.A. HEPPER NASA-GSFC
DI = J.A. MAYNARD NASA-GSFC

BRIEF DESCRIPTION

The purpose of this investigation was to study the
dynamic responses of the thermosphere and ionosphere to energy
infusion in the form of Joule heating, particle precipitation, and
temperature changes caused by by electric field-generated drifts. The objective was to determine the
relative importance of the various phenomena and the conditions
under which they occurred. Because the relative importance of
the different processes varied with geomagnetic activity,
both geographically quiet and disturbed conditions were
examined using theoretical models as tools. The principal
goals was to quantitatively analyze the physical processes
involved in the energy coupling between the magnetosphere
and the ionosphere. In addition to data obtained from various DC
telescope satellites, the investigation planned to use
ground-based or other observations.

-------- DYNAMICS EXPLORER 2- MAYNARD---------

INVESTIGATOR NAME= MAGNETOSPHERIC ELECTRO MAGNETIC ENERGY TO THE
ATMOSPHERE INVESTIGATION

ASSN 1D= 81-0700-10

INVESTIGATIVE PROGRAM= CODE EE-E, SCIENCE

INVESTIGATIVE DISCIPLINE(S)= PARTICLES AND FIELDS

AERONOMY

IONOSPHERES

PERSONNEL

PI = J.A. MAYNARD NASA-GSFC
DI = J.A. HEPPER NASA-GSFC
DI = J.A. MAYNARD NASA-GSFC

BRIEF DESCRIPTION

This investigation used data from various spacecraft
instruments to study the following: (1) global thermospheric
dynamics (the effects of energy input from the thermosphere to
the magnetosphere or earth's magnetic field, Joule heating, particle
precipitation and tidal energy); (2) the convective coupling of
the thermals and the internal waves of the ionosphere and
the thermosphere; and (3) the energy-loss mechanisms of ionspheric
photoelectrons in the plasmasphere.

-------- DYNAMICS EXPLORER 2- ROBLE---------

INVESTIGATOR NAME= NEUTRAL-PLASMA INTERACTIONS

INVESTIGATION

ASSN 1D= 81-0700-11

INVESTIGATIVE PROGRAM= CODE EE-E/CD-P, SCIENCE

INVESTIGATIVE DISCIPLINE(S)= AERONOMY

IONOSPHERES

PERSONNEL

PI = J.A. MAYNARD NASA-GSFC
DI = J.A. HEPPER NASA-GSFC
DI = J.A. MAYNARD NASA-GSFC

BRIEF DESCRIPTION

This investigation used data from various spacecraft
instruments to study the following: (1) global thermospheric
dynamics (the effects of energy input from the thermosphere to
the magnetosphere or earth's magnetic field, Joule heating, particle
precipitation and tidal energy); (2) the convective coupling of
the thermals and the internal waves of the ionosphere and
the thermosphere; and (3) the energy-loss mechanisms of ionspheric
photoelectrons in the plasmasphere.
BRIEF DESCRIPTION
This investigation used data from several spacecraft to study the large-scale plasma interactions in the thermosphere caused by magnetosphere-lowspheric and thermospheric coupling processes. Planned use of the models was to provide a theoretical framework in which certain important lowospheric and thermospheric properties needed for coupling processes such as the Pedersen and Hall conduction coefficients were calculated using satellite data measured at a given height. Planned analysis of these coefficients (1) to calculate vertical profiles of lowospheric properties that were useful for comparison with incoherent scatter radar measurements and other ground-based supporting data (2) to identify and evaluate the lowospheric heat and momentum sources (3) to determine the effectiveness of high-latitude dynamic processes in controlling the lowospheric circulation and thermal structure.

------- DYNAMICS EXPLORER 2: SPENCER -------
INVESTIGATION NAME: WIND AND TEMPERATURE SPECTROMETER
NSIDC ID: 81-0728-04
INVESTIGATIVE PROGRAM
CODE CE-8, SCIENCE
INVESTIGATION DISCIPLINE(S)
AERONOMY
PERSONNEL
PI - H.K. SPENCER
01 - A.E. MEIN
01 - R.E. PILLIN
01 - L.E. WHITFORD
01 - J.G. MAURER
U OF MICHIGAN
U OF MICHIGAN
U OF MICHIGAN
U OF MICHIGAN
BRIEF DESCRIPTION
The Wind and Temperature Spectrometer (WATS) measured the ion and neutral particle distributions and temperatures in the neutral and lowospheric regions just below the altitude of satellite passes. The objective of this investigation was to measure the lowospheric and thermospheric electron temperatures and to study their relationships. Among the measured parameters were the neutral and lowospheric temperatures, the distribution of ion species, the electron densities, and the ion and neutral particle pressures. The data were used to study the lowospheric and thermospheric properties needed for coupling processes such as the Pedersen and Hall conduction coefficients, and to evaluate the lowospheric heat and momentum sources. The data were also used to study the effects of high-latitude dynamic processes in controlling the lowospheric circulation and thermal structure.

------- DYNAMICS EXPLORER 2: SUGIURA -------
INVESTIGATION NAME: MAGNETIC FIELD OBSERVATIONS
NSIDC ID: 81-0708-01
INVESTIGATIVE PROGRAM
CODE CE-8, SCIENCE
INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
AERONOMY
MAGNETOPHYSICS
PERSONNEL
PI - M. SUGIURA
01 - R.G. LEDLEY
01 - W.R. PARKER JR.
01 - L.J. CAMILLI JR.
NASA-GSFC
NASA-GSFC
U OF MINNESOTA
BRIEF DESCRIPTION
A triaxial fluxgate magnetometer (MAG-8) similar to one on board DE 1 (81-0704-01) was used to obtain magnetic field data needed to study the magnetosphere-lowspheric-thermospheric coupling. The primary objectives of this investigation were to measure field-aligned currents in the auroral oval and over the polar cap at two different altitudes using the two spacecrafts, and to correlate these measurements with observations of electron distributions. The instrument was placed in the high-latitude regions of the auroral oval. The magnetometer had a digital output for the axial component and a 12-bit digital output for the transverse components. The instrument also included an E-field sensor and a system of control that generated a 4-bit digital word consisting of a 12-bit representation of the field measured along each of three magnetometer axes. The data were used to study the effects of high-latitude dynamic processes in controlling the lowospheric circulation and thermal structure.
BREF DESCRIPTION

The ESRO 4 spacecraft was designed to investigate neutral particles and their concentrations in the ionosphere and near magnetosphere, to detect auroral particles, and to monitor solar particles in order to discover the mechanism by which they penetrate and diffuse in the magnetosphere. The spacecraft was launched into a polar orbit with a nodal regression rate near zero, thus providing a complete scan of local time in 1 year. To provide an altitude scan over the whole globe, the perigee precessed at a rate of ~3°/day. The spacecraft was cylindrical in shape (the structure to ESRO 2), was spin stabilized and used a PDM/PMT technology and was made transmittable in three forms: real-time at 64 bps, tape-recorder playback, and high-speed telemetry at 10240 bps. The spacecraft spin rate was about 1 rps. The spin orientation was changed periodically during the mission. The spacecraft reentered the earth's atmosphere after a successful mission on April 15, 1974.

-------- ESRO 4: RAIT ---------

INVESTIGATION NAME- POSITIVE ION SPECTROMETER

NSSDC ID- 72-092A-01 INVESTIGATIVE PROGRAM
CODE CC-9/CO-0+ SCIENCE
INVESTIGATION DISCIPLINE(s)- AERONOMY

PERSONNEL
PI = R.A. RAIT
01 = R.L. BOYD

UNIT STATE U
U COLLEGE LONDON

BREF DESCRIPTION

The primary objective of this experiment, designated as part of the ESRO 4 project, was to measure the density and temperature of ions in the vicinity of the spacecraft and to identify the prominent ion species observed. Three spherical probes of different sizes were flown to obtain the desired measurements. The largest one, 19 cm in diameter, functioned as a hot-wire mass spectrometer, its mass spectrometer, was surrounded by a spherical grid 20 cm in diameter which was maintained at a negative potential to repel electrons. The application of a controllable electric field was used to species identification to be made and their densities to be measured. One probe of mass was made every 4 s. This sensor was mounted on a radial axis, approximately 130 cm from the spacecraft's skin, in order that it have a 360°-deg look angle, and that sample the mass spectrometer could be measured. To keep this thin mass sensor from crossing the satellites, the satellite's attitude had to be such that the velocity vector was kept inside one cone of approximately 35 deg half-angle around the spin axis. The small electron collecting probe, 1 cm in diameter, was voltage swept to provide electron temperature and density data. In addition, this Langmuir probe was mounted relatively close to the mass spectrometer, approximately 30 cm away from it so that the spacecraft potential it measured could be directly applied to the ion spectrometer without being affected by induced fields. It was not mounted close enough to cause mutual interference. The third probe, 9 cm in diameter, was mounted on an axial boom protruding from the separator plane of the satellite (slab the center) for approximately 25 cm and was flown to monitor total ion density. The measurements from the second sensor were used to evaluate the spatial distribution of ions on the satellite skin, to be provided simultaneously to the additional spheres on the end of boom. It maintained the satellite at a reasonable potential for this experiment, the potential induced by the solar cells and the spacecraft functioned normally until spacecraft recovery (April 15, 1974).

*************** EXPLORER 1 ***************

SPACERK COMMON NAME- EXPLORER 1
ALTERNATE NAMES- 1959 ALPHA 1 0004

NSSDC ID- 58-001A

LAUNCH DATE- 02/01/58 WEIGHT- 16.6 KG
LAUNCH SITE- CAPE CANAVERAL UNITED STATES
LAUNCH VEHICLE- JUNO

SPONSORING COUNTRY/AGENCY UNITED STATES DD0-ARMY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
ORBIT PERIOD- 114.8 MIN
INCLINATION- 35°, KM LAT
EPOCH DATE- 02/01/58

APOGEE- 356, KM ALY

PERSONNEL
PI = J. FREELICH
PS = A. MINIBS

NASA-APL

BREF DESCRIPTION

Explorer 1, the first U.S. artificial earth satellite, was instrumented for the study of cosmic rays, micrometeorites, and satellite temperatures. Data were continuously transmitted using a 60-watt amplitude-modulated transmitter and a 100-watt phase-modulated transmitter. Data were recorded only when the cylindrical spin-stabilized spacecraft was over one of 17 receiving stations. The full 17 receiving stations were battery powered and operated properly until February 12, 1958, and March 16, 1958, respectively.

-------- EXPLORER 1: JACCHIA --------

INVESTIGATION NAME- SATELLITE DRAG ATMOSPHERIC DENSITY

NSSDC ID- 58-001A-03 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(s)- AEROLOGY

PERSONNEL
PI = L.G. JACCHIA
01 = J.W. SLOWE

NASA-APL

BREF DESCRIPTION

Because of its symmetrical shape, Explorer 1 was selected for use in determining upper atmospheric densities as a function of altitude, latitude, season, and solar activity. Density values near perigee were estimated from sequential observations of the spacecraft position, using optical (Baker-brown camera network) and radio devices. A good discussion of the general techniques used to measure density values from satellite drag data can be found in L. G. Jacchia and J. Slowey, "Accurate drag determination for eight artificial satellites of atmospheric densities and temperatures," Smithsonian Special Report n. 106, Cambridge, Mass., July 1962. This experiment was successful in determining reasonable density values until the spacecraft reentered the earth's atmosphere on March 31, 1970.

-------- EXPLORER 1: MANNING --------

INVESTIGATION NAME- MICROMETEORITE DETECTOR

NSSDC ID- 58-001A-02 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(s)- INTERPLANETARY DUST

PERSONNEL
PI = E. MANNING
01 = M. DUBIN

NASA-GSC

BREF DESCRIPTION

Direct measurements of micrometeorites were made on Explorer 1 using two separate detectors: a wire grid detector and a crystal transducer. The parameters determined were the influx rate of each size group, the impinging velocity, the composition, and the density of the micrometeorite. The wire grid detector consisted of 10 parallel transitions mounted in a four-section supporting ring which was mounted on the satellite's spherical surface. Each card was wound with an aerogel 17-particle wire. Two layers of wire were wound on each card to ensure that a total area of 1 cm by 1 cm was completely covered. A micrometeorite of about 10 microns would fracture the wire upon impacts, destroy the electrical connection and thus record the event. The acoustic detector transducer and solid-state amplifier was placed in a vacuum contact with the plastic section skin, so that it could respond to meteorite impacts on the spacecraft skin and that each recorded event would be a function of mass and velocity. The effective area of this section was 0.075 sq m, and the average threshold sensitivity was 2.5×10^3 g cm/s. During launch, from February 1, 1958, one or two of the 12 grid detectors were apparently broken. The recorded grid data, to approximately 60 days after launch (February 1, 1958, to April 1, 1958), showed no more than one or two of the 12 grid detectors broken from meteorite impacts. Data from the acoustic detector were obtained when an impact occurred while the satellite was over a ground recording station. Over an 11-day period (February 1, 1958, to February 12, 1958), 45 impacts were recorded from eight impacts that registered during the launch and injection into orbit. Due to poor signal-to-noise ratio, very elaborate data reduction procedures had to be developed. The high impact rates on one portion of the orbit and the subsequent failures in the satellites' electronic system have been attributed to a meteor shower.

-------- EXPLORER 1: VAN ALLEN --------

INVESTIGATION NAME- COSMIC-RAY DETECTOR

NSSDC ID- 58-001A-01 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(s)- PARTICLES AND FIELDS COSMIC RAYS
PERSONNEL

PI = J.A. VAN ALLEN
01 = G.H. LUDWIG
U OF IOWA
NAA-ERL

BRIEF DESCRIPTION

Explorer 7 was designed to measure solar X-ray and
Lumin-a-alpha flux, trapped energetic particles, and heavy
primary cosmic rays (253). Secondary objectives included
collecting data on micrometeorite penetration and molecular
sputtering and studying the earth-atmosphere heat balance. The
spin-stabilized satellite's external structure consisted of two
truncated conical finglass shells joined by a cylindrical
aluminum center section. The spacecraft was 75 cm wide at its
equator and about 75 cm high. The spacecraft was powered by
approximately 3000 solar cells mounted on both the upper and
lower shells. Additional power was provided by 15
calendium batteries that were positioned on its equator
near the outer skin as an aid in maintaining a proper spin
rate. Two crossed dipole (1 W, 25 MHz) telemetry antennas
projected outward from the center section, and a 100-MHz
antenna used for tracking was mounted on the bottom of the
lower shell. Located around the periphery of the center
section were five bolometers for thermal radiation measurements
and three caesium sulfide microchannel detector cells.
A cylindrical ion chamber (lithium fluoride window) and a
bismuth window x-ray chamber were located on opposite sides
of the upper cones, and a coaxial Geiger counter was
located on the very top. A primary cosmic-ray ionization chamber
was located within the center section of the upper cone. Useful
real-time data were transmitted from launch through February

-------- EXPLORER 7, POMERANTZ1

INVESTIGATION NAME = HEAVY PRIMARY COSMIC RAYS

INVESTIGATIVE PROGRAM
CODE EE-9a SCIENCE

INVESTIGATION DISCIPLINES
PARTICLES AND FIELDS

COSMIC RAYS

PERSONNEL

PI = V.E. SUOMI
U OF WISCONSIN

BRIEF DESCRIPTION

The Explorer 7 thermal radiation experiment was designed to
measure incident and reflected solar UV radiation and
terrestrial IR radiation in order to obtain a better understanding
of the driving force on the earth-atmosphere system.
The primary instrumentation consisted of five
bolometers in the form of two silver hemispheres that were
thermally insulated from but in close proximity to specially
aluminized mirrors. The hemispheres thereby behaved very much
like photometric spheres in space. Two of the hemispheres had
calk coatings and responded almost equally to solar and
terrestrial radiation. A third hemisphere, coated white, was
more sensitive to terrestrial radiation than to solar
eradiation. A fourth, which had a gold metal surfaces was
more sensitive to solar radiation than to terrestrial radiation.
The fifth hemisphere protected from direct sunlight was used
to measure the reflected sunlight. A glass-coated bead thermistor was mounted on the top of each hemisphere to measure the temperature. A complete set of four temperature observations and one reference sample required 30 s. Thus, in each orbit, about 180 temperature measurements could be obtained. The experiment was a success, and usable data were obtained from launch until February 28, 1961.

--- EXPLORER 7, VAN ALLEN---

INVESTIGATION NAME= TRAPPED RADIATION AND SOLAR PROTONS
NSSDC ID= 59-020A-04
INVESTIGATIVE PROGRAM CODE= AE-1 SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS
PERSONNEL
PI = J.A. VAN ALLEN
OI = G.W. LUDWIG
OI = L.A. FRANK
U OF IOWA NASA-ERL
U OF IOWA

BRIEF DESCRIPTION
Two omnidirectional Geiger counters (anode 302 and 112) were used to conduct a comprehensive spatial and temporal monitoring of total cosmic-ray intensity, geographically trapped corpuscular radiations and solar protons. The detector was sensitive to protons (E > 20 MeV) and electrons (E > 90 keV). The experiment operated successfully from launch until February 28, 1961, except for a brief period in September and October 1960.

--- EXPLORER 8 ---

SPACESHIP COMMON NAME= EXPLORER 8
ALTERNATE NAMES= 1960 XI 1 + 00860 S 30
NSSDC ID= 60-024A
LAUNCH DATE= 11/03/60
WEIGHT= 41.8 KG
LAUNCH SITE= CAP CANAVERAL, UNITED STATES
LAUNCH VEHICLE= JUNO
SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE= GEODETIC
ORBIT PERIOD= 11.2 MIN
INCLINATION= 50.6 DEG
PERIAPL= 417.7 KM
APOPL= 226.8 KM

PERSONNEL
PI = R.E. BOURDEAUX RETIRED
OI = R.E. BOURDEAUX RETIRED
GS = NASA GSC

BRIEF DESCRIPTION
Explorer 8 was a 41-g mercury-battery-powered earth-orbiting satellite designed to obtain measurements of the ionosphere at altitudes between 400 and 1600 km. The electron density, electron temperature, the ion temperature, the ion mass, the microfourette distribution, the sferemeteorite mass. It was intended to study the temporal and spatial distribution of these properties and their variation from full sunlit conditions to full shadow or nighttime conditions. The payload was in the form of two truncated cones with the bases attached to a cylindrical equator. The outer shell was a thin metal and had an internal diameter of 76 cm and a height of 76 cm. The 108-GHz transmitter had to average power and it functioned for the life of the battery pack (54 days). The data system included telemetry consisting of continuous operation with real-time transmission. To avoid the possibility of effects on the experiments by asymmetrical charging of solar cell surfaces, solar cells were not used. The experiment instrumentation included an RF Impedance probe, an ion current meter, a retarding potential probe a two-element and a three-element electron temperature probe, an electron current monitor, a magnetometer, a photographic-type and a microfourette micrometer detector, an electronic field meter, a solar horizon sensor, and thermometer temperature probes. 587 ion equivalent measurements of electron and ion concentration were used to solve the question of neutrality of the medium. Battery power failed on December 27, 1960. Considerable difficulty was encountered in deactivating the telemetry data for machine processing possible. As a result of these difficulties, the data were mostly processed by hand. In spite of these difficulties, considerable new knowledge about the ionosphere was gained from operation of the satellite.

--- EXPLORER 9, O'SULLIVAN JR. ---

INVESTIGATION NAME= SATELLITE DRAG ATMOSPHERIC DENSITY
NSSDC ID= 61-0204A-01
INVESTIGATIVE PROGRAM CODE= E-2 SCIENCE
INVESTIGATION DISCIPLINE(S) AERODYNAM

PERSONNEL
PI = W.J. O'SULLIVAN JR.
OI = R.W. COOK JR.
OI = G.W. KEATING
OI = L.A. JACCHIA
U OF IOWA NASA-LARC

BRIEF DESCRIPTION
Explorer 9 was the first in a series of 3.66-m inflatable spheres designed for the determination of atmospheric densities. The spacecraft consisted of alternating layers of aluminum foil and plastic film, uniformly distributed over the aluminum surface. The white paint for thermal control. Explorer 9 carried a 136-MHz beacon for tracking purposes. The beacon failed on the first orbit however, and the 50 Baker-Kunn camera Classic had to be relied upon for tracking. The spacecraft reentered the earth's atmosphere on April 9, 1964.

--- EXPLORER 10, JACCHIA ---

INVESTIGATION NAME= SATELLITE DRAG ATMOSPHERIC DENSITY
NSSDC ID= 62-0214A-07
INVESTIGATIVE PROGRAM CODE= E-2 SCIENCE
INVESTIGATION DISCIPLINE(S) AERODYNAM

PERSONNEL
PI = L.A. JACCHIA
OI = L.A. JACCHIA

BRIEF DESCRIPTION
Because of its symmetrical shape, Explorer 10 was selected for the determination of upper atmospheric densities as a function of altitude, latitude, season and solar activity. Density values near perigee were deduced from sequential observations of the spacecraft positions using optical (Baker-Kunn camera network) and radar tracking techniques. A good discussion of the general techniques used to deduce density values from satellite drag data can be found in L. A. Jacchia and J. Slowey, "Accurate drag determination for eight artificial satellites of atmospheric densities and temperatures of Smithsontan Astrophysical Observatory special report n° 100. Cambridge, Mass., July 1962. This experiment resulted in the successful determination of reasonable density values and is capable of yielding long-term atmospheric density values as Explorer 10 has an expected orbital lifetime of 80 yr.

--- EXPLORER 11, O'SULLIVAN JR. ---

SPACESHIP COMMON NAME= EXPLORER 11
ALTERNATE NAMES= 1961 DELTA 1, S 56A
NSSDC ID= 61-0204A
WEIGHT= 36.0 KG
LAUNCH SITE= WALLOPS FLIGHT CENTER, UNITED STATES
LAUNCH VEHICLE= SCOUT
SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE= GEODETIC
ORBIT PERIOD= 118.6 MIN
INCLINATION= 38.91 DEG
PERIAPL= 545.5 KM
APOPL= 2225.9 KM

PERSONNEL
PI = R.W. COOK JR.
OI = R.F. FELLOWS RETIRED
GS = NASA-LARC NASA HEADQUARTERS

BRIEF DESCRIPTION
Explorer 11 was the first in a series of 3.66-m inflatable spheres designed for the determination of atmospheric densities. The spacecraft consisted of alternating layers of aluminum foil and plastic film, uniformly distributed over the aluminum surface. The white paint for thermal control. Explorer 11 carried a 136-MHz beacon for tracking purposes. The beacon failed on the first orbit however, and the 50 Baker-Kunn camera Classic had to be relied upon for tracking. The spacecraft reentered the earth's atmosphere on April 9, 1964.

--- EXPLORER 12, JACCHIA ---

SPACESHIP COMMON NAME= EXPLORER 12
ALTERNATE NAMES= 1961 DELTA 2, S 56B
NSSDC ID= 61-0204A
WEIGHT= 36.0 KG
LAUNCH SITE= WALLOPS FLIGHT CENTER, UNITED STATES
LAUNCH VEHICLE= SCOUT
SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE= GEODETIC
ORBIT PERIOD= 118.6 MIN
INCLINATION= 38.91 DEG
PERIAPL= 545.5 KM
APOPL= 2225.9 KM

PERSONNEL
PI = R.W. COOK JR.
OI = R.F. FELLOWS RETIRED
GS = NASA-LARC NASA HEADQUARTERS

BRIEF DESCRIPTION
Because of its symmetrical shape, Explorer 12 was selected for the determination of upper atmospheric densities as a function of altitude, latitude, season and solar activity. Density values near perigee were deduced from sequential observations of the spacecraft positions using optical (Baker-Kunn camera network) and radar tracking techniques. A good discussion of the general techniques used to deduce density values from satellite drag data can be found in L. A. Jacchia and J. Slowey, "Accurate drag determination for eight artificial satellites of atmospheric densities and temperatures of Smithsontan Astrophysical Observatory special report n° 100. Cambridge, Mass., July 1962. This experiment resulted in the successful determination of reasonable density values and is capable of yielding long-term atmospheric density values as Explorer 12 has an expected orbital lifetime of 80 yr.

--- FR 1 ---

SPACESHIP COMMON NAME= FR 1
ALTERNATE NAMES= 1961 DELTA 3, FRANCE-1
The F-1 spacecraft was a small spacecraft carrying two experiments. One was designed to observe VLF signals from earth-based transmitters, and the other was an electron density probe measuring electron concentration at the satellite. The satellite structure consisted of two truncated octagonal pyramids joined at their bases by an octagonal prism measuring 6.4 cm across from corner to corner. This basic structure was covered with solar cells and measured about 71.2 cm high. Extending upward from the top was a structure 71.2 cm high which consisted of the magnetic field antenna and its supporting tube. Extending diagonally upward from the base of this tube were four telemetry antennas. Four 190-cm-long electric field antenna booms extended outward from the prismatic portion of the basic structure. The spacecraft was spin-stabilized, with attitude and spin determination made from observations by a sun sensor and a three-axis fluxgate magnetometer. This satellite was used to study VLF propagation in the magnetosphere and irregularities in the ionosphere. Simultaneous on-board data were obtained over designated telemetry locations. The spacecraft operated successfully until August 1968.

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**INVESTIGATION NAME:** VLF RECEIVER

**NSSDC ID:** 65-1014-01

**PERSONNEL**

PI - L.R. Story, GCDA
OI - G. Bard, GCDA
GI - M. Pas, GCDA

**BRIEF DESCRIPTION**

The experiment consisted of equipment to observe the field strength of the magnetic and electric fields at the satellite, which resulted from transmissions of two VLF ground transmitters. The electric field intensity was observed with two dipoles and their corresponding receivers and the magnetic field intensity was observed with three antennas and their corresponding receivers. The observations consisted of field strength recording vs. time (location) in the regions over the ground transmitter and in the region conjugate to the ground transmitter. The experiment failed on August 26, 1968, after 30 months of operation. This exceeded the 3-month planned lifetime, these five selected dipoles and the three antennas (160 Hz) VLF receivers recorded at frequencies of 16.0 kHz (5.333 Hz wide-dynamic-range (500) or at 24.0 kHz (Barbados, Panama -160). For a more extensive experimental description see R. G. Storey, "Preliminary results on VLF propagation in the lower magnetosphere obtained by the F-1A satellite." Space Research, vol 7, pp 586-603, North Holland Pub Co, Amsterdam, 1967.

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**SPACECRAFT COMMON NAME:** FRA-U

**ALTERNATE NAMES:** FRA-U, U.S. GERMAN RESEARCH SAT

**NSSDC ID:** 69-097A

**LAUNCH DATE:** 11/10/69

**WEIGHT:** 78.7 kg

**LAUNCH VEHICLE:** SCOUT

**Sponsoring Country/Agency**

FED REP OF GERMANY

**NSSDC ID:** 65-1014

**LAUNCH DATE:** 12/06/65

**WEIGHT:** 60.0 kg

**LAUNCH VEHICLE:** SCOUT
INVESTIGATION NAME  PROTON TELESCOPE

NSSDC ID  69-097A-03
INVESTIGATIVE PROGRAM
CODE EC-E/CO-OP-SCIENCE
INVESTIGATION DISCIPLINE(S)  SOLAR PHYSICS
PARTICLES AND FIELDS

PERSONNEL
PI  - J.B. MONZIT
U OF KIEL

BRIEF DESCRIPTION
Two solid-state devices were used in conjunction with four pulse-height discriminators to detect trapped and solar protons using coincidence techniques. The detector had six energy discriminators for energies from 0.165 keV to 1.65 keV, 1.65 to 1.65 keV, and 1.65 to 1.65 keV, and alpha particles from 2 to 6.4 MeV. Electrons were also detected from the incidence beam using a broom magnet. The acceptance cone was 20.4 degrees full angle. The experiment worked normally until the spacecraft telemetry system malfunctioned in early July 1970.

-------- IE-A-BOYD

INVESTIGATION NAME  FLUXGATE MAGNETOMETER

NSSDC ID  69-097A-01
INVESTIGATIVE PROGRAM
CODE EC-E/CO-OP-SCIENCE
INVESTIGATION DISCIPLINE(S)  PARTICLES AND FIELDS

PERSONNEL
PI  - G. MUSMANN
BRAUNSCHWEIG TECH U

BRIEF DESCRIPTION
A 2-component fluxgate magnetometer with two identical electrically independent measuring units was used as an attitude sensor and as an experiment for detecting transverse magnetic fields. It was oriented perpendicular to the magnetic field. In order to eliminate magnetic fields from the satellite, the magnetometer was placed on a boom about 80 cm long. The sensor was to be thermally shielded by a cylindrical metal cap. Each sensor had a range of minus to plus 1,444 nT with 4.36 mT digitization resolution. Each sensor was sampled for 125 ms every 5 s. The experiment worked normally until the spacecraft telemetry system malfunctioned in early July 1970. For further details, see B. Thelle and H. W. Praetorius, "Field aligned currents between 400 and 3000 km in auroral and polar latitudes," Planet. Space Sci., v. 21 pp. 179-187, February 1973.

-------- IE-A-KNECHT

INVESTIGATION NAME  FIXED-FREQUENCY IONOSonde

NSSDC ID  64-051A-01
INVESTIGATIVE PROGRAM
CODE EC-E/CO-OP-SCIENCE
INVESTIGATION DISCIPLINE(S)  IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI  - R.W. KNECHT
NATL BUREAU OF STD
01 - W. CALVERT
U OF IOWA
01 - J.C. VAN IZANDT
NOAA-ERL
01 - R.B. NORTON
NOAA-ERL
01 - J.W. WARNock
NOAA

BRIEF DESCRIPTION
The purpose of the fixed-frequency ionosonde was to investigate the fixed-frequency ionosonde electron density in the altitude range 300 to 1000 km. The experiment was most useful for the study of irregularities in the electron density distribution and for the investigation of fine structure in the plasma resonances. The fixed-frequency ionosonde was a radio transmitter-receiver that recorded the time delay between a transmitted and a returned radio pulse. Six specific frequencies from 1.5 to 7.22 MHz were sampled in sequence every 0.015 second. Several delay times were often observed for each frequency due to plasma resonances. The detection of these resonances was made by observing the fine structure in the ionosonde frequencies. A delay time was primarily a function of distance traversed by the signal electron density along the signal path, and the mode of propagation. A total of 76500 h of data was acquired. Most of the data were of adequate quality to prepare ionograms. Since only time is noted on each ionogram, satellite navigation and other related information must be obtained from world maps.

-------- IE-A-STONE

INVESTIGATION NAME  COSMIC NOISE

NSSDC ID  64-051A-03
INVESTIGATIVE PROGRAM
CODE EC-E/CO-OP-SCIENCE
INVESTIGATION DISCIPLINE(S)  IONOSPHERES AND RADIO PHYSICS
ASTRONOMY

PERSONNEL
PI  - R.W. KNECHT
NATL BUREAU OF STD
01 - W. CALVERT
U OF IOWA
01 - J.C. VAN IZANDT
NOAA-ERL
01 - R.B. NORTON
NOAA-ERL
01 - J.W. WARNock
NOAA

BRIEF DESCRIPTION
Explorer 20 was designed to measure electron distribution, ion density and temperatures, and to estimate cosmic noise levels between 2 and 7 MHz. The satellite was a small ionospheric observatory equipped with a satellite sounder and an ion probe. A cosmic noise experiment used the noise signal from the sun-earth line. The satellite consisted of a short cylinder terminated on each end by truncated cones. The ion probe was a short beam of ions, 1444 nT with 4.36 mT digitization resolution. Each sensor was sampled for 125 ms every 5 s. For further details, see B. Thelle and H. W. Praetorius, "Field aligned currents between 400 and 3000 km in auroral and polar latitudes," Planet. Space Sci., v. 21 pp. 179-187, February 1973.
PERSONNEL
PI - R.W. KREPLIN
NASA/MSFC

BRIEF DESCRIPTION
This experiment consisted of two ionization chambers mounted 180° apart on the equator of the GREE 3 satellite along with a sun aspect sensor and telemetry unit. The two ion chambers were designed to measure solar X rays in the 2 to 8-A range. The detectors were operated in the two detectors were mounted behind a permanent magnet to shield them from penetrating energy of 1 MeV. The magnets were mounted behind the detectors and were designed to measure the angle between the sun and the satellite's equator.
INVESTIGATION NAME: ELECTRON DIFFERENTIAL ENERGY SPECTROMETER

PERSONNEL
PI - C.D. LAUSHLIN
MODDANO OBS

BRIEF DESCRIPTION
This experiment was designed to study auroral and radiation zone phenomena using three end-window type 213 directional Geiger-Müller (GM) counters. Small magnets were used to focus electrons with energies between 40 and 50 keV into one of the GM counters and electrons with energies between 90 and 100 keV into another counter. The third GM counter served as a monitor of penetrating 3 rays and energetic protons. The detector accumulators were sampled once per second, and the accumulation time for each detector was 60/64 s. (The spacecraft had a complex spin-and-tumble motion with an 11-defined and variable period of several minutes). The experiment performed nominally throughout the lifetime of the spacecraft.

INVESTIGATION NAME: AURORAL AND AIRGLOW PHOTOMETER

PERSONNEL
PI - D.E. O'BRIEN
DEPT OF ENVIRON PROT

BRIEF DESCRIPTION
This photometer was included in the payload of Injun 1 for the purpose of measuring the auroral and airglow intensities of the atomic oxygen green line at 5577 Å. A malfunction prevented the separation of Injun 1 from the Naval Research Laboratory satellite. GRED 3 (also known as Solar 3). GRED 3 completely filled the field of view of the Injun 1 photometer. Consequently, no useful auroral or airglow data were obtained and the experiment was a failure. The instrument did operate for the lifetime of the satellite about 18 months.

INVESTIGATION NAME: FLUXGATE MAGNETOMETER

PERSONNEL
PI - J.A. VAN ALLEN
U OF IOWA

BRIEF DESCRIPTION
This detector consisted of a one-axis fluxgate magnetometer that was intended to check the magnetic field alignment of Injun 1 and to determine the location of the various detectors. The magnetometer, mounted in a pointed direction normal to the magnetic field vectors, was a range of 0 to 5E-5 tv. Measurements were made at the rate of once per second, with each fourth measurement being used as a calibration check. The magnetometer performed nominally throughout the lifetime of Injun 1.

INVESTIGATION NAME: SATELLITE DRAG ATMOSPHERIC DENSITY

PERSONNEL
PI - L.A. JACCHIA
U OF IOWA

BRIEF DESCRIPTION
Because of its symmetrical shape, Injun 3 was selected by the experimenters for use in determining upper atmospheric densities, as a function of altitude, latitude and solar activity. This experiment was not planned or ordered to launch. Density values near perigee were deduced from sequential observations of the spacecraft position, using optical (Baker-Hunn camera network) and radio (or radar) tracking techniques. Reasonable density values were obtained until the spacecraft reentered the earth's atmosphere on August 25, 1968.

INVESTIGATION NAME: VLF ELECTROMAGNETIC RADIATION

PERSONNEL
PI - J.E. GURNETT
U OF IOWA

BRIEF DESCRIPTION
This experiment was designed to study very low frequency (VLF) noise phenomena received at low earth-orbital altitudes. It was possible that noise sources included magnetic signals from the ground or satellites, electric or magnetic noise, and noise from other extraterrestrial sources. The receiver system used a 50-50 cm diameter magnetic loop antenna mounted above the spacecraft on a stubby support. The plane of the loop antenna was maintained parallel to the earth's magnetic field lines. In order to receive magnetic wave components perpendicular to the field with a spectral density greater than 5E-11 mV/m per Hz. This experiment had three data outputs: (1) wideband (0.5 to 3.0 kHz) spectral information in analog form, (2) wideband (0.5 to 7.0 kHz) signal strength in digital form and (3) 6 channels (0.5, 2.5, 3.0, 5.0, 7.0, and 8.0 kHz) of spectral data in digital form. The wideband analog data were mixed with the spacecraft digital data and transmitted to 16 ground-tracking stations in real time. Wideband signal strength was derived from the experiment automatic gain control (AGC) voltage, and provided a 40-dB dynamic range from 1E-3 to 1E-1 nV. These digital data were read out every 4 s. The onboard spectrum analyzer provided absolute amplitude information for the minimum amplitude from the six channels (50 Hz bandwidth). The amplitude data were obtained typically every 2 s over a dynamic range of 40 dB. The center frequencies were 1E-3 to 1E-1 nV per Hz, with an additional two satellite-controlled attenuation steps of 20 dB each. Digital resolution was 2.5% of digital and analog data were recorded almost continuously from launch to spacecraft failure on October 28, 1965. More details about the VLF experiment's construction, calibration and operation are in J. E. Gurnett and J. O'Brien, J. Geophys. Res., 69, 1: p. 1964.

INVESTIGATION NAME: SAT ORBIT DENSITY

PERSONNEL
PI - L.A. JACCHIA
U OF IOWA

BRIEF DESCRIPTION
Because of its symmetrical shape, Injun 3 was selected by the experimenters for use in determining upper atmospheric densities, as a function of altitude, latitude and solar activity. This experiment was not planned or ordered to launch. Density values near perigee were deduced from sequential observations of the spacecraft position, using optical (Baker-Hunn camera network) and radio (or radar) tracking techniques. Reasonable density values were obtained until the spacecraft reentered the earth's atmosphere on August 25, 1968.
INVESTIGATION NAME: INJUN 3, O'BRIEN

NSSDC ID: 62-0678-09

INVESTIGATIVE PROGRAM - SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(s): PARTICLES AND IONOSPHERES - AERONOMY

PERSONNEL

PI: A.J. O'BRIEN
DEPT. OF ENVIRON PROG.

BRIEF DESCRIPTION

Three photometers were flown to measure auroral and airglow intensities. Two were sensitive to the atomic oxygen green line at 5577 Å and one to the molecular nitrogen band near 3914 Å. The 3914 Å photometer and one of the 5577 Å photometers were situated adjacent to each other on the spacecraft and had a viewing direction down toward the earth in the Arctic region. These two photometers, because of the magnetic orientation of the spacecraft, were facing out toward space in the Antarctic region. The other 5577 Å photometer was located on the opposite side of the spherical spacecraft and consequently had a viewing direction that was different from the others by 100 deg at all times. The satellite transmitted only upon command from the ground, for a fixed period of 27 min. During this time, the two 5577 Å photometers were usually sampled four times per second and the 3914 Å photometer once every 2 s. Useful data were obtained from the experiment from launch until October 26, 1963. The operation of the experiment was essentially normal, except for the intermittent performance of the 3914 Å photometer. A more complete description of the experiment, the instrumentation, and the calibration procedures can be found in D. R. O'Brien and H. Taylor, J. Geophys. Res. 69, 691 (1964).

------------- INJUN 4, VAN ALLEN -------------

SPACECRAFT COMMON NAME: INJUN 4
ALTENATE NAMES: EXPLORER 25, 00932

NSSDC ID: 64-0768

LAUNCH DATE: 11/21/66
WEIGHT: 40.4 KG
LAUNCH SITE: VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE: SCOUT

SPONSORING COUNTRY/AGENCY: UNITED STATES

NASA-OSSA

INITIAL ORBIT PARAMETERS

ORBIT TYPE: GEODCENTRIC
ORBIT PERIOD: 116.3 MIN
PERIAPSIS: 522.0 KM ALT

APOAPSIS: 2496.0 KM ALT

EPHEMERIS DATE: 11/21/66
INCLINATION: 81.4 DEG

BRIEF DESCRIPTION

Explorer 25 was a magnetically aligned satellite launched simultaneously with Explorer 24 (lair density experiment) using a Scout rocket. The satellite's primary mission was to make measurements of the influx of energetic particles into the earth's atmosphere. The spacecraft had a spherical shape with a diameter of 38 cm. The attitude of the spacecraft was such as to permit simultaneous measurements of energetic protons and electrons. The satellite was designed to study the behavior of energetic particles in the earth's magnetic field and to study the long-term decay of electrons in the artificially produced 'Starfish' radiation belt. Four Eon 6213 type directional GM counters were used for energy flux measurements. These counters were sensitive to electrons (E>400 keV) and protons (E>600 keV). The detectors were arranged to detect particles with pitch angles from 0 to 100 deg in four segments centered at pitch angles of 35, 90, 125, and 160 deg. Orientation was referred to the direction of the local magnetic field line such that 0 deg corresponded to a detector looking down towards the earth in the northern hemisphere. The 6213 GM counters at 35 and 160 deg functioned normally throughout the flight, while the counter at 90 deg operated properly only until about March 1966. Periods of intermittent operation commenced at that time due to continuous discharge of the GM counters, and the counter failed completely in June 1966. The fourth counter, at 125 deg, malfunctioned shortly after launch and yielded no useful data. One heavily sheathed directional Eon 6213 type counter was used for the study of the Starfish radiation. This counter was sensitive to protons (E>70 MeV) but insensitive to electrons except via bremsstrahlung (E>4 MeV). One omnidirecional 3112 type GM counter of the kind flown on the Explorer 7 satellite and one omnidirecional 3102 type GM counter were used for monitoring the natural radiation zones and cosmic rays. The 5112 GM counter was sensitive to protons (E>27 MeV) but insensitive to electrons except via bremsstrahlung (E>4 MeV). The four directional type 6213 GM counter accumulators were sampled sequentially every 4 s and the other GM counter accumulators were sampled sequentially every 8 s.

------------- INJUN 4, VAN ALLEN -------------

INVESTIGATION NAME: SOLID-STATE DETECTOR

NSSDC ID: 64-0768-04

INVESTIGATIVE PROGRAM - SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(s): PARTICLES AND IONOSPHERES

PERSONNEL

PI: J.A. VAN ALLEN
U OF IOWA

O1: S.W. KRANIMIS
APPLIED PHYSICS LAB

BRIEF DESCRIPTION

This experiment was designed to detect protons and alpha particles in the outer zone and in solar cosmic-ray events at low altitudes and high latitudes. The experiment used a totally depleted directional silicon surface barrier detector in the form of a thin silicon disk. The detector was located inside a conical collimator with a vertical angle of 40 deg and was oriented at 90 deg to the satellite symmetry axis. Several determinations of proton and alpha particle fluxes were made in the energy range 0.05 to 4 MeV/nucleon and 0.5 to 1.8 MeV/nucleon, respectively. The detector was insensitive to electron fluxes in the radiation zones. The four detector accumulators were sampled sequentially every 4 s and the detector performed normally through July 1966.

------------- INJUN 4, VAN ALLEN -------------

INVESTIGATION NAME: CADMIUM SULFIDE DETECTORS

NSSDC ID: 64-0768-05

INVESTIGATIVE PROGRAM - SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(s): PARTICLES AND IONOSPHERES

PERSONNEL

PI: J.A. VAN ALLEN
U OF IOWA

BRIEF DESCRIPTION

This experiment was designed to measure precipitating and trapped particle fluxes. Four CdS-type particle detectors were used for this purpose, one at a pitch angle of 90 deg; one at 125 deg; one at 160 deg, one with and one without a magnetic deflection within the entrance aperture. Orientation was referred to the direction of the local magnetic field line. The detectors were flown to yield total flux measurements for electrons (E>100 keV) and protons (E>100 MeV). Extremely high background counting rates encountered during the flight hindered analysis of the data.

------------- INJUN 4, VAN ALLEN -------------

INVESTIGATION NAME: PLASTIC SCINTILLATOR PARTICLE DETECTORS

NSSDC ID: 64-0768-06

INVESTIGATIVE PROGRAM - SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(s): PARTICLES AND IONOSPHERES

PERSONNEL

PI: J.A. VAN ALLEN
U OF IOWA

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PERSONNEL
PI - J.A. VAN ALLEN U OF IOWA
O1 - J.D. CRAVEN U OF IOWA

BRIEF DESCRIPTION
This experiment was designed to measure the directional fluxes of electrons (30 keV to 50 keV) arriving at satellite altitudes and being precipitated into the earth's upper atmosphere. Two plastic scintillator particle detectors were used. One detector, which was near the earth, was about 90 deg. plus or minus 15 deg. operated normally until late January 1965. The apparent intensity failure in the detector power supply caused further observations to be only brief periods of the intensity throughout the entire life of the satellite. The other detectors, which were located at an angle of about 90 deg. and plus or minus 15 deg. operated normally throughout the 20-month life of the satellite. Orientation was referred to the direction of the local magnetic field line such that 0 deg. corresponded to a detector looking downward towards the earth in the northern hemisphere. The detector accumulators were samples sequentially every 6 s.

*************** INJUN 5 ****************

SPACERCRAFT COMMON NAME- INJUN 5
ALTERNATE NAMES- EXPLORER 40, INJUN-C
INJUN IC-0 03358

NSSC ID- 68-0669
LAUNCH DATE- 08/28/68
WEIGHT - 71.4 KG
LAUNCH SITE- VANDEVERB AFB, UNITED STATES
LAUNCH VEHICLE- SM-1B
SPONSORING COUNTRY/AGENCY
UNITED STATES
UNITED STATES
COORDINATE SYSTEM
COORD-NAVY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- CYCLOCENTRIC
ORBIT PERIOD- 10.3 HRS
EPOCH DATE- 12/13/68
ICLIPATH- 99.2 DEG
APOLIPO- 665. KM ALT

PERSONNEL
PP - J.E. ROGERS U OF IOWA
PM - J.A. VAN ALLEN U OF IOWA
PS - J.A. VAN ALLEN U OF IOWA

BRIEF DESCRIPTION
Injun 5 (Explorer 40) was a 71.4 kg magnetically oriented spacecraft, and was launched by a Survey rocket. Together with a 365-g inflatible balloon (Explorer 35) used for air density measurements, Injun 5 was designed to accomplish the following objectives: (1) comprehensive study of the downward flux of charged particles; (2) study of very low frequency (VLF) radio emission in the ionosphere associated with the downward flow of charged particles; (3) study of geomagnetically trapped protons, alpha particles, and electrons; (4) observation of solar cosmic rays; (5) observation of the continuing decay of the Starfish artificial radiation belt; and (6) study of the temperature and density of electron and positive ions of thermal and near thermal energy. The spacecraft systems performed normally except for the malfunction of the solar cell power device (short after launch) which caused the solar cells to deliver a lower power level to the experiments and reduced the time during which the on-board tape recorder could be run. The passive magnetic field experiment became effective in late December 1964. The spacecraft was turned off from May 31, 1970 to February 13, 1971; after this time it was turned on again. The spacecraft was put in an operational off-mode in early June 1972 and became inoperable shortly thereafter.

----------- INJUN 5, FRANK -----

INVESTIGATION NAME- LOW-ENERGY PROTON AND ELECTRON DIFFERENTIAL ENERGY ANALYZER (LEPEDEA)
NSSC ID- 68-0669-01
INVESTIGATING PROGRAM
CODE EE-8/C0-0P, SCIENCE
INVESTIGATION DISCIPLINE(s)
PARTICLES AND FIELDS
IONOSPHERES

PERSONNEL
PI - L.A. FRANK U OF IOWA

BRIEF DESCRIPTION
This experiment was designed to conduct detailed measurements of trapped and precipitating proton and electron energy fluxes typically over the range 50 eV to 50 keV. The energy spectra of these particles were studied separately as a function of pitch angles, latitude, local times, and altitude. The objectives of the experiment were: (1) to determine the Low-Energy Proton and Electron Differential Energy Analyzer (LEPEDEA) instrument. The LEPEDEA was composed of two E0 Type 6213 Selin-Muller tetrodes, each made up of cylindrical curved plate electrostatic analyzers, and continuous channel multiple collectors. Each LEPEDEA was accompanied by one E0 Type 6213 Selin-Muller tetrode, each made up of cylindrical curved plate electrostatic analyzers and continuous channel multiple collectors. Each LEPEDEA was accompanied by one E0 Type 6213 Selin-Muller tetrode, each made up of cylindrical curved plate electrostatic analyzers and continuous channel multiple collectors. Each LEPEDEA was accompanied by one E0 Type 6213 Selin-Muller tetrode, each made up of cylindrical curved plate electrostatic analyzers and continuous channel multiple collectors. Each LEPEDEA was accompanied by one E0 Type 6213 Selin-Muller tetrode, each made up of cylindrical curved plate electrostatic analyzers and continuous channel multiple collectors. Each LEPEDEA was accompanied by one E0 Type 6213 Selin-Muller tetrode, each made up of cylindrical curved plate electrostatic analyzers and continuous channel multiple collectors. Each LEPEDEA was accompanied by one E0 Type 6213 Selin-Muller tetrode, each made up of cylindrical curved plate electrostatic analyzers and continuous channel multiple collectors. Each LEPEDEA was accompanied by one E0 Type 6213 Selin-Muller tetrode, each made up of cylindrical curved plate electrostatic analyzers and continuous channel multiple collectors. Each LEPEDEA was accompanied by one E0 Type 6213 Selin-Muller tetrode, each made up of cylindrical curved plate electrostatic analyz...
BRIEF DESCRIPTION

This experiment was designed to conduct an investigation of the spatial and temporal distributions and energy spectra of low-energy ionospheric particles, protons, and alpha particles. A set of solid-state detectors (totally depleted silicon surface barrier type) was used to form a proton-telescope capable of detecting proton energies greater than 262 keV. The detector was equipped with 15 energy channels and with energies greater than 262, 264, 267, 269, 405, 425, 435, 544, 806, and 838 keV. Included in the experiment was an alpha particle detector composed of similar solid-state detectors, capable of detecting alphas in the range 1.25 to 6.55 keV and 2.5 to 2.9 MeV. The experiment performed normally. Further details are found in J. A. Van Allen et al., J. Geophys. Res., v. 75, n. 31, p. 6085, 1970.

PERSONNEL
PI - J. A. VAN ALLEN
OI - T. P. ARMSTRONG
OI - S. W. KRIMIS
U OF IOWA
U OF KANSAS
APPLIED PHYSICS LAB

INVESTIGATIVE NAME - CYLINDRAL ELECTROSTATIC PROBES
NSSDC ID - 69-0094-07
INVESTIGATIVE PROGRAM CODE CE-06-C0-DP, SCIENCE
INVESTIGATION DISCIPLINES GEOPHYSICS

PERSONNEL
PI - L. W. BRACE
OI - J. A. FINDLAY
NASA-GSFC

BRIEF DESCRIPTION

The purpose of this experiment was to study the global variations of electron temperature and electron concentration at spacecraft (S/C) altitudes during solar maxima and to study the characteristics of the S/C ion sheath. The measurements were made with two cylindrical probes, operating as Langmuir probes, positioned near the spacecraft. The probe extended 43 cm from the S/C along the spin axis and was centered among the four telemetered antennas on the underside of the S/C. This probe was capable of making measurements uncorrelated by the satellite motion only when the probe preceded the S/C in its motion through the plasma. The probe showed extended horizontally and outward from the S/C frame of reference from a probe 1 m long, which in turn extended from an upper surface of the satellite at an angle of about 45 degrees to the spin axis. The probe recorded some observations during each S/C spin cycle that were free of S/C wake effects. The probe consisted of three concentric, electrically insulated stainless steel tubes. The outer (0.046-cm) and (2.5-cm) long tube floated at its own equilibrium potential and served to place the collector well away from the S/C plasma sheath. The center tube (0.065-cm) extending 23 cm outward from the outer tube acted as an electrical guard for the collector. Its electrical potential was controlled. The collector (0.039-cm) extended 23 cm outward from the guard. During each 2-min sequence, a volt-ampere curve was obtained from the 20th second voltage (-2 to +10 V) applied to the collector. This was interpreted in electron densities over a range of 1.12 to 1.576 electrons per cm and temperatures from about 400 to 5,250 degrees K. NASA-GSFC has all the useful data that exist from this investigation.

PERSONNEL
PI - W. CALVERT
OI - R. M. NORTON
OI - J. H. WARNOCK
OI - J. W. WHITHEKER
U OF IOWA
NASA-ERL
NASA
DOE-CE

BRIEF DESCRIPTION

The purpose of this experiment was to study the natural and man-made VLF signals of a smaller scale than could be detected by the sweep sounder, and to study plasma resonances. Sounder measures were made with a typical VLF propagation time (the reflected pulse) and time. These data were normally observed only when the spacecraft was in a region of a telemeter station. The fixed-frequency sounder operated from the same antenna, transmitter, and receiver used for the sweep-frequency experiment. It normally operated for 5-10 times the frequency (2000-2000 MHz) was chosen for use by the experimenter as desired. Other modes of operation were available, including concurrent observation of all VLF signals in a fixed mixed mode with transmission at the fixed frequency of 0.82 MHz and sweep reception.
INVESTIGATION NAME: COSMIC RADIO NOISE  
INVESTIGATIVE PROGRAM CODE CE-8/6-CO-OP, SCIENCE  
INVESTIGATION DISCIPLINE(S):  
ASTRONOMY, IONOSPHERES AND RADAR PHYSICS  
PERSONNEL  
P1 - J.R. MARTZ (RETIRED)  
P2 - N.G. JAMES  
OC - D.R. HUMPHREY  
BRIEF DESCRIPTION  
This experiment studied the ionospheric phenomena by studying low-energy electrons and ions. The spectrometer simultaneously measured the differential energy spectra of positive and negative particles by a divergent electrostatic deflection system with electron multipliers for detectors. The experiment consisted of two such systems: one looking along the satellite spin axes and one perpendicular to it. A programmed power supply provided constant up and down rates of operation, selected either by internal programming or by ground command. The energy range was from 1 keV to 10 keV per unit charge. The selected energy provided a 22-point spectrum in 0.5 s, while the stepped mode provided a 20-point (geometrically spaced) spectrum in 40 s. The experiment worked well. NSSC has all the useful data that exist from this investigation.

INVESTIGATION NAME: WIND-CURRENT PARTICLE DETECTORS  
INVESTIGATIVE PROGRAM CODE CE-8/6-CO-OP, SCIENCE  
INVESTIGATION DISCIPLINE(S): MAGNETIC PHYSICS, PARTICLES AND FIELDS  
PERSONNEL  
P1 - J.R. MARTZ  
P2 - R.G. MULLIN  
P3 - J.D. JONES  
P4 - D.R. HUMPHREY  
BRIEF DESCRIPTION  
The primary purpose of this experiment was to provide data that would aid in understanding the mechanisms responsible for the production and control of the outer radiation zones (2) and the intertelluric and solar wind. This experiment consisted of four sets of detectors. The first set comprised four high-count detectors, measured electrons greater than 20 and 40 keV and protons greater than 50 and 100 keV. The second and third set consisted of high-count silicon junction detectors that responded to protons greater than 0.5 MeV and 5 MeV, respectively. The fourth set consisted of high-count silicon junction systems. Each system operated in two modes and responded to electrons greater than 50 keV and 70 keV.

INVESTIGATION NAME: POSITIVE ION MASS SPECTROMETER I-20  
INVESTIGATIVE PROGRAM CODE CE-8/6-CO-OP, SCIENCE  
INVESTIGATION DISCIPLINE(S): IONOSPHERES AND AERONOMY  
PERSONNEL  
P1 - J.R. MARTZ  
P2 - N.G. JAMES  
P3 - D.R. HUMPHREY  
BRIEF DESCRIPTION  
The objective of the spherical electrostatic analyser experiment was to measure the spherical electron density in the latitude range 30° to 35° and to 35° to 35° and to 35° to 35° and to 35° to 35°. This measurement was designed to provide information on the ionospheric parameters and the ionosphere's response to solar and geomagnetic activity.

INVESTIGATION NAME: ELECTRON DENSITY SPECTROMETER  
INVESTIGATIVE PROGRAM CODE CE-8/6-CO-OP, SCIENCE  
INVESTIGATION DISCIPLINE(S): IONOSPHERES AND RADAR PHYSICS  
PERSONNEL  
P1 - G.L. NEUMANN  
P2 - D.R. HUMPHREY  
P3 - J.D. JONES  
P4 - D.R. HUMPHREY  
P5 - R.G. MULLIN  
P6 - J.R. MARTZ  
P7 - J.D. JONES  
P8 - D.R. HUMPHREY  
P9 - D.R. HUMPHREY  
P10 - J.R. MARTZ  
P11 - J.R. MARTZ  
P12 - J.R. MARTZ  
P13 - J.R. MARTZ  
P14 - J.R. MARTZ  
P15 - J.R. MARTZ  
P16 - J.R. MARTZ  
P17 - J.R. MARTZ  
P18 - J.R. MARTZ  
P19 - J.R. MARTZ  
P20 - J.R. MARTZ  
P21 - J.R. MARTZ  
P22 - J.R. MARTZ  
P23 - J.R. MARTZ  
P24 - J.R. MARTZ  
P25 - J.R. MARTZ  
P26 - J.R. MARTZ  
P27 - J.R. MARTZ  
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P31 - J.R. MARTZ  
P32 - J.R. MARTZ  
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P34 - J.R. MARTZ  
P35 - J.R. MARTZ  
P36 - J.R. MARTZ  
P37 - J.R. MARTZ  
P38 - J.R. MARTZ  
P39 - J.R. MARTZ  
P40 - J.R. MARTZ  
P41 - J.R. MARTZ  
P42 - J.R. MARTZ  
P43 - J.R. MARTZ  
P44 - J.R. MARTZ  
P45 - J.R. MARTZ  
P46 - J.R. MARTZ  
P47 - J.R. MARTZ  
P48 - J.R. MARTZ  
P49 - J.R. MARTZ  
P50 - J.R. MARTZ  
P51 - J.R. MARTZ  
P52 - J.R. MARTZ  
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P63 - J.R. MARTZ  
P64 - J.R. MARTZ  
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P66 - J.R. MARTZ  
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P81 - J.R. MARTZ  
P82 - J.R. MARTZ  
P83 - J.R. MARTZ  
P84 - J.R. MARTZ  
P85 - J.R. MARTZ  
P86 - J.R. MARTZ  
P87 - J.R. MARTZ  
P88 - J.R. MARTZ  
P89 - J.R. MARTZ  
P90 - J.R. MARTZ  
P91 - J.R. MARTZ  
P92 - J.R. MARTZ  
P93 - J.R. MARTZ  
P94 - J.R. MARTZ  
P95 - J.R. MARTZ  
P96 - J.R. MARTZ  
P97 - J.R. MARTZ  
P98 - J.R. MARTZ  
P99 - J.R. MARTZ  

INVESTIGATION NAME: ELECTRON DENSITY SPECTROMETER  
INVESTIGATIVE PROGRAM CODE CE-8/6-CO-OP, SCIENCE  
INVESTIGATION DISCIPLINE(S): IONOSPHERES AND AERONOMY  
PERSONNEL  
P1 - G.L. NEUMANN  
P2 - D.R. HUMPHREY  
P3 - J.D. JONES  
P4 - D.R. HUMPHREY  
P5 - R.G. MULLIN  
P6 - J.R. MARTZ  
P7 - J.D. JONES  
P8 - D.R. HUMPHREY  
P9 - D.R. HUMPHREY  
BRIEF DESCRIPTION  
The objective of the spherical electrostatic analyzer experiment was to measure the ionospheric phenomena by studying low-energy electrons and ions. The spectrometer simultaneously measured the differential energy spectra of positive and negative particles by a divergent electrostatic deflection system with electron multipliers for detectors. The experiment consisted of two such systems: one looking along the satellite spin axes and one perpendicular to it. A programmed power supply provided constant up and down rates of operation, selected either by internal programming or by ground command. The energy range was from 1 keV to 10 keV per unit charge. The selected energy provided a 22-point spectrum in 0.5 s, while the stepped mode provided a 20-point (geometrically spaced) spectrum in 40 s. The experiment worked well. NSSC has all the useful data that exist from this investigation.
undisturbed plasmas. Two units made up the experiment package: a 96-ce beam that supported a sensor and made possible omnidirectional measurements, and a solar radiation package (considered to include the sensor) to perform the measurements and tc process the data into a suitable format for telemetry. The sensor was made up of two concentric spherical wire grids having radii of 3.18, 2.54, and 1.90 cm. The innermost grid was the collector. These grids were made from tungsten mesh and had a transparency of 80 to 95%. To measure the parameters listed above, suitable sweep and stop voltages were applied to the grids. This instrument was operated in a few minor intervals. The ion densities were sampled 60 times a second, corresponding to a spatial resolution of 150 m. Once per minute, the wavelength distribution was sampled. The energy distribution was sampled once every 2 min. NSSDC has all the useful data that exist from this investigation.

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**SPACECRAFT COMMON NAME:** ISIS 2  
**ALTERNATE NAMES:** ISIS-1, PL-7515, OS104  
**NSSDC ID:** 71-024A  
**LAUNCH DATE:** 04/01/71  
**WEIGHT:** 258.0 kg  
**LAUNCH SITE:** VANDERBORG AFB, UNITED STATES  
**LAUNCH VEHICLE:** DELTA  
**SPONSORING COUNTRY/AGENCY:** DOD-CRC  
**CANADA UNITED STATES** NASA-SSDA  
**INITIAL ORBIT PARAMETERS:**  
**EPOCH DATE:** 04/02/71  
**EPOCH PERIOD:** 113.6 min  
**INCLINATION:** 86.1 deg  
**PERIAPSE:** 1350.0 km  
**APOAPSE:** 1420.0 km  
**PERSONNEL:**  
**PI:** R.K. BARRINGTON  
**PI:** F.W. PALMER  
**OI:** K.G. JAMES  
**BRIEF DESCRIPTION:** The purpose of this experiment was to study natural and manmade VLF signals. Specific objectives included the measurement of VLF propagation phenomena, ion and hybrid plasma motions, and the formation of ion rain and intense fluxes of energetic particles. In this experiment, a swept-frequency receiver was used to stimulate tone resonances in the plasma. The instrumentation consisted of a swept-frequency broadband receiver that observed the signals from the 73 m long dipole (split monopole) antenna between 5, 25, and 30 kHz. This same antenna was used for receiving signals between 50 kHz on the ionosphere. The VLF receiver had a wide dynamic range that was achieved by use of an automatic gain control system. The experiment also permitted antenna impedance measurements with and without a dc bias on the antenna. The real-time data were transmitted on 136.00-MHz telemetry. The VLF data could be recorded on one of the four tape-recorder channels when the spacecraft tape-recorder was operating. Tape-recorded and backup real-time data were transmitted on 400-MHz telemetry.

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**INVESTIGATION NAME:** CYLINDRICAL ELECTROSTATIC PROBES  
**NSSDC ID:** 71-024A-07  
**INVESTIGATIVE PROGRAM:** CODE EE-8/6-CPL-00, SCIENCE  
**INVESTIGATION DISCIPLINES:** PARTICLES AND FIELDS AERONOMY  
**PERSONNEL:**  
**PI:** L.W. BRACE  
**OI:** J.W. FINOLAY  
**BRIEF DESCRIPTION:** The purpose of this experiment was to study the global variations of electron temperature and electron concentration at spacecraft altitudes during the winter phase of the solar cycle. The measurements were made with two cylindrical probes mounted along the spin axis, one at each end of the spacecraft. The sensors were operated as Langmuir probes with the probe current being measured as a function of probe voltage. Although basically the same cylindrical probe experiment was flown on ISIS 1, the ISIS 2 probe provided (1) greatly improved sensitivity, allowing a more complete coverage of low-density regions such as the polar cap; (2) very high resolution of plasma structure (down to 10 cm in extent); and (3) onboard signal processing with basic data in the format that had been used for the ISIS 1 experiment. NSSDC has all the useful data that exist from this investigation.

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**INVESTIGATION NAME:** FIXED-FREQUENCY SOUNDER  
**NSSDC ID:** 71-024A-09  
**INVESTIGATIVE PROGRAM:** CODE EE-8/6-CPL-00, SCIENCE  
**INVESTIGATION DISCIPLINES:** PARTICLES AND FIELDS AERONOMY  
**PERSONNEL:**  
**PI:** C.D. ANGER  
**BRIEF DESCRIPTION:** Dual-wavelength scanning auroral photometer was designed to map the distribution of auroral emissions at 5577 and 3954 A over the portion of the earth visible from the spacecraft. The instrument, which was a moveable light detector and of the natural orbital and rotational motions of the spacecraft permitted the sensor to systematically scan the entire auroral region. The observing power was constructed to allow incident radiation to be accepted from two directions 180 deg apart, and then to focus this light at a common point on the single-image-dissector photometer tube.
PERSONNEL
PI - W. CALVERT
OI - J.W. MURPHY
OI - J.M. WHITTEKER
OI - J.M. WANGDEK

BRIEF DESCRIPTION
This experiment was designed to study ionospheric features of a smaller scale than could be detected by the sweep sounder and to study plasma resonances. Parameters measured were virtual range and function of propagation time of the pulse and time. These data were normally observed only when the spacecraft was in one of the range regions of the ionosphere. The fixed-frequency sounder operated continuously at the same antenna frequency, transmitter, and receiver for the sweep-frequency experiment. It was operated for 3 to 5 s during the frequency sweep period of the sweep-frequency operation which was every 1 to 21 s. One of six frequencies (0.125, 1.25, 1.0, 1.125, 1.0, 1.125, 1.625, 0.16, or 0.1956) was chosen by the operator for use by the experimenter, as desired. Other modes of operation were available, including continuous observation at a selected frequency and a special fixed mode with transmission at a selected one of the six fixed frequencies and sweep reception.

--- 82. HERRICKA

INVESTIGATION NAME - COSMIC RADIO NOISE
NSSC ID - 71-0044-10
INVESTIGATIVE PROGRAM
CODE CE-818C-OP, SCIENCE
INVESTIGATION DISCIPLINE(S)
ASTRONOMY.
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - T.R. MARTIN
OI - G.S. JAMES

BRIEF DESCRIPTION
This experiment used the sweep-frequency ionosonde receiver automatic gain control voltages to measure galactic and solar proton-noise levels. The receiver sweep rate varied from 0.1 to 20 MHz. The dynamic range was 50 dB, and the bandwidth was 50 kHz. The antennas used were 181-m and 73-m dipoles.

--- 82. HERRICKA

INVESTIGATION NAME - SOFT-PARTICLE SPECTROMETER
NSSC ID - 71-0044-05
INVESTIGATIVE PROGRAM
CODE CE-818C-OP, SCIENCE
INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND PARTICLES OF THE EARTH'S MAGNETOSPHERE
AERONOMY

PERSONNEL
PI - W.J. HERRICKA
OI - D.M. KLUMM
OI - U.O. TEXAS, DALLAS

BRIEF DESCRIPTION
The soft-particle spectrometer (basically an electrostatic analyzer) was used to study the directional intensity and differential-energy spectrum of ions and electrons to obtain a greater understanding of auroras, geomagnetic disturbances, and various ionospheric features. Differential energy spectra were obtained in the energy range 5 eV to 1 keV with a 200 eV energy resolution. The voltage sweep program of the analyzer was flexible. The experimenter worked well from launch through October 1964, when the data ended. The experiment worked well from launch through October 1964, when the data ended. Subsequently, only electron data were acquired. NSSC has all the useful data that exist from this investigation.

--- 82. HERRICKA

INVESTIGATION NAME - ION-MASS SPECTROMETER
NSSC ID - 71-0044-36
INVESTIGATIVE PROGRAM
CODE CE-818C-OP, SCIENCE
INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND PARTICLES OF THE EARTH'S MAGNETOSPHERE
AERONOMY

PERSONNEL
PI - J.M. HOFFMAN
U.O. TEXAS, DALLAS

BRIEF DESCRIPTION
The magnetic ion-mass spectrometer experiment was flown to determine the distribution of the concentrations of the positive ion species as a function of time and position with particular interest focused on the polar aurora. The instrument had two ion spectrometer systems and mass scanning through the range from 1 to 64 atomic mass units (u) was accomplished in two sections: 1 to 8 u and 8 to 64 u. Two ion beams emerged from the magnetic sector of the instrument and were simultaneously detected by electron multipliers and a log electron number multiplier. A circuit following each multiplier detected the peak amplitude of the ion currents. This peak amplitude, rather than the entire mass spectrum, was transmitted in order to reduce the telemetry transmission. In this mode of operation, the complete mass range was scanned in 1 s.

--- 82. HERRICKA

INVESTIGATION NAME - 6300-A PHOTOMETER

PERSONNEL
PI - M. MAIER
OI - J.W. BURROWS
OI - J.W. BURROWS

BRIEF DESCRIPTION
The objective of the energetic particle experiment was to provide data that would aid in the understanding of (1) the mechanisms responsible for the production and control of the outer radiation zone (2) the demonstration of solar-flare particle entry into the earth's magnetic field and (3) the determination of magnetic field strength and the solar wind. This experiment consisted of four ion detectors, the first set consisted of three silicon detectors for which one set was left at launch and measured electrons greater than 10 keV and 40 keV perpendicular and parallel to the spin axis. These silicon detectors were also sensitive to protons with energies greater than 200 and 600 keV, respectively. All remaining detectors measured particles perpendicular to the spin axis. The second set consisted of two solid-state silicon junction detectors. Both detectors were operated in low- and high-threshold modes, while one could additionally be switched to another discrimination. The fourth set was composed of two cesium thallous scintillation-photomultiplier systems (chambers with cylindrical electrostatic analyzers) stepped through energy levels 0.6 to 2.5 and 12 to 20 keV and electrons in the energy range 0.6 to 2.5 keV. The second set was composed of two cesium thallous scintillation-photomultiplier systems (chambers with cylindrical electrostatic analyzers) stepped through energy levels 0.6 to 20 keV.

--- 82. SHEPPARD
NSSDC ID- 71-0244-12
INVESTIGATIVE PROGRAM
CODE EE-C+COP, SCIENCE
INVESTIGATION DISCIPLINE(S)
IONOSPHERES PARTICLES AND FIELDS
AERONOMY

PERSONNEL
PI- G.G. SHEPHERD YORK U

BRIEF DESCRIPTION
A two-channel photometer was used to measure directly and to map the intensity of the atomic oxygen red line at 6300 A in daytime twilight, and night airglow and aurora. Each channel had its own multichannel inputs and the two inputs were mounted at the same end of the spacecraft separated by 100 deg with their axes at 90 deg to the spacecraft's spin axis. One optical input was characterized by a spectral bandwidth of 12 A centered around the 6300-A line of atomic oxygen and the other input was used for white-light measurements. The spinning satellite caused the photometer to alternately view the earth and then the sky, i.e., when one sensor viewed the earth the other sensor saw the sky. Both sensors had a 2.5-deg circular field of view. With the use of a beam-combiner arrangement, the same photomultiplier accepted the two inputs. The dynamic range of intensity measurements was from about 1 e-11 photons per sq m per s (10 reylight) to more than 1 e-11 photons per sq m per s. Sunlight could enter the optical systems directly in addition to earth-reflected light. The instrument was illuminated by the sun only for the off-axis angles less than 47 deg. Outside this limit the data were not degraded by sunlight, permitting normal operation in the region of the orbit where the spacecraft was in sunlight, but the portion of the sky beneath it was dark. A spectrometer selected the filter only when it was 7.5 deg or less off-axis. In the range 7.5 to 47 deg good data were obtained only when the sun was directly in the field of view of the contamination.

The Knoop analysis was necessary, among other operations, to evaluate different geometrical situations and to locate the on-earth time crossing of the 12 deg passage photometer so that the data could be organized into spin maps. For more details see G.G. Shepherd et al. (1975). Applied Optics v. 12 n. 8, pp. 1767-1774, August 1973.

---- ISIS 2- WHITTECKER----

INVESTIGATION NAME- SWEEP FREQUENCY SOUNDER
NSSDC ID- 71-0244-01
INVESTIGATIVE PROGRAM
CODE EE-C+COP, SCIENCE
INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI- J.H. WHITTECKER DC-CCRC
01- G.B. MULDREW DC-CRC
01- J. TURNER IONOSPHERIC PRED SERV
01- M. SYLVAIN LDE
01- O. HOLT AURORAL OBS
01- Y. OGATA RADIO RESEARCH LAB
01- R. RASHVARDI PHYSICAL RESEARCH LAB
01- J.E. JACKSON NASA-GSF
01- R.B. NORTON NOAA-ERL
01- R.L. CHAI NASA-ARC
01- R.S. UNWIN DEPT OF SCI+INDUS RES

BRIEF DESCRIPTION
The purpose of this experiment was to measure the isospheric plasma density in the vicinity of 100 h, 3400 km. Another important function of the sounder was to provide a correlative data for the other ISIS 2 experiments, particularly those measuring isospheric parameters. The ISS 2 ionosphere was a radio transmitter that recorded the time delay between a transmitted and returned radio-frequency pulse. A continuum of frequencies between 0.1 and 20 MHz was sampled every 10 or 21 s, and one of six selected frequencies was always used for such measurements. A fixed frequency was used for 5 weeks during early March 21-25 period. In addition to the sweep and fixed-frequency modes of operation, a mixed mode was available in which a fixed frequency was fixed at one of six possible frequencies while the receiver swept. Several virtual-range (delay-time) traces resulting from ground reflections or between spacecrafts and ground stations of the ionosphere, nonvertical propagation etc., were normally observed. Virtual range at a given frequency was primarily a function of the frequency and the spacecrafts distance along the propagation path, and mode of propagation etc., were normally observed. The standard data was an ionogram (graph) showing virtual range as a function of frequency.

----------------------------- ISIS-2 -----------------------------

SPACECRAFT COMMON NAME- ISS-2
ALTERNATE NAMES- IONOSP SOUNCING SAT 2 T- 10674
UHE 2 T- 1592

NSSDC ID- 78-018A
LAUNCH DATE- 02/17/78
LAUNCH SITE- TANAGASHIMA, JAPAN
LAUNCH VEHICLE- NASA
SPONSORING COUNTRY/AGENCY
JAPAN

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOSTATIONARY
ORBIT PERIOD- 107. MIN
PERIAPSE- 972. KM ALT
APOAPSE- 1235. KM ALT

PERSONNEL
PI- T. HAKURA RADIO RESEARCH LAB
PS- N. MATSUURA

BRIEF DESCRIPTION
The Ionospheric Sounding Satellite (ISS) was part of Japan's contribution to the International Magnetospheric Study (IMS). Its objectives were to accumulate data for study of the topside ionosphere and to survey radio noise at four frequencies from both earth and cosmic sources. It prepared world-wide maps of F2 critical frequency from the ionospheric sounding data. The ISS 2 was a small observatory with four experiments on board. The spacecraft, a right cylinder, 82 cm long and 93.5 cm in diameter, was stabilized at about 3 cm with the spin axis normal to the ecliptic plane. Two pairs of crossed dipole antennas extended from the central part of the satellite and lay perpendicularly to the spin axis. These antennas, 36.8 and 11.4 cm long, were unturled in orbit and were also shared by ionospheric sounding and radio noise experiments. A spherical retardation potentials trap sensor was mounted on a boom exterior to the spin axis and a magnetic attitude sensor was mounted on a similar boom on the opposite side of the spacecraft. The remaining experiment involves a magnetometer and a mass spectrometer with two sensors flush-mounted on opposite ends of the spacecraft. The spacecraft attitude was determined by means of a magnetometer and a solar sensor, and a horizon sensor. Small telemetry and command antennas extended from the spacecraft. The spacecraft were powered by a battery and a small solar system with solar cells covering most of the cylindrical surface. One recorder on board permitted sounding rate operations in either a recorded (for up to 112 min) or real-time mode. Readout and real-time operation were done from Kashiwa, Japan, and Ottawa, Canada.

----------------------------- ISIS-3 -----------------------------

INVESTIGATION NAME- SWEEP FREQUENCY TOPSIDE IONOSPHERIC SOUNDER (TOS)
NSSDC ID- 78-0184-01
INVESTIGATIVE PROGRAM
CODE EE-C+COP, SCIENCE
INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI- K. AKIYAMA RADIO RESEARCH LAB

BRIEF DESCRIPTION
The Ionospheric Sounding Satellite (ISSI) ionosphere was a pulsed radio transmitter and receiver that recorded the time delay between a transmitted and returned radio-frequency pulse. A continuum of frequencies between 0.1 and 14.8 MHz was sampled in 0.1-MHz steps to provide virtual range (delay time) of signal reflections. One or more frequency channels were prepared for these measurements. The standard data was an ionogram (graph) showing virtual range as a function of frequency. This sounding mode of operation, called TOS-A, required 16 s to sample all frequencies (ionogram). A TOP-B mode was also available. In the TOP-A mode, an iterative logic was employed with the pulsed transmission to determine the F2 region critical frequency, its corresponding virtual height and other related sounding data. Unfortunately in the TOP-A mode failed to function due to internal control software from the top-B mode. World-wide maps of critical frequency were prepared. For both the TOP-A and TOP-B modes, the complete alternate time between successive ionograms or successive critical frequency observations was 64 s.

----------------------------- ISIS-5 -----------------------------

INVESTIGATION NAME- ION MASS SPECTROMETER
NSSDC ID- 78-0184-04
INVESTIGATIVE PROGRAM
CODE EE-C+COP, SCIENCE
INVESTIGATION DISCIPLINE(S)
IONOSPHERES AERONOMY

53
PERSONNEL
PI - I. IWAMOTO  RADIO RESEARCH LAB

BRIEF DESCRIPTION
This experiment was flown to measure the positive ion composition over the spacecraft orbit. Two Bennett-type ion-mass spectrometers were flush-mounted on opposite sides of the spacecraft to look in opposite directions along the spin axis. The inside diameter of these cylindrical sensors was 36 mm. The mass range covered was 1 to 20 atomic mass units and the ion concentrations were measured over the range from 1 to 1.4 ions per cm.

------- 155-B KOTAKI -------

INVESTIGATION NAME -ION MASS SPECTROMETER
NSSDC ID- 78-013A-02 INVESTIGATIVE PROGRAM SCIENTIFIC SATELLITE
INVESTIGATION DISCIPLINE(S) ASTROPHYSICS AND RADIO PHYSICS

PERSONNEL
PI - M. KOTAKI  RADIO RESEARCH LAB

BRIEF DESCRIPTION
The objectives of this experiment were to observe and study (1) the global distribution of spherics and (2) the time variation of spherics and cosmic noise. Radio noise was observed at the following frequencies: 2.497, 5.997, 9.997, 10.997, 24.994, and 25.906 MHz. Characteristics observed at each frequency were noise intensity (resolution of 1/128 s) and occurrence frequency of inductive noise (15 db above resolved intensity).

------- 155-B MIYAZAKI -------

INVESTIGATION NAME - RETARDING POTENTIAL TRAP
NSSDC ID- 78-014A-03 INVESTIGATIVE PROGRAM SCIENTIFIC SATELLITE
INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - S. MIYAZAKI  RADIO RESEARCH LAB

BRIEF DESCRIPTION
This probe was a spherical retarding-potential trap designed to observe ambient ion and electron densities ranging from 1 x 10^3 to 1 x 10^6 per cm. Ambient ion and electron temperatures in the range 500 to 5000 deg K were determined. As with all retarding-potential instruments, these parameters were derived from interpretation of the current flow measured with a given voltage sequence applied to the collector and screen grids. The sensor was mounted on a boom extending perpendicularly to the spacecraft spin axis. It consisted of a 2-cm diameter collector, concentrically enveloped by 4 and 10-cm diameter spherical wire grids. The current-voltage analog data were telemetered and subsequently analyzed by the experimenter.

------------ KYOKKO, MUKAI ------------

SPACECRAFT COMMON NAME - KYOKKO
ALTERNATE NAMES - EXOSPHERIC SAT, A EXOS A 1064

NSSDC ID- 78-014A
LAUNCH DATE- 02/06/78
WEIGHT- 126.6 KG
LAUNCH SITE- KAGOSHIMA, JAPAN
LAUNCH VEHICLE- ME-3H

SPONSORING COUNTRY/AGENCY
JAPAN

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
ORBIT PERIOD- 133.7 MIN
PERIODICITY- 492 KM ALT

PERSONNEL
PF - K. MIRAO
PS - T. ITOH
U OF TOKYO
U OF TOKYO

BRIEF DESCRIPTION
This satellite was a part of Japan's contribution to the International Magnetospheric Study. The mission objectives were to observe the aurora borealis, study aurora-related phenomena, and study the ionosphere and magnetosphere. The main body of the spacecraft was a cylinder 0.944 m in diameter with shallow truncated cones attached at both ends. Most of the surface was covered with solar cells that produced 35 W. Two booms of roughly 1.29 m each extended outward from the equator of the main body. At the tip of each boom was a permanent magnet to provide alignment of the spacecraft center axis along the local geomagnetic field line. Two sets of circularly polarized quadrupole antennas, one for VHF (400 MHz) and another for VHF, extended from opposite ends of the spacecraft. The VHF antenna was deployed for telemetry (136 MHz) and command (148 MHz). Other attitude sensors included a vector magnetometer and a solar sensor. The spacecraft contained a tape recorder to store 10 min of data at 512 bps or 40 min at 2048 bps, with readout in 10 min at 8192 bps. Besides the solar cells, there was a nickel-cadmium battery for nighttime operation.

------- KYOKKO, IWAMOTO -------

INVESTIGATION NAME-ION MASS SPECTROMETER
NSSDC ID- 78-014A-06 INVESTIGATIVE PROGRAM SCIENTIFIC SATELLITE
INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - I. IWAMOTO  RADIO RESEARCH LAB
OI - T. SAGAWA

BRIEF DESCRIPTION
The instrument measured upper-atmosphere positive ions in the ranges 1 to 4 and 1 to 16 atomic mass units and consisted of a quadrupole mass filter and a channel electron multiplier. The ion inlet was located on the forward end of the spacecraft main body.

------- KYOKKO, KANEDA -------

INVESTIGATION NAME- UV AURORAL TV IMAGING
NSSDC ID- 78-014A-03 INVESTIGATIVE PROGRAM SCIENTIFIC SATELLITE
INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - T. KANEDA
OI - M. NIWA
OI - M. TAKAGI

BRIEF DESCRIPTION
The instrument was a TV camera that consisted of an image-memory tube with a slow-scan readout. The photodiode surface was potassium bromide with a magnesium fluoride faceplate that made it sensitive to photons around 1300 A. A pair of spherical mirrors produced an image on the photodiode surface. An auroral pattern was measured every 128 s when the satellite was over the Arctic. The number of pixels in an image frame was 176 x 178 and the camera field of view was 60 deg.

--------- KYOKKO, MUKAI ---------

INVESTIGATION NAME- ELECTRON ENERGY ANALYZER
NSSDC ID- 78-014A-02 INVESTIGATIVE PROGRAM SCIENTIFIC SATELLITE
INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - T. MUKAI

BRIEF DESCRIPTION
The instrument consisted of two spherical electrostatic analyzers that were mounted at the front and one at the back of the spacecraft to view the electrons streaming either down the magnetic field line or toward the equator. Each analyzer covered the energy range from 4.5 eV to 11.3 keV in nine energy channels.

------- KYOKKO, NAKAMURA -------

INVESTIGATION NAME- UV SLOW SPECTROPHOTOMETER
NSSDC ID- 78-014A-05 INVESTIGATIVE PROGRAM SCIENTIFIC SATELLITE
INVESTIGATION DISCIPLINE(S) ASTRONOMY

PERSONNEL
PI - M. NAKAMURA
OI - T. WATANABE

BRIEF DESCRIPTION
The instrument consisted of a grating spectrophotograph with a resolution of 10 A and vibrating slit. The spectrum was scanned in a bandwidth of plus or minus 15 A around the following spectral lines: 304 A (H+), 584 A (He+), 833 A (O+), 1216 A (H Lyman-alpha) and 1204 A (O). Five channel multipliers, one for each spectral line, were used to measure intensity. The UV emissions from the atmosphere, magnetosphere, and interplanetary space were observed.
INVESTIGATION NAME- ELECTRON PROBES

NSSDC ID- 78-014A-01

INVESTIGATIVE PROGRAM
SCIENTIFIC SATELLITE
IONOSPHERES
ELECTRODYNAMICS
AERONOMY

PERSONNEL
PI - K. ISTYMA
OI - M. HIRAO

BRIEF DESCRIPTION
The experiment consisted of several instruments designed to measure electron temperature and density as well as ion composition. The electron-temperature probe was an
RTFLECTOR type and a Langmuir probe was used to obtain electron density.

INVESTIGATION NAME- ELECTROSTATIC Plasma WAVE MEASUREMENT

NSSDC ID- 78-014A-04

INVESTIGATIVE PROGRAM
SCIENTIFIC SATELLITE
MAGNETOSPHERIC PHYSICS
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - T. YOSHINO
OI - R. NAKAMURA
OI - T. TAN

BRIEF DESCRIPTION
This investigation involved electrostatic waves in the magnetosphere in the frequency range 0.045 to 3 MHz and radio waves between 0.045 and 3 MHz. Two Faraday cups were employed to pick up electrostatic waves while a dipole antenna was used to receive radio waves. The dipole antenna consisted of a pair of thin wires 1.5 m long and was attached along the extendable stabilization boom. One Faraday cup was mounted to look parallel to the spin axis and the other perpendicular to the spin axis. Waves in the 0.045 to 3 MHz range were received by wave detectors and telemetered in analog form. The wave strength in the 0.045 to 3 MHz range was measured in 11 bands.

--- MAGSAT ---

SPACECRAFT COMMON NAME- MAGSAT
ALTERNATE NAMES- ACME-C, GLOBAL MAGNETIC SURVEY MAGSAT-1, 11066

NSSDC ID- 79-0994

LAUNCH DATE- 10/10/79
WEIGHT - 158. KG
LAUNCH VEHICLE- SCOUT
SPONSORING COUNTRY/AGENCY
UNITED STATES

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEODETIC
EPOCH DATE- 10/31/79
INCLINATION - 96.8 DEG
PERIAPSE- 351.9 KM ALT
APOAPSE- 578.4 KM ALT

PERSONNEL
PM - L. W. O'GILLY
PS - R. A. LANGLEY

BRIEF DESCRIPTION
The MagSat project was a joint NASA/United States Geodetic Survey (USGS) effort to measure near-earth magnetic fields on a global basis. Objectives included obtaining an accurate description of the earth's magnetic field, obtaining data for use in the update and refinement of world and regional magnetic charts, completion of a global crustal magnetic anomaly map, and interpretation of that map in terms of geology/geophysical models of the earth's crust. The spacecraft was launched into a low near-polar orbit by the Scout vehicle. The basic spacecraft was made up of two distinct parts: the instrument module that contained a vector and a scalar magnetometer and their unique supporting gear and the base module that contained the necessary control-handling, power, communications, command and attitude-control subsystems to support the instrument module. The base module complete with the transport superstructure was comprised of residual Small Astronomy Satellite (SAS-C) hardware. The magnetometers were deployed after launch to a position 6 m behind the spacecraft. At this distance, the influence of magnetic materials for the instrument and base module (chiefly from the star cameras) was less than 1 nT.

--- MAGSAT, LANGLEY ---

INVESTIGATION NAME- SCALAR MAGNETOMETER

NSSDC ID- 79-0994A-01

INVESTIGATIVE PROGRAM
CODE CE-8/DO-SP., APPLICATIONS
INVESTIGATIVE DISCIPLINE(S)
PARTICLES AND FIELDS
GEODYNAMICS

PERSONNEL
PI - R. A. LANGLEY
OI - W. M. FARMIN

BRIEF DESCRIPTION
The scalar magnetometer had two dual-cell, cesium-vapor sensor heads whose output frequency was proportional to the total magnetic field. This sensor configuration only two small iron-core-shaped dead zones existed. These lay along the orbit of the spacecraft (the east-west direction) for the orbit and attitude chosen for this mission and a direction in which the magnetic field was never oriented. The scalar magnetometer's basic accuracy was on the order of 0.5 nT. A period count system converted the magnetometer output frequency to a digital word acceptable to the spacecraft telemetry system. This digital data had a resolution and accuracy of between 0.5 and 1.0 nT in the range 1.0-4 to 6.0-4 nT. Most of the times noise on the spacecraft resulted in operation of only one sensor at a time.

--- MAGSAT, LANGLEY ---

INVESTIGATION NAME- VECTOR MAGNETOMETER

NSSDC ID- 79-0994A-02

INVESTIGATIVE PROGRAM
CODE CE-8/DO-SP., APPLICATIONS
INVESTIGATIVE DISCIPLINE(S)
PARTICLES AND FIELDS
GEODYNAMICS

PERSONNEL
PI - R. A. LANGLEY
OI - W. H. ACUNA

BRIEF DESCRIPTION
The vector magnetometer consisted of three fluxgate sensing elements aligned along orthogonal axes. The output of each sensor was converted to a digital word by an analog-to-digital converter. The output of all these axes were sampled essentially at the same time. Each vector measurement had a resolution of better than 0.5 nT and an absolute accuracy of better than 0.6 nT when referenced to a geodetic coordinate system. The measurement range was plus or minus 6.0-4 nT.

--- MIDAS 2 ---

SPACECRAFT COMMON NAME- MIDAS 2
ALTERNATE NAMES- 1940 ZETA 1, 00043

NSSDC ID- 60-0064

LAUNCH DATE- 05/24/60
WEIGHT - 230. KG
LAUNCH VEHICLE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- ATLAS
SPONSORING COUNTRY/AGENCY
UNITED STATES

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
EPOCH DATE- 05/24/60
INCLINATION - 94.44 DEG
PERIAPSE- 48.4 KM ALT
APOAPSE- 511. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
Midas 2 was an earth-orbiting satellite designed to measure infrared background and define IR sources. In addition to the satellite carried experiments to measure cosmic radiation, atmospheric density, thermal emission and reflected solar radiation from the earth, and microirradiation. A plasma probe was included too. The spacecraft weighs 268 kg (including the second stage) and was chemical-battery powered. IR radiation data were received for the lifetime of the battery pack, which powered the final transmission on May 26, 1960.

--- MIDAS 2, MIASAC ---

INVESTIGATION NAME- ATMOSPHERIC NEUTRAL DENSITY

NSSDC ID- 60-0064A-02

INVESTIGATIVE PROGRAM
CODE CE-8/DO-SP., APPLICATIONS
INVESTIGATIVE DISCIPLINE(S)
AERONOMY
PERSONNEL
PI - J.P. MESSAC
USAF GEOPHYS LAB

BRIEF DESCRIPTION
This density experiment was designed to yield atmospheric
pressure and densities for seven orbits of spacecraft, but additional
method of measurement was satisfactory after the telemetry fell
screw damage and lack of solidity in the spacecraft attitude while measurements
were being taken.

SPACECRAFT COMMON NAME - OGO 2
ALTERNATE NAMES- OGO-C, PGOO 1
5 53 0168

NSSID: 65-081A
LAUNCH DATE- 10/1/65
WEIGHT- 520. KG
LAUNCH SITE- VANDELERS AFB, UNITED STATES
LAUNCH VEHICLE- IMP

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-GSFC

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOMETRIC
ORBIT PERIOD- 194. MIN
EPOCH DATE- 10/15/65
INCLINATION- 84.4 DEG
PERIAPSIS- 414. KM ALT

PERSONNEL
PM - W.E. SCULLIN(LA)
PS - N.A. SPENCER

NSSID: 65-081A
LAUNCH DATE- 10/1/65
WEIGHT- 520. KG
LAUNCH SITE- VANDELERS AFB, UNITED STATES
LAUNCH VEHICLE- IMP

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-GSFC

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOMETRIC
ORBIT PERIOD- 194. MIN
EPOCH DATE- 10/15/65
INCLINATION- 84.4 DEG
PERIAPSIS- 414. KM ALT

PERSONNEL
PM - W.E. SCULLIN(LA)
PS - N.A. SPENCER

BRIEF DESCRIPTION
OGO 2 was a large observatory instrumented with 23
experiments designed to make simultaneous, correlative
observations of radiation, aurora and solar emissions, energetic
particles, magnetic field, corotatory properties, etc., especially over the polar areas. OGO 2 consisted of a
main body generally parallelepiped in form, two rectangular
solar panels, each with four solar-oriented experiment packages (SPEP), and two orbital plane experiment packages (OEPP). It also included six experiment packages (EP-1, 2, 3 and 4, 5, and 6) mounted on booms extending generally fore and
aft of the spacecraft along a y axis. Antenna and attitude control
fixtures also extended from separate and/or EP booms. The main
body was attitude-controlled by use of horizon scanners and gas
jets and was designed to point toward the sun (2 axes). The
axis connecting the two solar panels (x axis) was designed to
oscilate on axis to remain perpendicular to the earth-sun-spacecraft plane. The solar panels activated by sun
cells could rotate such that the x axis could be maintained
looking forward in the orbital plane of the satellite. To maintain this orientation, the OPEP axes could rotate over 90 deg. In addition, an angular difference of
90 deg was possible between the orientation of the upper and
lower SPEP packages. Each SPEP contained four experiments; and the OPEP contained five experiments. A second achieving orbit, difficulties in maintaining earth lock with horizon
scanners caused cessation of attitude control gas by October
23, 1965, 10 days after launch. At this point, the spacecraft entered a spin mode about 0.11 rpm with a large angular error about the same direction. Several additional experiments became useless when the satellite went into this spin mode. Six
additional experiments were degraded by this loss of attitude
control. By April 1966, both the SPEP and OPEP, had been
relocated to the remaining observatory. The SPAE observations were limited to sunlit portions of the Earth
by December 1966, only eight experiments were operational, five of which were degraded by the spin mode
currently operating. By April 1967, the tape recorders had malfunctioned and only one third of the recorded data could be processed. Spacecraft power and periods of operational sequence conflicts created six large data gaps so that data were observed on a total of about 206 days of the 2-year survey, 18-month data
and 2 years of observed satellite data to November 1, 1967. The
data gaps were (a) 8 November 1976 to November 1, 1967, (b) 6 December 1965, to January 7, 1966, (c) April 9, 1966, to
June 21, 1966, (d) September 16, 1965, to November 1, 1967, (e)
December 27, 1965, to April 11, 1967, and (f) May 9, 1967, to
September 19, 1967. The spacecraft was shut down on November
1, 1967, with eight experiments functional. It was reactivated for 2 weeks in February 1968 to operate experiment
56 A barograph system was placed in the spacecraft, but a collector, with controlled voltages and voltage sweeps on
from some profiles were taken. Temperature, density, temperature and composition data
were obtained. The instrument was designed so that the spacecraft was seen in the spacecraft motion. Due to
the failure (10 days after launch) of the spin control system, the instrument could not be oriented properly. The subsequent data obtained were not scientifically useful.
BRIEF DESCRIPTION
This experiment was designed to study fluctuations in the trapped radiation by measuring low-energy trapped radiation and auroral particles. Two scintillators, in conjunction with photomultiplier tubes, were designed to observe electrons between 10 and 100 keV and protons between 100 keV and 4.5 MeV. The scintillator/photomultiplier tube was intended to point radially away from the Earth. The other scintillator was to have looked at 90° to this. One of the two photomultiplier tubes lost three orders of magnitude gain when turned on after launching. This coupled with the failure of the attitude control system, made the data from the remaining detector worthless. The experiment failed on October 14, 1965. No useful data were obtained from this experiment.

--- 500 2s KREPLIN ---------------

INVESTIGATION NAME: SOLAR-X-RAYS

NSSDC ID: 65-081A-16

INVESTIGATIVE PROGRAM
CODE EE-6C-SP SCIENCE

INVESTIGATION DISCIPLINE(S)
PHYSICS

PERSONNEL
PI: R.W. KREPLIN
OI: T.A. CHUBB (RETIRED)
OI: W.C. FRIEDMAN (RETIRED)

US NAVAL RESEARCH LAB

BRIEF DESCRIPTION
This experiment utilized four ion chambers to observe broadband solar emissions in the wavelength range 0.5-3 Å, 2-8 Å, and 0.1-1.6 Å and 0.6 Å. To minimize contamination from charged particles the field of view of each ion chamber was limited to 0.4 sr, and the experiment package was mounted in a compartment located on one of the solar panels, which was pointed toward the sun to an accuracy of plus or minus 5°. The instrument included a charge detector with a zero-current calibration check. Six detectors, except the 0.6-Å, incorporated automatic range changing in order to avoid saturation; however, this feature could be overridden by a command from the ground. The spacecraft horizon scanners locked onto thermal gradients in the earth's atmosphere and the spacecraft lost orientation on October 23, 1965. NSSDC has all the useful data that exist from this investigation.

--- 500 2s MANGE ---------------

INVESTIGATION NAME: LYMAN-ALPHA AND UV AIRGLOW

NSSDC ID: 65-081A-11

INVESTIGATIVE PROGRAM
CODE EE-6C-SP SCIENCE

INVESTIGATION DISCIPLINE(S)
PHYSICS
AERONOMY
IONOPHYSICS

PERSONNEL
PI: P.J. MANGE

US NAVAL RESEARCH LAB

BRIEF DESCRIPTION
There were two parts to this experiment: a far-UV experiment (1230-1350 Å) and a Lyman-alpha experiment (1020-1250 Å). The far-UV experiment used a UV ion chamber. The far-UV experiment yielded information about the rate at which energy is absorbed. The Lyman-alpha experiment measured Lyman-alpha radiation from the direction of the earth and from space. The sensors functioned properly but the spacecraft spin made the data useless.

--- 500 2s NEWTON ---------------

INVESTIGATION NAME: NEUTRAL PARTICLE STUDY

NSSDC ID: 65-081A-20

INVESTIGATIVE PROGRAM
CODE EE-6C SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI: G.P. NEWTON

NASA HEADQUARTERS

BRIEF DESCRIPTION
The purpose of this experiment was to measure the neutral particle density and temperature along the GOS 2 orbit. The instrumentation contained a Bayard-Alpert ionization gauge, which consisted of a grid and tube open to the neutral atmosphere. The experiment failed immediately after launch; the breakaway device, which should have opened the sensor to the vacuum environment could not be deployed. The reason for failure could not be uniquely established. It was believed to be due to a deficiency in the spacecraft/experiment wiring.

--- 500 2s NILLSON ---------------

INVESTIGATION NAME: INTERPLANETARY DUST PARTICLES

NSSDC ID: 65-081A-20

INVESTIGATIVE PROGRAM
CODE EE-6C SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI: R.K. NILLSON

NASA-GSFC

BRIEF DESCRIPTION
This experiment was designed to study fluctuations in the trapped radiation by measuring low-energy trapped radiation and auroral particles. Two scintillators, in conjunction with photomultiplier tubes, were designed to observe electrons between 10 and 100 keV and protons between 100 keV and 4.5 MeV. The scintillator/photomultiplier tube was intended to point radially away from the Earth. The other scintillator was to have looked at 90° to this. One of the two photomultiplier tubes lost three orders of magnitude gain when turned on after launching. This coupled with the failure of the attitude control system, made the data from the remaining detector worthless. The experiment failed on October 14, 1965. No useful data were obtained from this experiment.
INVESTIGATIVE PROGRAM
CODE EE+6-8, SCIENCE
INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
INVESTIGATION NAME = TRIAXIAL SEARCH-COIL MAGNOMETER
INVESTIGATION DISCIPLINE(S)
IONOSPHERES
PERSONNEL
PI = R.L. SMITH
OI = R.E. HOLZER
NASA-JPL
U OF CALIF, LA
BRIEF DESCRIPTION
This experiment was used to study the ELF frequency range of magnetic fluctuations in the earth's magnetic field. The search coil sensor consisted of a coil of 100,000 turns of wire wound around a nickel-steel-laminated core. The coil sensitivity was approximately 10 microvolts per nT of magnetic flux. A low-noise preamplifier with a gain of 100 was mounted on an auxiliary housing near the search coil. The signal was amplified further by a high-pass filter and generated a spectrum analysis which generated five outputs per axis, each a measure of the energy in a given frequency band. The three orthogonal sensors and the associated preamplifiers were mounted at the end of a 6-m boom to reduce interference from spacecraft-generated magnetic fields. Magnetic fluctuation measurements were made in the frequency range from below 0.01 Hz to above 1000 Hz. The three digital data rates were 4, 16, or 64 kbits/s, and the booms were tilted to provide a full sample of the spectrum analyzer measuring 36.9, 9.22, and 2.31 Hz. Difficulties immediately after launch caused OGO 2 to spin, creating severe interference problems in the magnetometer. This interference made the data obtained very poor in quality. The data base from this investigation no longer exists.

INVESTIGATION NAME = IONOSPHERIC COMPOSITION
INVESTIGATION DISCIPLINE(S)
IONOSPHERES
PERSONNEL
PI = H.A. TAYLOR, JR.
OI = N.W. SPENCER
NASA-GSFC
BRIEF DESCRIPTION
A laminar-Bennet radio-frequency ion mass spectrometer tube with its associated electronics was used to measure the thermal atomic ions having mass-to-charge values from 1 to 45 atomic mass units in two fractions of approximately 1/20 in 20. Concentrations from 1.1 to 1.6 ng per cc were measured. The time between consecutive samples of equal volume was 15 min. The spectral sweep rates were 25.6 s. This time interval corresponded to a spatial resolution of from...
175 to 200 keV along the orbit paths or to 1.5 deg in latitude. Mean ion mass and total ion concentration were also calculated. The instrument is described in detail in the paper cited above. Because of the long exposure, evidence of solar and geomagnetic control.* J. Geophys. Res. 75, 17 pp. 5351-5353, September 1969. Data sets are no longer available from this investigation.

--------- OGO 2, WEBBER---------

INVESTIGATION NAME- GALACTIC AND SOLAR COSMIC RAYS

NSSDC ID- 65-061A-02
INVESTIGATIVE PROGRAM CODE EE-4, SCIENCE
INVESTIGATIVE DISCIPLINE(S) SOLAR PHYSICS PARTICLES AND FIELDS COSMIC RAYS

PERSONNEL
PI - W. A. WEBBER
U OF NEW HAMPSHIRE

BRIEF DESCRIPTION
The cosmic-ray telescope experiment was designed to measure the differential energy spectra of protons, helium nuclei, and heavier nuclei up to Z ≥ 10, within the energy range of 50 to 2500 MeV per nucleon. The telescope had a maximum sampling rate of one count per 288 ms. The telescope consisted of two detectors, a scintillator with its associated photomultiplier (PMT) tube and a scintillator and a Cerenkov element sandwich with both elements optically coupled to the same PMT tube. A 70-m coincidence circuit coupled the two detectors to form the telescope. Pulses from each detector were pulse-height analyzed. Sample pulse-height spectra, coincidence count rates, and the output of the first detector were telemetered. The noise levels of the spacecraft increased to sufficient amplitude to render the first detector unusable except during eclipse periods. All the useful data from this experiment were obtained between October 15 and February 1, and about 1.7% of the data obtained during this period contain useful information. NSSDC has all the useful data that exist from this investigation.

********** OGO **********

SPACESHIP COMMON NAME- OGO 4
ALTERNATE NAME- SATELLITE 20, POSS 2

NSSDC ID- 67-073A
LAUNCH DATE- 07/28/67
WEIGHT- 562.0 KG
LAUNCH SITE- SEDGEMBieber AFB, UNITED STATES
SPONSORING COUNTRY/AGENCY UNITED STATES

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEODETIC
ORBIT PERIOD- 106.3 MIN
PERIAPSIS- 412, KM AL

EPIC PHASE DATE- 07/28/67
INCLINATION- 86 deg
APOLLEPSIS- 906, KM ALT

PERSONNEL
PI - W. A. WEBBER
U OF NEW HAMPSHIRE

BRIEF DESCRIPTION
The cosmic-ray telescope experiment was designed to measure the differential energy spectra of protons, helium nuclei, and heavier nuclei up to Z ≥ 10, within the energy range of 50 to 2500 MeV per nucleon. The telescope had a maximum sampling rate of one count per 288 ms. The telescope consisted of two detectors, a scintillator with its associated photomultiplier (PMT) tube and a scintillator and a Cerenkov element sandwich with both elements optically coupled to the same PMT tube. A 70-m coincidence circuit coupled the two detectors to form the telescope. Pulses from each detector were pulse-height analyzed. Sample pulse-height spectra, coincidence count rates, and the output of the first detector were telemetered. The noise levels of the spacecraft increased to sufficient amplitude to render the first detector unusable except during eclipse periods. All the useful data from this experiment were obtained between October 15 and February 1, and about 1.7% of the data obtained during this period contain useful information. NSSDC has all the useful data that exist from this investigation.

--------- OGO 4, ANDERSON---------

INVESTIGATION NAME- COSMIC-RAY IONIZATION

NSSDC ID- 67-073A-07
INVESTIGATIVE PROGRAM CODE EE-4, SCIENCE
INVESTIGATIVE DISCIPLINE(S) PARTICLES AND FIELDS SOLAR PHYSICS COSMIC RAYS

PERSONNEL
PI - W. A. ANDERSON
U OF WASH., ELECTROSCIENCE LAB.
OO- R. H. NEMER,(RETIRED)
SCIENCE APPLS., INC

BRIEF DESCRIPTION
This experiment was designed to measure cosmic-ray and solar flare particle intensities above 10 MeV electrons and above 0.5 MeV protons using an ion chamber. The ion chamber was mounted at the end of a spacecraft boom about 2.5 m from the main body of the spacecraft. The ion chamber operated successfully for only the first 160 orbits of the satellite.

--------- OGO 4, BARTH---------

INVESTIGATION NAME- UV SPECTROMETER 1100-1750Å, 1750-3400Å

NSSDC ID- 67-073A-14
INVESTIGATIVE PROGRAM CODE EE-4, SCIENCE
INVESTIGATIVE DISCIPLINE(S) IonoDOSIMETRY AERONOMY

PERSONNEL
PI - J. A. BARTH
U OF COLORADO
OI - W. H. WALLACE
KITT PEAK NAVAL OBS
OI - E. F. MACKAY
PACKARD-BELL CORP

BRIEF DESCRIPTION
On Ebert Fastie scanning spectrometer was used to measure the ultraviolet (UV) spectrum of the earth in the wavelength range from 1100 to 3400 Å, with a 20Å resolution. The objective of this experiment included the measurement of the intensity of the following emissions: (a) the hydrogen Lyman-alpha on both the day and night sides, (b) the atomic oxygen 1304Å day and twilight glow and (c) the atomic oxygen 1356Å lines, the atomic nitrogen 1246Å lines, and the molecular nitrogen Lyman-Bragg-Mopfield Bands of the photodetector excited dayglow. Other objectives were the determination of the vertical distribution of ozone from the measurement of the back-scattered UV dayglow in the 2600- to 3400Å range. The focal length of the Ebert monochromator was 250 mm, and the grating used had 2160 lines per millimeter. The spectroscopic scan period was essentially 74.5 s. However, during about 10% of the time, the scan period was reduced to 18.4 s. The instrument was mounted looking to nadir. The F channel was the output of a photomultiplier behind a spark gap window and a cesium telluride cathode. The wavelength intervals measured here extended from 1750 to 3400 Å, with a dynamic range of intensities of 1-60. On this channel the wavelength ranges scanned extended from 1750 to 1750 Å and the measured intensity could vary over a range from 1 to 10000. The exponential voltage gain characteristic of the PMT resulted in a near-logarithmic scaling between flux and high-energy level. Approximate count rates translated the output to 1-5000 V analog an output signal consistent with the spacecraft data system. Prefocused light sources were operated on command provided by orbit calibrations. A complete description of this experiment can be found in J. A. Barth and E. F. Mackay* OGO IV ultraviolet airglow spectrometer* IEEE Transactions on Geoscience Electronics V. GE-7 No. 2 Pp. 114-119 April 1969.

--------- OGO 4, CAIN---------

INVESTIGATION NAME- MAGNETIC SURVEY, RUDIUS II VAPOR METEROMETER

NSSDC ID- 67-073A-06
INVESTIGATIVE PROGRAM CODE EE-4, SCIENCE
INVESTIGATIVE DISCIPLINE(S) PARTICLES AND FIELDS

59
PERSONAL
PI - J.C. CAIN
OI - R.A. LANGLEY
NASA-GSCF

INVESTIGATIVE PROGRAM
A continuation of the only complete pole-to-pole survey (5) started on 023 of the period 1969-1970. The experiment was
reactivated in 1970 (February 1 to March 9), and continued in 1971
(January 28 to February 1 and August 17 to September 27). It
was initiated on 023 of the period 1971 for Apollo support, and once
to obtain correlative data for USAF -open field 17-0670) observations.

INVESTIGATIVE NAME: SOLAR UV EMISSIONS
ASSDC ID - 67-0733-20
INVESTIGATIVE PROGRAM
CODE EE-A6, SCIENCE
INVESTIGATIONAL DISCIPLINE(S)
IGONSPHERES
PHYSICS
AERONOMY

PERSONAL
PI - H.W. HINTEREGGER
OI - D.L. BEDO
USAF GEOPHYS LAB

INVESTIGATIVE PROGRAM
This experiment was designed to measure solar particle detector
activity as a function of wavelength between 170 and 1700 A.

INVESTIGATIVE NAME: LOW-ENERGY AURORAL PARTICLE DETECTOR
ASSDC ID - 67-0733-11
INVESTIGATIVE PROGRAM
CODE EE-A6, SCIENCE
INVESTIGATIONAL DISCIPLINE(S)
PARTICLES AND FIELDS
IGONSPHERES
AERONOMY

PERSONAL
PI - D.M. HOFFMAN
OI - D.E. EVANS
NASA-GSCF

BRIEF DESCRIPTION
This experiment was designed to measure solar particle detector
activity as a function of wavelength between 170 and 1700 A.
The experiment was located on a solar-oriented platform on the
spacecraft. Solar radiation entered the experiment package
through an aperture equipped with a set of electrically charged
grids to reject charged particles. The radiation
illumination of a stack of six gold gratings and was diffracted
onto six photomultipliers. By electronic discrimination, only one
photomultiplier was used at any given time in each
photomultiplier. The gratings were all illuminated at the same
angle of incidence, and were steered through the spectral range
by changing current intervals every 7 minutes of solar rotation.
An alternative arrangement was provided for a short span of 32
seconds, beginning at any of 16 pitch angles near the 520-second
period. The experiment failed after 2 weeks in orbit (August 12, 1971).
The 2-week period was used to check the instrument rather
than to collect data so no data resulted.
INVESTIGATION NAME: SOLAR X-RAY EMISSIONS
NSDC ID: 67-0734-21 INVESTIGATIVE PROGRAM CODE EE-V/C0-P, SCIENCE
INVESTIGATION DISCIPLINE(S) SOLAR PHYSICS
PERSONNEL
PI - R.W. KREPLIN US NAVAL RESEARCH LAB
01 - T.A. CHUBERT (RETIRED) US NAVAL RESEARCH LAB
02 - R.F. FRIEDMAN (RETIRED) US NAVAL RESEARCH LAB
BRIEF DESCRIPTION
This experiment was composed of four ionization chambers that were sensitive in nominal 0.5-3 A, 1-8 A, 8-16 A, or 16-20 A passbands. The detectors were mounted on a solar-oriented experiment package (SCEP) of the spacecraft and were pointed continuously at the sun. The currents generated for the ionization chambers were amplified by twin electrometers, three of which changed ranges autotomatically to provide the appropriate sensitivity for observations during both intense solar flares and solar quiet periods. The outputs from the electrometers were digitized and either transmitted directly to the ground or stored in the spacecraft tape recorders for later transmission. The worst resolution obtained with the spacecraft multiplexer operating at 4 kps, was 4.6 s for the 8-16 A and 44.6 s for the detectors. The time resolution was considerably better for the 0.5-8 A detectors. The 44.6 s A detector failed in November 1967, but the other three detectors produced useful data until the spacecraft tape recorder was disabled in January 1969. For results, see R.W. Kreplin et al., "Measurements of solar X-ray emission from the OGO 4 spacecraft," Solar Flares and Space Research, pp. 121-138, North Holland Publ. Co., Amsterdam, The Netherlands, 1969. NSDC has all the useful data that exist from this investigation.

INVESTIGATION NAME: LYNAN-ALPHA AND UV AIRGLOW STUDY
NSDC ID: 67-0734-13 INVESTIGATIVE PROGRAM CODE EE-V/C0-P, SCIENCE
INVESTIGATION DISCIPLINE(S) IGNORES ASTRONOMY AERONOMY
PERSONNEL
PI - R.W. MANGE US NAVAL RESEARCH LAB
01 - R.W. MEIER US NAVAL RESEARCH LAB
BRIEF DESCRIPTION
This experiment was designed to measure the Lyman-alpha nightglow radiation (1250 to 1350 Å), Lyman-alpha background radiation from space (1250 to 1550 Å), and the far UV airglow radiation from earth (1250 to 1350 Å and 1350 to 1550 Å), using eight detectors. Seven of the detectors were pointed toward the earth to measure the far UV airglow and Lyman-alpha nightglow, and one was directed toward space to measure the Lyman-alpha background radiation. The 1250-1550 Å detectors had lithium fluoride windows and nitric oxide gas, while the 1350-1550 Å detectors had oxide nitric oxide gas fillers. The results of this experiment were inconclusive. The satellite tape recorder's tapes were not available for analysis. The satellite tape recorder failed on January 22-24, 1969. The data to real time only. Prior to this equipment failure, the radiation detectors operated with negligible loss of sensitivity with the exception of the 1250-1550 Å detectors. After this failure, no known reason, the sensitivity decreased and became useless after 6 weeks of operation. In general, the operation of the instrumentation was nominal.

INVESTIGATION NAME: AERIALG PHOTOMETER
NSDC ID: 67-0734-12 INVESTIGATIVE PROGRAM CODE EE-V/C0-P, SCIENCE
INVESTIGATION DISCIPLINE(S) IGNORES AERONOMY
PERSONNEL
PI - E.L. REED NASA-GSFC
01 - J.E. BLAMONT CWS-SA
BRIEF DESCRIPTION
The objective of the main body experiment was to study the characteristics and distribution of airglow and auroral activity by obtaining photometric measurements of several prominent emission lines. An EMI 7053 photomultiplier (tritium cathode and sodium sulfite window) was used with seven interference filters. The two interference filters noted below all the emissions in the visible and ultraviolet wavelengths were viewed in the nadir direction, i.e., directly below the spacecraft. Each wavelength of the various filters were measured and were essentially generated by rotating mirrors. For each position of the mirrors, the light intensity for a particular light path through the entire filter was recorded. The mirrors switched at 1 s intervals. In the 8-s interval, total to complete a measurement cycle, the satellite moved 0.5 deg latitude. In the first mirror position, the field of view was not too deep and the noise level of the sensor was measured. The next mirror position observed the radiation intensity through an interference filter centered at 2635 Å. The third position measured the radiation intensity through the 6300 Å filter. The measurement was the only upward-looking monitor. The next mirror position also passed the radiation through a 6304 Å filter, except here the field of view was from below. The fifth mirror position enabled radiation from nadir at 6325 Å to be measured. Subsequent mirror positions permitted measurement of the field of view at following wavelengths: 5892, 5577, and 3914 Å. The field of view was 10 deg across the downward direction and 7 deg across looking upward. An adjustable slit of detectors was oriented vertically for a good deal of the experiment life. However, some unknown noise in the rear sensor system limited the data to useful events and were not used after five weeks of data coverage.

INVESTIGATION NAME: NEUTRAL PARTICLE MEASUREMENTS
NSDC ID: 67-0734-17 INVESTIGATIVE PROGRAM CODE EE-V, SCIENCE
INVESTIGATION DISCIPLINE(S) AERONOMY
PERSONNEL
PI - G.P. NEWTON NASA HEADQUARTERS
BRIEF DESCRIPTION
This experiment was flown to obtain a description of the distribution of the neutral atmospheric density and temperature in the upper thermosphere and exosphere as a function of space. Free electrons were observed by a charged particle detector, and changes in the thermospheric parameters and variations of solar and magnetic activity were to be studied. The Bayard-Alpert pressure balance was set at 0.01 Torr to observe the neutral density. The Lyman-alpha detector had a helical grid on an axial cylindrical collector. Electrons emitted from one of the three redundant filaments, mounted outside the grids ionized the neutral particles by collision. The positively charged grid not only accelerated the electrons, but it also helped the grid to facilitate the detection of the measurable collector currents, which was proportional to the number density of the ionized particles. The Lyman-alpha detector was scanned about the velocity vector. It did showed that the variation of gauge density during the scanning operation would yield gas flow neutral densities, from which atmospheric temperature could be deduced. The data base from this investigation no longer exists.
determined from the overhead transit of Saturn and Jupiter. In addition to the main body photometer there was a photometer mounted on the 0.5 meter telescope that scanned the earth's limb. The projected light through a 630-A filter, NSSEC has all the useful data that exist from this investigation.

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INVESTIGATION NAME: LOW-ENERGY PROTON, ALPHA PARTICLE MEASUREMENT

NSSEC ID: 67-0734-05

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): PARTICLES AND FIELDS

COSMIC RAYS

PERSONNEL

PI - J.A. SIMPSON U OF CHICAGO
CI - C.T. PAN U OF ARIZONA
CI - E.C. STONE CALIF INST OF TECH

BRIEF DESCRIPTION

Two solid-state particle telescopes were used to study low-energy cosmic-ray protons and alpha particles. One of these was a three-element range telescope (vertical) sensitive to protons and alpha particles in the energy range 30 to 300 MeV. The other telescope was a one-element telescope (horizontal) sensitive to protons and alpha particles in the energy range 50 to 300 MeV. The vertical telescope was designed to measure the gross components of the magnetic field from a low-altitude satellite. The horizontal telescope was designed to measure the gross components of the magnetic field from a low-altitude satellite. The horizontal telescope has a deflection angle of 90 degrees and is pointed in the direction of the satellite's motion. The vertical telescope has a deflection angle of 90 degrees and is pointed perpendicular to the direction of the satellite's motion. The data from this investigation are not available.

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INVESTIGATION NAME: TRIAXIAL SEARCH-COIL MAGNETOMETER

NSSEC ID: 67-0734-05

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): PARTICLES AND FIELDS

PERSONNEL

PI - E.W. SMITH NASA/JPL
CI - R.L. HOLZER U OF CALIF, LA

BRIEF DESCRIPTION

The NSSEC triaxial search-coil magnetometer was designed to measure the gross components of the magnetic field from a low-altitude satellite. The data from this investigation are not available.

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INVESTIGATION NAME: POSITIVE ION COMPOSITION

NSSEC ID: 67-0734-16

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): IDIOSPHERES

AERONOMY

PERSONNEL

PI - H.W. TAYLOR, JR. NASA/GSFC
CI - N.W. SPENCER NASA/GSFC

BRIEF DESCRIPTION

This cosmic-ray telescope experiment was designed to measure the differential energy spectra of protons, helium nuclei, and heavier nuclei up to 2 x 10^10 within the energy range 50 to 2 x 10^8 eV and at a maximum sampling rate of one per 0.28 ns. The telescope consisted of two detectors, a scintillator with an associated photomultiplier (PMP) tube and a scintillator with a Cerenkov element for events with both elements optically coupled to the same PMP tube. The 70-ns coincidence circuit coupled the two detectors to form the telescope. The PMP tube was pulsed-height analyzed, and the pulse height was recorded. The data from this investigation are not available.

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INVESTIGATION NAME: LOW-ENERGY PROTON AND ELECTRON DIFFERENTIAL ANALYZER (LEPEDEA)

NSSEC ID: 67-0734-10

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): PARTICLES AND FIELDS

SOLAR PHYSICS

COSMIC RAYS

PERSONNEL

PI - J.A. VAN ALLEN U OF IOWA
CI - L.W. FRANK U OF IOWA

BRIEF DESCRIPTION

The objectives of this experiment were to conduct a comprehensive study of the latitude and temporal study of the intensities and differential energy spectra of electrons and protons precipitating into the earth's upper atmosphere and to provide information on the spatial and temporal distribution of magnetically trapped protons and alpha particles. The instrumentation included a low-energy particle and electron differential analyzer (LEPEDEA) with an energy range of 5 to 50 MeV and a thin window Geiger tube for a differential energy analyzer. The data from this investigation are not available.

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INVESTIGATION NAME: GALACTIC AND SOLAR COSMIC RAYS

NSSEC ID: 67-0734-09

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): SOLAR PHYSICS

PARTICLES AND FIELDS

COSMIC RAYS

PERSONNEL

PI - W.R. WEBBER U OF NEW HAMPSHIRE

BRIEF DESCRIPTION

This cosmic-ray experiment was designed to measure the differential energy spectra of protons, helium nuclei, and heavier nuclei up to 2 x 10^10 within the energy range 50 to 2 x 10^8 eV and at a maximum sampling rate of one per 0.28 ns. The telescope consisted of two detectors, a scintillator with an associated photomultiplier (PMP) tube and a scintillator with a Cerenkov element for events with both elements optically coupled to the same PMP tube. The 70-ns coincidence circuit coupled the two detectors to form the telescope. The PMP tube was pulsed-height analyzed, and the pulse height was recorded. The data from this investigation are not available.

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INVESTIGATION NAME: LOW-ENERGY PROTON AND ELECTRON DIFFERENTIAL ANALYZER (LEPEDEA)

NSSEC ID: 67-0734-10

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): PARTICLES AND FIELDS

SOLAR PHYSICS

COSMIC RAYS

PERSONNEL

PI - J.A. VAN ALLEN U OF IOWA
CI - L.W. FRANK U OF IOWA

BRIEF DESCRIPTION

The objectives of this experiment were to conduct a comprehensive study of the latitude and temporal study of the intensities and differential energy spectra of electrons and protons precipitating into the earth's upper atmosphere and to provide information on the spatial and temporal distribution of magnetically trapped protons and alpha particles. The instrumentation included a low-energy particle and electron differential analyzer (LEPEDEA) with an energy range of 5 to 50 MeV and a thin window Geiger tube for a differential energy analyzer. The data from this investigation are not available.

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INVESTIGATION NAME: GALACTIC AND SOLAR COSMIC RAYS

NSSEC ID: 67-0734-09

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): SOLAR PHYSICS

PARTICLES AND FIELDS

COSMIC RAYS

PERSONNEL

PI - W.R. WEBBER U OF NEW HAMPSHIRE

BRIEF DESCRIPTION

This cosmic-ray experiment was designed to measure the differential energy spectra of protons, helium nuclei, and heavier nuclei up to 2 x 10^10 within the energy range 50 to 2 x 10^8 eV and at a maximum sampling rate of one per 0.28 ns. The telescope consisted of two detectors, a scintillator with an associated photomultiplier (PMP) tube and a scintillator with a Cerenkov element for events with both elements optically coupled to the same PMP tube. The 70-ns coincidence circuit coupled the two detectors to form the telescope. The PMP tube was pulsed-height analyzed, and the pulse height was recorded. The data from this investigation are not available.

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INVESTIGATION NAME: LOW-ENERGY PROTON AND ELECTRON DIFFERENTIAL ANALYZER (LEPEDEA)

NSSEC ID: 67-0734-10

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): PARTICLES AND FIELDS

SOLAR PHYSICS

COSMIC RAYS

PERSONNEL

PI - J.A. VAN ALLEN U OF IOWA
CI - L.W. FRANK U OF IOWA

BRIEF DESCRIPTION

The objectives of this experiment were to conduct a comprehensive study of the latitude and temporal study of the intensities and differential energy spectra of electrons and protons precipitating into the earth's upper atmosphere and to provide information on the spatial and temporal distribution of magnetically trapped protons and alpha particles. The instrumentation included a low-energy particle and electron differential analyzer (LEPEDEA) with an energy range of 5 to 50 MeV and a thin window Geiger tube for a differential energy analyzer. The data from this investigation are not available.

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INVESTIGATION NAME: GALACTIC AND SOLAR COSMIC RAYS

NSSEC ID: 67-0734-09

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): SOLAR PHYSICS

PARTICLES AND FIELDS

COSMIC RAYS

PERSONNEL

PI - W.R. WEBBER U OF NEW HAMPSHIRE

BRIEF DESCRIPTION

This cosmic-ray experiment was designed to measure the differential energy spectra of protons, helium nuclei, and heavier nuclei up to 2 x 10^10 within the energy range 50 to 2 x 10^8 eV and at a maximum sampling rate of one per 0.28 ns. The telescope consisted of two detectors, a scintillator with an associated photomultiplier (PMP) tube and a scintillator with a Cerenkov element for events with both elements optically coupled to the same PMP tube. The 70-ns coincidence circuit coupled the two detectors to form the telescope. The PMP tube was pulsed-height analyzed, and the pulse height was recorded. The data from this investigation are not available.

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INVESTIGATION NAME: LOW-ENERGY PROTON AND ELECTRON DIFFERENTIAL ANALYZER (LEPEDEA)

NSSEC ID: 67-0734-10

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): PARTICLES AND FIELDS

SOLAR PHYSICS

COSMIC RAYS

PERSONNEL

PI - J.A. VAN ALLEN U OF IOWA
CI - L.W. FRANK U OF IOWA

BRIEF DESCRIPTION

The objectives of this experiment were to conduct a comprehensive study of the latitude and temporal study of the intensities and differential energy spectra of electrons and protons precipitating into the earth's upper atmosphere and to provide information on the spatial and temporal distribution of magnetically trapped protons and alpha particles. The instrumentation included a low-energy particle and electron differential analyzer (LEPEDEA) with an energy range of 5 to 50 MeV and a thin window Geiger tube for a differential energy analyzer. The data from this investigation are not available.

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INVESTIGATION NAME: GALACTIC AND SOLAR COSMIC RAYS

NSSEC ID: 67-0734-09

INVESTIGATIVE PROGRAM CODE EE-6; SCIENCE

INVESTIGATION DISCIPLINE(S): SOLAR PHYSICS

PARTICLES AND FIELDS

COSMIC RAYS

PERSONNEL

PI - W.R. WEBBER U OF NEW HAMPSHIRE

BRIEF DESCRIPTION

This cosmic-ray experiment was designed to measure the differential energy spectra of protons, helium nuclei, and heavier nuclei up to 2 x 10^10 within the energy range 50 to 2 x 10^8 eV and at a maximum sampling rate of one per 0.28 ns. The telescope consisted of two detectors, a scintillator with an associated photomultiplier (PMP) tube and a scintillator with a Cerenkov element for events with both elements optically coupled to the same PMP tube. The 70-ns coincidence circuit coupled the two detectors to form the telescope. The PMP tube was pulsed-height analyzed, and the pulse height was recorded. The data from this investigation are not available.
BRIEF DESCRIPTION

OGO 6 was a large observatory instrumented with 26 experimenters designed to study various interrelationships between, and latitudinal distributions of high-altitude atmospheric parameters during a period of increased solar activity. The main body of the spacecraft was attitude controlled by means of horizon scanners and gas jets so that its orientation was maintained constant with respect to the earth and the sun. The solar panels rotated on a horizontal axis extending transversely through the main body of the spacecraft. The rotation of the panels was activated by sun sensors so that the panels received maximum sunlight. Seven experimenters were mounted on the solar panels (the OSEP package). An additional axis oriented vertically across the front of the main body, carried seven experiments (the OSEP package). Normally, these sensors observed in a forward direction in the orbital plane of the satellite. The sensors could be rotated to 90 deg relative to the normal present position and more than 90 deg with respect to the upper and lower OSEP groups mounted on either end of this axis. On June 22, 1969, the spacecraft potential control system was enhanced to control gas lifetimes of the attitude control system. In August 1970, tape recorder (TR) no. 1 operation degraded, so all recorded data were subsequently taken with TR no. 2. By September 1970, power and equipment degradation left 14 experiments operating normally, 3 partially, and 9 unoperational. From October 14, 1970, TR no. 2 was used only on Wednesdays (world days) to conserve power and extend TR operation. In June 1971, the number of operating experiments decreased from 13 to 7, and on June 28, 1971, the spacecraft was placed in a spin-stabilized mode about the yaw (2) axis and turned off due to difficulties with spacecraft power. OGO 6 was turned on again from October 30, 1971, through March 1972, for operation of experiment 25 by The Radio Research Laboratory, Japan. For additional information see J. E. Jackson and J. J. Vette, OGO Program Summary, NASA SP-7651, Dec. 1975.

INVESTIGATION NAME: ELECTRIC FIELD MEASUREMENTS

BRIEF DESCRIPTION

Ambient dc electric fields were to be measured by determining the potential difference between two oppositely directed, 35-ft antennas with a high-input impedance voltmeter. The antennas were always parallel to the earth's surface using near-linearly polarized fields in the oblique plane and west in the midnight plane. Dc electric fields and 4 Hz to 4 kHz ac fields were measured. On June 22, 1969, 12 days after launch, the first potential required by the experiment in 512 steps due to a spacecraft electrical failure. After this time the only good electric field data were obtained. The operational life was extended during eclipse times which was estimated to be 10% of the total time.

INVESTIGATION NAME: UV PHOTOMETER

BRIEF DESCRIPTION

The OGO 6 ultraviolet photometer was an optically powered self-calibrating instrument used to measure the scalar magnetic field in polar orbit. The instrument was calibrated every 0.256 A by observing the sodium D lines and operating almost continuously from launch in June 28, 1969. The measurements were plus or minus 0.6 N (gauss) with an accuracy of approximately 2 N. Accuracy of the measurements was limited by spacecraft fields.

INVESTIGATION NAME: SOLAR UV EMISSIONS

BRIEF DESCRIPTION

The purpose of this experiment was to measure solar radiation intensity in the wavelength range from 160 to 1600 A, with a total passband from 7 to 20 A in width. Solar radiation entered the instrument through polarized apertures which served to minimize the background signal noise due to charged particles and secondary electron emissions. This radiation struck a vertical stack of six gratings at an angle of 85 deg from the principal normal. The six gratings had different grating constants. The diffracted radiation was observed with a photomultiplier detector. Normal operation consisted of measuring the entire spectrum in 25 steps with the accumulation time of 283.5 sec at 25 steps. In another mode, 15 overlapping short scans of about 65 steps each were available for continuous coverage of a shorter spectral range. The experiment worked well, but data were not taken after October 1971 due to degradation of the channel electron multipliers. The data are no longer of any value for current or future research.
INVESTIGATION NAME- LYMAN-ALPHA PHOTOMETER

NSDC ID- 69-0514-12

INVESTIGATIVE PROGRAM CODE CE-6C-GF-0P, SCIENCE

INVESTIGATION DISCIPLINE(S) ASTRONOMY

PERSONNEL

PI = M.A. CLARK
OI = D.D. ELLIOTT
PI = F.A. MEIZER

AEROSPACE CORP
SRI INTERNATIONAL
AEROSPACE CORP

BRIEF DESCRIPTION

This experiment was designed to observe within the geocorona weak external enhancements of the Lyman-alpha sky. The instrument consisted of a skycrane-scanning hydrogen Lyman-alpha photometer with a 3-to 1 bandwidth. The instrument was equipped with: (1) an insertable SRF2 scattered light testing filter, (2) a hydrogen-filled type 3D stainless steel cell resonance filter which suppressed the strong Lyman-alpha alread, (5) an oxygen bandpass filter, (6) an EP type SRF-1 photomultiplier, and an NAL cathode (7) a rotating plane mirror optimized for reflection at 1216 A and (6) a platinum-tin foil secondary standard light filter. The photomotor was external mounted to the spacecraft above the 2-axis, allowing a view of both horizons. The scanner plane was canted 20 deg from the spacecraft axis to avoid direct observation of the sun. Therefore, the instrument scanned most of the geocorona sphere excepting of a cone of 20 deg half-angle around the solar and antisolar points. Zenith observations were made once per scan and were taken alternately with the resonance cell on and off. The automatic functions of the photometers, which had a field of view of 5 deg at half-maximum, were programmed to operate from a clock pulse generated by the rotating scanner mirror. The calibration signal was generated for 4 of every 30 turns of the scanner which occurred every once every 40 s, and the SRF2 filter was inserted for 4 every 15 turns. The scanner sensitivity was about 1 rayleigh during early operations but was corrected approximately after 10 cycles later. Count rate data were obtained during the period June 6 to 18, 1969, and were of excellent quality.

OOO 6, CLARK--

INVESTIGATION NAME- AURORAL PARTICLE MEASUREMENT

NSDC ID- 69-0514-15

INVESTIGATIVE PROGRAM CODE CE-6C-GF, SCIENCE

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS IONOPHERES AERONOMY

PERSONNEL

PI = G.S. EVANS
OI = D.E. STILWELL

NOAA-ERL
NASA-GSC

BRIEF DESCRIPTION

The purpose of this experiment was to measure the directional intensity and energy spectrum of auroral electrons and protons in the range from 1 to 20 keV. The instrumentation consisted of a curved plate electrodistor, an open window electron multiplier. The overall performance of the experiment was good, however, the experiment tape recorder output modulation became erratic about August 15, 1969. Therefore, a real-time special purpose system had to be used. This limited the operation of the high voltage from 30 to 200 mV, and the special purpose 6-day cycle of operation. In June 1970, the experiment was turned off together with the spacecraft.

OOO 6, EVANS--

INVESTIGATION NAME- TRAPPED AND PRECIPITATING ELECTRONS VCLAC

NSDC ID- 69-0514-16

INVESTIGATIVE PROGRAM CODE CE-6C-GF, SCIENCE

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS

PERSONNEL

PI = T.J. FARLEY
OI = C.K. CHAPMAN

U OF CALIF, LA
TR SYSTEMS GROUP

BRIEF DESCRIPTION

Six plastic scintillator detectors measured the unidirectional electron fluxes in eight energy intervals between 50 keV and 112 keV. A seventh plastic scintillator measured omnidirectional electron fluxes in the same energy intervals. Hours after launch a unidirectional detector experienced a gamma-ray induced loss. Other detectors functioned normally from launch until June 26, 1971, when the experiment was turned off. Unfortunately, these data are contaminated by protons whenever they are present.

OOO 6, FARLEY--

INVESTIGATION NAME- ION MASS SPECTROMETER

NSDC ID- 69-0514-06

INVESTIGATIVE PROGRAM CODE CE-6C-GF, SCIENCE

INVESTIGATION DISCIPLINE(S) IONOPHERES AERONOMY

PERSONNEL

PI = W.B. HANSON
OI = T.W. FLOWEY

U OF TEXAS, DALLAS
U OF TEXAS, DALLAS

BRIEF DESCRIPTION

A large mass spectrometer was employed to measure the composition of positive ions in the mass range from 1 to 34 atomic mass units (u). The instrumentation consisted of a grid with an attracting potential located near the aperture; a 900 sector magnetic analyzer with constant magnetic field strength, an electron multiplier detector, and a linear automatic-triggering instrument. Different mass spectra were sampled by applying a varying voltage to the analyzer. The spectrometer could operate in a sweep mode and a
step mode. In the sweep mode the voltage was swept exponentially from -4000 V to 90 V. The time for each sweep depended on the data telemetry rate (21.5, 64, 64, 49, 49, and 16 kbps at 16 kbps and 8 kbps). In the step mode the voltage could be stepped through a sequence of 11 values (corresponding to mass peaks at 1, 1.4, 1.4, 1.6, 1.8, 29, 35, and 52 u). The duration of each step was 1.5 s. The experimenter could operate in both a real-time and a tape recorder mode. There were no scientific data from this experiment because the equipment was irreparably damaged at turn-on by high voltage arcing.

--- OSG 6 & HELLWELL---

INVESTIGATION NAME: VLF NOISE AND PROPAGATION

NSSID ID: 69-051A-24

INVESTIGATIVE PROGRAM CODE EE-6, SCIENCE

INVESTIGATION DISCIPLINE(S): IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - R.W. HELLWELL
01 - W. RONEN
DEVELCO INC

BRIEF DESCRIPTION
Three magnetic antennas and one electric antenna were used to study the properties of waves in the ionosphere over the frequency range 20 Hz to 32 kHz. The experiment provided information such as the polarization, wave-normal direction, and L/H ratio of signals in the frequency range of interest. Also, it measured the antenna impedance and current both with and without the phase and angle of VLF transient signals. On July 25, 1969, the antenna extension was completed. On August 22, 1969, failure of a node logic component limited observations to only one field spectrum. Subsequently, the special purpose data was limited to the narrow-band mode (0 to 32 kHz) and the spectrum mode (32 to 100 kHz).

--- OSG 6 & KREPLIN---

INVESTIGATION NAME: SOLAR X-RAY EMISSIONS

NSSID ID: 69-051A-08

INVESTIGATIVE PROGRAM CODE EE-6, SCIENCE

INVESTIGATION DISCIPLINE(S): SOLAR PHYSICS

PERSONNEL
PI - M.W. KREPLIN
01 - M. ARONSON
US NAVAL RESEARCH LAB
01 - R.W. KREPLIN
US NAVAL RESEARCH LAB
01 - J. J. BROWN
US NAVAL RESEARCH LAB
01 - J. S. FRANKLIN
U OF CALIF, BERKELEY

BRIEF DESCRIPTION
This experiment used a scintillating crystal photomultiplier detector and a proportional counter to observe solar X-rays between 0.15 and 6.4 x 10^-13 to 2 x 10^-12 ergs/cm^2 per sec. The detector was coupled to an eight-channel pulse-height analyzer. Although the detectors were white-lighted, the data was very noisy due to contamination from trapped particles. The experiment was turned off when the spacecraft was turned off.

--- OSG 6 & LASPERE---

INVESTIGATION NAME: WHISTLER AND LOW-FREQUENCY ELECTRIC FIELD STUDY

NSSID ID: 69-051A-25

INVESTIGATIVE PROGRAM CODE EE-6, SCIENCE

INVESTIGATION DISCIPLINE(S): IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - J. LASPERE
01 - M. J. MORGAN
DARTMOUTH COLLEGE

BRIEF DESCRIPTION
Two 60-ft electric dipole antennas were used to study the propagation and characteristics of whistler-mode waves in the ionosphere over an extended range of frequency. For the 25-12 kHz broad bands (0.02 to 15 kHz, 15 to 30 kHz, 30 to 60 kHz, 60 to 120 kHz, and 120 to 250 kHz) could be received in real-time. Two 0.25 to 295 kHz narrow bands (at 200 and 540 kHz) could be tape recorded and a 0.25 to 1000 kHz broadband signal could be recorded. The tape-recorded data was digitized and digital values of signal intensities. The real-time data were normally cycled through each of the four bands at a rate of 40 kbps, resulting in overlapping gain and finally cycled at a third overlapping gain. This whole 12-cycle step was then repeated. Each of the steps was repeated 10 times. The cycle was required for a total of 1000 kHz which read all bands were observed in 1.25 kHz and all bands at all gans were observed for 3.5 min. The automatic cycling could be interrupted for manual control. These real-time data were transmitted on special purpose telemetry and were observed near eight locations. Each of the stations was mounted on the spacecraft and alone for a total of 300 kHz signals from the spacecraft and the results were observed for a total of 300 kHz signals from the spacecraft and of

--- OSG 6 & LOCKWOOD---

INVESTIGATION NAME: NEUTRON MONITOR

NSSID ID: 69-051A-18

INVESTIGATIVE PROGRAM CODE EE-6, SCIENCE

INVESTIGATION DISCIPLINE(S): PARTICLES AND FIELDS COSMIC RAYS

PERSONNEL
PI - J.J. LOCKWOOD
01 - E.L. CHUSS
U OF NEW HAMPSHIRE

BRIEF DESCRIPTION
A boron-coated, moderated helium 3 proportional counter was used to measure the total neutron flux in the energy interval from 1 keV to 10 MeV. For sets of charged particle counters placed on the spacecraft, the detector was designed to detect protons above 10 MeV and electrons above 10 MeV. A plastic scintillator was operated in coincidence with the proportional counter to measure 1 to 10 MeV neutrons in four energy intervals. The detector performed normally until December 24, 1970, when the power supply failed. No useful data were obtained after that date. For a more detailed description of the experiment see J. J. Lockwood et al., "Cosmic-ray neutron monitor for OSG-F," IEEE Transactions on Geoscience Electronics, v. GE-7, pp. 86-93, April 1971. OSG has all the useful data that exist for this investigation.

--- OSG 6 & MASLEY---

INVESTIGATION NAME: LOW-ENERGY COSMIC-RAY MEASUREMENT

NSSID ID: 69-051A-19

INVESTIGATIVE PROGRAM CODE EE-6, SCIENCE

INVESTIGATION DISCIPLINE(S): PARTICLES AND FIELDS COSMIC RAYS

PERSONNEL
PI - A.J. MASLEY
01 - P.A. SATTERLEE
TRW SYSTEMS GROUP
MCDONNELL-DOUGLAS CORP

BRIEF DESCRIPTION
This experiment was designed to study solar cosmic radiation and magnetically trapped and precipitating radiation. The instrumentation consisted of two solid-state detector foils mounted coaxially to form a telescope that looked away from the earth with a 28-degree conical half-angle. Protons in 14 contiguous energy intervals between 5 and 75 MeV in 12 intervals between 17 and 125 MeV were counted. The sum of counts of protons above 70 MeV and electrons above 250 MeV was also obtained. A complete set of measurements was obtained in five main frames (0.846 s at an 8-kbps telemetry rate). This experiment functioned normally from launch until August 30, 1970, at which time a spacecraft failure prevented the transmission of any further experimental data.

--- OSG 6 & NAGY---

INVESTIGATION NAME: LANGMUIR PROBE

NSSID ID: 69-051A-02

INVESTIGATIVE PROGRAM CODE EE-6, SCIENCE

INVESTIGATION DISCIPLINE(S): IONOSPHERES AERONOMY

PERSONNEL
PI - A.F. NAGY
01 - L.M. BRACE
U OF MICHIGAN

BRIEF DESCRIPTION
This experiment was designed to study the properties of the ionized sheath and the ambient plasma. The experiment used a Langmuir probe to measure the electron density and temperature and the ion density and temperature. The probe was mounted on the spacecraft and a total of 300 kHz signals from the spacecraft and of
BRIEF DESCRIPTION

The purpose of this experiment was to observe the worldwide distribution of electron densities and temperatures. It consisted of two probes mounted on the OCEP 2, at right angles to each other, with one probe aligned in the direction of the spacecraft velocity vector and the other parallel to the OCEP rotational axes. Each probe consisted of a collector 22.9 cm long and 2.6 cm in diameter extending outward from a concentric guard 22.9 cm long and 16.3 mm in diameter. Both components were made of stainless steel and were insulated from each other with teflon. The electronics package in the main spacecraft body provided a smooth voltage sweep to the probes, enabling the determination of electron density and temperature at selected ground and corona velocities. The apparatus was mechanically milled so that the probe was forced to oscillate in the magnetic fields of the oscillations being proportional to the applied and rectified. The electrical voltage generated by the motion of the ribbon through the magnetic field was amplified and rectified to provide a dc signal for telemetry. From the pressure values and from a knowledge of the velocity of the air stream effective spacecraft velocity, atmospheric density could be deduced. Once every 2 minutes, the air flow was stopped for 20 s to establish a zero reference value for in-flight calibration. For more details of the experiment operation see C.W. Sharp et al., "Atmospheric density measurement with a satellite-borne microphonograph" Geophys. Res. Lett. 6, 784-786, 1979.

PERSONNEL

PI = C.W. SHARP(NASA) OE = J.L. WRITE(NASA) PI at JPL (CALTECH) INVESTIGATION NAME = MICROPHONE ATMOSPHERIC DENSITY GAUGE

INVESTIGATION NAME = MICROPHONE ATMOSPHERIC DENSITY GAUGE

INVESTIGATION DESCRIPTION

The atmospheric neutral density gauge experiment measured the spatial and temporal variations of density in the altitude range from 100 to 700 km. The instrumentation consisted of a thin metal ribbon suspended near the spacecraft pressure field along a spacecraft velocity vector and oriented in the moving air stream. The ribbon, after passing through the apparatus, was mechanically milled so that the ribbon was forced to oscillate in the magnetic field at a rate of 180 cycles per second. The electrical voltage generated by the motion of the ribbon through the magnetic field was amplified and rectified to provide a dc signal for telemetry. From the pressure values and from a knowledge of the velocity of the air stream effective spacecraft velocity, atmospheric density could be deduced. Once every 2 minutes, the air flow was stopped for 20 s to establish a zero reference value for in-flight calibration. For more details of the experiment operation see C.W. Sharp et al., "Atmospheric density measurement with a satellite-borne microphonograph" Geophys. Res. Lett. 6, 784-786, 1979.

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solid-state detectors, D1 and D2, a Cerenkov detector D3y, and an anticoincidence counter C4. Triggers were set on one of the detectors or on a preset number of coincident pulses from the detectors. D1, D2, and D4 were also monitored for use in detecting accidental coincidences from the D1-D3-D4an action. The experiment was carried out in a scatter frame telescope composed of two solid-state detectors, D5 and D6, with respective threshold energies for protons and alpha particles of 0.3 and 6 MeV. The telescope was triggered only on pairs of D5 and D6 events, and three 256-channel pulse-height analyzers were used to analyze the output of D1, D2, and 0.5 of the range telescope or D3, D2, D3 of the Cerenkov telescope, or C5. D6 (or D5) D6 events only) of the telescope once per counting rate accumulation period. In general, the accumulation period ranged from 0.2 to 3.4 depending on the spacecraft telemetry bit rate. There existed a priority to which telescope output would be sampled for a given accumulation interval, and this interval could be from the D6 range telescope detector being filtered on in the first month. The spacecraft performed normally throughout the mission. The data time coverage was near 100% until August 1970, after which the coverage dropped due to the malfunction of the spacecraft tape record. For further details, see [1].

Science on the solar and galactic cosmic ray experiment.
BRIEF DESCRIPTION

The experiment consisted of six dosimeters that were used to obtain dose rate data in the trapped-particle environment. Three of the dosimeters were mounted on or within an aluminum sphere, depending on the amount of shielding required. These detectors, designated the surface proton, middle proton, and center proton dosimeters, were lithium drifted silicon detectors with a minimum aluminum shielding of 0 g/cm², 4 g/cm², and 16 g/cm² respectively. They had a nominal energy threshold of 0.5 MeV and an energy resolution of 6.5%. Saturation dose-rate data (rad/hr) were obtained from these detectors through 656 orbits (October 5 to December 1, 1965) even though the region of peak proton flux. The response of the surface dosimeters, however, decreased with time. The fourth dosimeter was an X-ray detector composed of a 0.64 cm diameter CsI crystal (0.05 cm thick) that had a minimum aluminum shielding of 5 g/cm². It measured the dose rate (rad/hr) of hard X-rays incident on the crystal and obtained excellent data during the period October 5 to December 1, 1965. The dose rates and the terrestrial magnetic-field region sampled correspond closely to those of the middle proton dosimeter. The X-ray detector has a dynamic range of 0.2 to 30 rad/hr, was accurate to plus or minus 10%, and has a counting accuracy of better than 0.1%. The fifth and sixth dosimeters were the Al-Fe Rh weapons laboratory tissue-equivalent fum chambers with minimum amounts of equivalent aluminum shielding of 0.1% and 1.2 g/cm² respectively. They also measured dose rates during the period October 5 to December 1, 1965. More details on the instruments, their calibration, and the data reduction can be found in W. M. Cooper and W. C. Chapman's "Space flight experiment to study radiation shielding calculations" ANN-TR-66-34, 1966, and R. Fortney, "General results from the OVI-12 satellite," Aerospace Peditons, pp. 1476-1485, December 1966.
BRIEF DESCRIPTION

CVI-15 was also referred to as SPADES (Solar Perturbation of Atmospheric Density Experimental Satellite), installed to study
typically the fluctuations of atmospheric density, composition, and
temperature as a function of solar magneto-spheric disturbances. The
Cylindrical spacecraft, 69 cm in diameter, was fitted with a hemispheric multifaceted solar panel covering both
ends. The spin-stabilized spacecraft had two major objectives: (1) to
take a detailed study of events causing and sustaining trapped radiation in the Van Allen belts, and (2) to study the hazards to man of incoming and
trapped radiation. The spacecraft performed normally from
launch until early 1970, when serious problems developed in its
telemetry system. The amount of useful data continually declined during this period, and the spacecraft was
discontinued in March 1970.

-------- CVI-19, FREDEN

INVESTIGATION NAME- HI ENERGY RESOLU PROTON MEAS ISOTOPIC
ANAL WITH A DC/DE TELESCOPE

SPONSORING COUNTRY/AGENCY
UNITED STATES
SPONSORING COUNTRY/AGENCY
UNITED STATES
SPONSORING COUNTRY/AGENCY
UNITED STATES

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GECCENTRIC
ORBIT PERIOD- 155.44 MIN
PERIAPSIS- 466.54 KM ALT
APOAPSIS- 5764.4 KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION

CVI-19 was one of four research satellites injected into
orbit simultaneously from a single launch vehicle. The
spacecraft was an 81-cm-long cylinder measuring 69 cm in
diameter, and was fitted with a hemispheric multifaceted solar panel
covering both ends. The spin-stabilized spacecraft had two major objectives: (1) to
take a detailed study of events causing and sustaining trapped radiation in the Van Allen belts, and (2) to study the hazards to man of incoming and
trapped radiation. The spacecraft performed normally from
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ANAL WITH A DC/DE TELESCOPE

SPONSORING COUNTRY/AGENCY
UNITED STATES
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INITIAL ORBIT PARAMETERS
ORBIT TYPE- GECCENTRIC
ORBIT PERIOD- 155.44 MIN
PERIAPSIS- 466.54 KM ALT
APOAPSIS- 5764.4 KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION

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take a detailed study of events causing and sustaining trapped radiation in the Van Allen belts, and (2) to study the hazards to man of incoming and
trapped radiation. The spacecraft performed normally from
launch until early 1970, when serious problems developed in its
telemetry system. The amount of useful data continually declined during this period, and the spacecraft was
discontinued in March 1970.
BRIEF DESCRIPTION

Because of its symmetrical shape, OVS-3 was selected by the experimental group to determine upper atmospheric densities as a function of altitude, latitude, season, and solar activity. The experiment was not planned prior to launch. Density values resulting from perigee were deduced from sequential observations of the spacecraft position using optical (Saksen-ham camera network) and radio and/or radar tracking techniques. This experiment resulted in the determination of reasonable density values and has the potential of yielding long-term atmospheric density values since OVS-3 has an expected orbital lifetime of 300 years.

--- OVS-3, VAPPOLA ---

INVESTIGATION NAME - MAGNETIC ELECTRON SPECTROMETER

NSSDC ID: 66-070A-05
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM
INVESTIGATION DiscIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PL = A.L. VAPPOLA
OI = P.L. MAGRAM
AEROSPACE CORP
LOS ALAMOS NAT LAB

BRIEF DESCRIPTION

A magnetic spectrometer was used to separate electrons, incident from directions normal to the spacecraft spin axis, into nine energy intervals between 0.3 and 2.51 Mev. Nine lithum-drifted solid state diodes were used to measure the electrons in the individual energy windows. Nine associated count rate meters were sampled once per second as were the proton count rates. Data for entire orbits were stored in a tape recorder for telemetry. The experiment worked well from launch to September 21, 1967, when the tape recorder failed. A limited amount of low-latitude real-time data was acquired after this date. For further details, see A.L. Vappola, J. Geophys. Res., 74, 5548, 1969.

--- Sunday, 11-15 ---

SPACECRAFT COMMON NAME = P 11-AS
ALTERNATE NAMES = DOAS

NSSDC ID: 66-049B
LAUNCH DATE = 08/18/64
WEIGHT = 79.4 KG
LAUNCH SITE - VENGENBERG AFB, UNITED STATES
LAUNCH VEHICLE = ATLAS
SPONSORING COUNTRY/AGENCY = UNITED STATES
SPONSORING AGENCY = DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE = GEOCENTRIC
ORBIT PERIOD = 121.40 MIN
INCLINATION = 95.67 DEG
PERIAPSIS = 275.0 KM ALT
APOAPSIS = 3748.0 KM ALT

PERSONNEL
PM = UNKNOWN
PS = UNKNOWN

BRIEF DESCRIPTION

P 11-AS was a polar-orbiting Air Force Scientific satellite that carried six experiments. Instrumentation on board included spectrometers and Geiger tubes to measure electrons and protons in various energy ranges (both directions and omnidirectional experiments), a Faraday cup, a VLF experiment, and a magnetometer. The spacecraft spin axis was approximately aligned with the earth's spin axis. Telemetry consisted of two tape-recorded and two real-time data channels. Each of two detectors had a real-time and one tape-recorded channel. Two weeks later, one of the detectors temporarily stopped and thereafter operated intermittently. Four weeks later, the tape recorder channel on the other detector failed. On September 1, 1967, the tape recorder failed and very little scientific data were obtained after that date.

--- P 11-AS, SCARF ---

INVESTIGATION NAME - VLF ELECTRIC FIELD DETECTOR

NSSDC ID: 66-049B-05
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM
INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PL = P.L. SCARF
OI = R.C. FLY
TRI SYSTEMS GROUP

BRIEF DESCRIPTION

The instrumentation for this experiment consisted of a 45.7-cm whip antenna aligned with the spacecraft spin axis and connected to four bandpass channels, each with a bandwidth of 15% of the center frequency. The experiment, designed to measure ambient electric fields, had a noise threshold of 400 microvolts per meter. A 1 V/m overcurrent to indicate strong emissions was included. The experiment had eight data points per 1.068 min taken in the following sequence: 1.7, 3.9, 7.3, 14.5 kHz overcount, 7.3, 3.9, and 1.7 kHz. Each point was occupied by 1 s. In real life, transmission occurred over a few specific geographic locations for periods from 5 to 15 min each. The onboard tape recorder periodically allowed sampling of the fields for a complete orbit. During playback of the tape data, ripples in the system caused data from all but 10% of the orbits to be degraded. On September 13, 1964, a drift in the voltage-controlled oscillator frequency for the tape-recorded channel limited subsequent tape data obtained to sporadic and noisy recordings. For a more complete description of the experiment see P.L. Scarf et al., "Survey of VLF electric fields in the magnetosphere with the Solar Orbiting spacecraft, 1964-1965," Radio Sciences 1, 1964.

--- Sunday, 7-18 ---

SPACECRAFT COMMON NAME - RADSAT
ALTERNATE NAMES = SCSP 72-1, DIP 72-1

NSSDC ID: 72-076A
LAUNCH DATE = 10/22/72
WEIGHT = 204.4 KG
LAUNCH SITE - VENGENBERG AFB, UNITED STATES
LAUNCH VEHICLE - ATLAS
SPONSORING COUNTRY/AGENCY = UNITED STATES
SPONSORING AGENCY = DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT.TYPE = GEOCENTRIC
ORBIT PERIOD = 99.6 MIN
INCLINATION = 98.4 DEG
PERIAPSIS = 731.0 KM ALT
APOAPSIS = 749.2 KM ALT

PERSONNEL
PM = UNKNOWN
PS = UNKNOWN

BRIEF DESCRIPTION

The objectives of this spacecraft were to measure background gamma radiation over the whole earth in the 100 to 300-keV range and in the 8700-20-keV range. Fluxes and spectra of low-altitude charged particles were to be measured as a function of time and magnetospheric position. The effects of the space environment on various thermal control coatings were to be determined. Measurements of UV radiation, and H and He atoms and ions were taken. Observation was made of external and far UV originating in interaction of solar wind with interplanetary medium or from galactic sources. The cylindrical spacecraft was a 4 x 13 m long and 1.37 m in diameter carried a gamma-ray spectrometer, a low-altitude particle measuring sensor, and an extensive UV radiation experiment. The antenna booms extended 2.74 m from each end, coincident with the spin axis.

--- RADSAT, KATZ ---

INVESTIGATION NAME - SOLAR PROTON, DEUTERON, TRITON
SOLAR-SATE TELESOPSE

NSSDC ID: 72-076A-01
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM
INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
SOLAR PHYSICS

PERSONNEL
PL = L. KATZ (ALI)
OI = P.L. ROTHWELL
O1 = R.C. FLY
USAF GEOPHYS LAB
USAF GEOPHYS LAB
USAF GEOPHYS LAB

BRIEF DESCRIPTION

This experiment was specifically designed to measure protons from 5 to 70 Mev, deuterons from 3.1 to 306 Mev/nucleon, and tritons from 2.4 to 2350 Mev/nucleon during solar events. The detection assembly consisted of four solid-state detectors with a plastic-scintillator and a 0.4 cm thick lead shield. The two front detectors were of 110 and 106 microns thick they were oriented perpendicular to the spacecraft spin axis and they provided a field-of-view of 6 degree half angle for the telescope. The middle detectors, which acted as one, were 5 mm thick lithium-drifted silicon detectors. The detector outputs were electronically combined to form a total-energy signal and a particle-identification signal, the latter being almost energy-independent for a given isotope. The detector functioned well for its first year of life, then less well for the next 6 months. The experiment was turned off April 2, 1974. Further details are found in P.L. Rothwell et al., "Upper Legend to Flare-Generated Deuterume and Tritium," Phys. Rev. Lett., 31, 6, 1973.

--- Sunday, 7-18 ---

INVESTIGATION NAME - LENS, X-ray, NEUTRON, TRITON
SOLAR-SATE TELESOPSE

NSSDC ID: 72-076A-02
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM
INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
SOLAR PHYSICS

PERSONNEL
PL = A. J. L. ROTHWELL
OI = P.L. ROTHWELL
O1 = R.C. FLY
USAF GEOPHYS LAB
USAF GEOPHYS LAB
USAF GEOPHYS LAB

BRIEF DESCRIPTION

The experiment was specifically designed to measure protons from 5 to 70 Mev, deuterons from 3.1 to 306 Mev/nucleon, and tritons from 2.4 to 2350 Mev/nucleon during solar events. The detection assembly consisted of four solid-state detectors with a plastic-scintillator and a 0.4 cm thick lead shield. The two front detectors were of 110 and 106 microns thick they were oriented perpendicular to the spacecraft spin axis and they provided a field-of-view of 6 degree half angle for the telescope. The middle detectors, which acted as one, were 5 mm thick lithium-drifted silicon detectors. The detector outputs were electronically combined to form a total-energy signal and a particle-identification signal, the latter being almost energy-independent for a given isotope. The detector functioned well for its first year of life, then less well for the next 6 months. The experiment was turned off April 2, 1974. Further details are found in P.L. Rothwell et al., "Upper Legend to Flare-Generated Deuterume and Tritium," Phys. Rev. Lett., 31, 6, 1973.
**RELAY 1**

**SPACECRAFT COMMON NAME= RELAY 1**
ALTERNATE NAMES= 1962 BETA UPHISON 1A 15 00503, RELAY A

**NSSDC ID= 62-068A**
LAUNCH DATE= 12/14/62
LAUNCH SITE= CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE= DELTA
SPONSORING COUNTRY/AGENCY= UNITED STATES NASA-055A

**INITIAL ORBIT PARAMETERS**
ORBIT TYPE= GECCENTRIC
ORBIT PERIOD= 195.5 MIN
INCLINATION= 47.5 DEG
PERIGEE= 1522.5 KM ALT
APOGEE= 7439.5 KM ALT

**PERSONNEL**
P W. S. SUDELLER(RETIRE) NASA-55FC
PS R. C. WADDELL(RETIRE) NASA-55FC

**BRIEF DESCRIPTION**
Relay 1 was principally a communications satellite. Included in its payload were radiation experiments designed to map the earth's radiation belts. The spin-stabilized spacecraft had an initial spin rate of 673 rmp and an initial spin axis orientation with a declination of -68.3 deg and a right ascension of -56 deg. Shortly after launch, two basic problems evolved. One was the satellite's response to spurious commands, and the other was the leakage of a high-power regulator. This leakage caused about 1.5 weeks of satellite operation to be useless. After this period, satellite operation returned to normal. The satellite carried one tracking antenna and one for telemetry. The telemetry system was PCM at 1152 bps. Each 128 words per telemetry frame (of 1 sec duration) used 115 words for the particle experiment. The leakage problem caused the return to a low voltage state early in 1965. Sporadic transmission occurred until 16 February 1965, after which no usable scientific data were obtained.

**RELAY 1, BROWN**

**INVESTIGATION NAME= SOLID-STATE ION CHAMBER ELECTRON AND PROTON DETECTOR**

**NSSDC ID= 62-068A-02**
INVESTIGATIVE PROGRAM CODE CE=4, SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS MAGNETOSPHERIC PHYSICS

**PERSONNEL**
PI W. L. BROWN BELL TELEPHONE LAB

**BRIEF DESCRIPTION**
Two phosphorus-diffused silicon diodes were used as small solid-state ionization chambers to map the earth's radiation environment. Counts were accumulated only in channels which matched within 10 deg of the local magnetic field. The diode used to detect protons was mounted behind a 25-deg half-angle aperture collimator with an entrance aperture of 2 mm diameter. The outer shield was sufficiently massive to exclude protons less than 80 MeV and electrons less than 10 MeV. Magnetic fields surrounding the diode effectively excluded electrons less than 300 KeV. The detector responded to protons with energies between 1 MeV to 18 MeV, and had three pulse-height discriminator levels corresponding to protons which lost 14, 3.2, or 1.8 MeV in the detector. Although the instrument was designed to operate at three different bias modes (120, 20, and 5 V), only the highest returned useful proton data. The other two bias modes served to detect electron contamination of the counting rate. The electron detector similar to the proton detector, had a collimator with a half-angle of 180 deg., and aperture of 2 mm and sufficient shielding to exclude protons less than 60 MeV and electrons less than 6 MeV. The magnetic shield was used on the electron detector. The electron spectrometer used a weight analysis to discriminate between 0.26- to 0.35-, 0.35- to 0.55-, 0.55- to 0.75-, and 0.75- to 1-keV electrons. The basic measurement sequence required 125 s. Counts from each detector were accumulated for 10 s. Samples were teleretered each hour during the accumulation time. The registers were then frozen, and one redundant reading (the 10th) was teleretered. For protons, this procedure was carried out three times for each bias mode and differentiated by 12.5% for each change. The entire sequence of three modes required 144 s. For electrons, the sequence was repeated every 12 s. NSSDC has all of the data that now exist from this investigation.

**RELAY 1, MILWAIN**

**INVESTIGATION NAME= PROTON-ELECTRON DETECTORS**

**NSSDC ID= 62-068A-03**
INVESTIGATIVE PROGRAM CODE CE=4, SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS MAGNETOSPHERIC PHYSICS

**PERSONNEL**
PI C. E. MILWAIN U OF CALIF, SAN DIEGO
TV. M. F ILIJUS U OF CALIF, SAN DIEGO

**BRIEF DESCRIPTION**
Instrumentation for this experiment consisted of an ensemble of particle detectors. An omnidirectional plastic scintillator, detector A, measured the sum of counts due to protons above 3 MeV and electrons above 3.7 MeV, using magnetometer gaging, the remaining detectors (B, C, D) and associated electronic discrimination circuitry measured fluxes of locally normally impinging particles. A solid-state surface barrier detector (E) measured protons in the nested intervals 1.1 to 1 MeV, 1 MeV to 7.1 MeV, and 2.25 to 6.7 MeV. A two-element solid-state telescope (C) measured protons in the energy intervals 10.2 to 25 MeV, 25 to 35 MeV, and 35 to 63 MeV. A plastic scintillator (D) measured in four discrimination states the sum of protons with energies above 5.2 MeV and electrons with energies above 0.53, 0.45, 0.62, and 0.82 MeV respectively. Background counts were accumulated by these detectors when their axes were not perpendicular to the local magnetic field. Detector A cumulative counts were teleretered every second. Detectors B, C, and D directional flux data were transmitted as follows during successive 12-s intervals every 90 s. Counts from the various discrimination states of a given detector were each teleretered one per second while accumulating for 10 s. (The spacecraft spin period was approximately 1.07 s.) Two redundant readouts followed the cessation of counting. Most useful data were teleretered between 19 May and 20 October 1965. Detector B provided no useful data after May 10, 1965. NSSDC has all the data that now exist from this investigation.

**RELAY 2**

**SPACECRAFT COMMON NAME= RELAY 2**
ALTERNATE NAMES= 16 00373

**NSSDC ID= 64-0034**
LAUNCH DATE= 01/21/64
WEIGHT= 184 KG
LAUNCH SITE= CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE= DELTA
SPONSORING COUNTRY/AGENCY= UNITED STATES NASA-055A

**INITIAL ORBIT PARAMETERS**
ORBIT TYPE= GECCENTRIC
ORBIT PERIOD= 196.6 MIN
INCLINATION= 46.3 DEG
PERIGEE= 2091.4 KM ALT
APOGEE= 7614.4 KM ALT

**PERSONNEL**
P W. S. SUDELLER(RETIRE) NASA-55FC
PS R. C. WADDELL(RETIRE) NASA-55FC

**BRIEF DESCRIPTION**
Relay 2, although principally a communications satellite, carried particle experiments designed to map the trapped radiation belt. The spin axis orientation had a right ascension of about 153 deg and a declination of about 60 deg. Accurate spin axis orientation information was not available. The initial spin rate was about 173 rmp. Relay 2, physically similar to Relay 1, had on board two transmitters, one of which was used for PCM telemetry. The sequence required about 1 s. Design changes in this satellite improved its performance to the point where response to spurious commands was essentially eliminated. One of the two onboard transmitters operated normally until November 29, 1966. From that time until its failure on January 20, 1967, it required a longer time than normal to send commands. The other transmitter continued to operate until June 9, 1967, when it too failed to operate normally.

**RELAY 2, BROWN**

**INVESTIGATION NAME= SOLID-STATE ION CHAMBER ELECTRON AND PROTON DETECTOR**

**NSSDC ID= 64-0035A-02**
INVESTIGATIVE PROGRAM CODE CE=4, SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS MAGNETOSPHERIC PHYSICS

**PERSONNEL**
PI W. L. BROWN BELL TELEPHONE LAB
BRIEF DESCRIPTION
Two phosphorous-diffused silicon diodes were used as small solid-state ion detectors to map the radiation environment. Counts were accumulated only when the detectors looked within 10 deg of the local magnetic field. The diode were connected to detect protons, which were detected with an entrance aperture of 2-mm diameter. The outer shield was sufficiently massive to exclude protons less than 60 MeV and electrons less than 10 MeV. Magnets surrounding the detector effectively excluded electrons less than 300 keV. The detector responded to protons with energies between 1.8 MeV and 18 MeV, and had three pulse-height discriminator levels corresponding to protons which lost 1.97, 5.60, or 9.50 MeV in the detector. Although the instrument was designed to operate at three different bias levels (1.2V, 25, and 5 V), the highest returned useful proton data. The other two bias levels served to detect electron contamination of the counting rate. The electron detector, similar to the proton detector, had a collimator with a half-angle of 10 deg, aperture diameter of 2 mm, and sufficient shielding to exclude protons less than 60 MeV and electrons less than 10 MeV. (No magnetic shield was used on the electron detector.) The detection scheme employed pulse-height analyses to discriminate between 0.223- to 0.403-, 0.403- to 0.580-, 0.580- to 0.775-, and 0.775- to 1.302-MeV electrons. The basic measurement sequence required 12 s. Counts from each detector were accumulated for 12 s. Samples were interchanged each second during the accumulation time. The registers were then freeze, and one redundant reading (the 12th) was telemetered. For protons, this procedure was carried out three times for each bias level, interspersed by 12-s allowance for bias change. The entire sequence of three reads required 114 s. For electrons, the sequence was repeated every 12 s. NSSDC has all the data that now exist from this investigation.

*************** S-3-3 ****************

SPACECRAFT COMMON NAME = S-3-3
ALTERNATE NAMES = S-3-3, S-3-24, S-3-4
NSSDC ID 76-6659-00
LAUNCH DATE 1976/06/10
LAUNCH SITE VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE UNKNOWN
SPONSORING COUNTRY/AGENCY UNITED STATES
INVESTIGATION NAME = SHAFFER低-ENERGY PARTICLE SPECTROMETER
PI = R.D. SHAFFER

*************** S-3-4 VAMPOLAL *

INVESTIGATION NAME = VAMPOLAL-ENERGY ELECTRON MAGNETIC SPECTROMETER
NSSDC ID 76-6659-07
INVESTIGATION DISCIPLINE(3) PARTICLES AND FIELDS MAGNETIC PHENOMENON
PERSONNEL PI = A.L. VAMPOLA

*************** S-3-5 ***************

INVESTIGATION NAME = DC ELECTRIC FIELDS
NSSDC ID 76-6659-01
INVESTIGATION DISCIPLINE(3) PARTICLES AND FIELDS MAGNETIC PHENOMENON
PERSONNEL PI = F.S. MOZER
and a spin rate control system. In addition, solar panels were mounted equatorially on the inner core. The satellite performed normally after launch until vehicle reentry on November 28, 1971.

--- SAN MARCO 3, NEWTON---

INVESTIGATION NAME - NEUTRAL ATMOSPHERIC COMPOSITION SPECTROMETER

NSSDC ID - 71-056A-02 INVESTIGATIVE PROGRAM CODE EE=EO/DO, SCIENCE
INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - G.P. NEWTON NASA HEADQUARTERS
OI - D.W. PELZ

BRIEF DESCRIPTION
The objectives of the San Marco 3 satellite mission included (1) to measure the equatorial thermospheric density, temperature, and neutral composition as a function of atmospheric heating and (2) to study the correlations between three sets of neutral density measurements each obtained using a different technique, namely, direct particle counts, instantaneous satellite drag, and integrated satellite drag. The composition of the neutral equatorial atmosphere was measured in situ over five complete cycles of local solar time. The mass analyzer was a double-focusing magnetic sector instrument and was a modification of the sensors flown on Explorer 17 (60-094A-01) and Explorer 32 (66-044A-02). Entering through a knifed-edged orifice, the atmosphere particles struck the walls of a gold-plated stainless steel thermalization chamber. They were ionized by electron bombardment in the dual-film enclosed ion source which was also gold-plated. Simultaneous measurements were obtained of the following species: helium (4%), atomic oxygen (65%), molecular nitrogen (28%), molecular oxygen (32%), and argon (4%). The analyzer could be tuned by ground commands and therefore occasional measurements were made of the concentrations of the following species: atomic nitrogen (4%), water vapor (1%), and carbon dioxide (4%). Linear range-switching electrometers were used. Since the spectrometer was mounted with its entrance orifice normal to the satellite spin axis, which was maintained nearly perpendicular to the orbit plane, the ion source concentrations were spin-modulated with a spin period ranging from 10 to 6 s. From these modulation signals the ambient concentrations were obtained. Preliminary results show good agreement between the total mass density values obtained from the three techniques. Some of the data obtained are presented in G. P. Newton et al., "Local time variation of equatorial thermospheric composition determined by the San Marco 3 NACE," J. Atmos. Terr. Phys., 36, p. 2299-2301, 1975. Data from this investigation no longer exist.

--- SAN MARCO 3, SPENCER---

INVESTIGATION NAME - ATMOSPHERIC NITROGEN DENSITY

NSSDC ID - 71-056A-03 INVESTIGATIVE PROGRAM CODE EE=EO/DO, SCIENCE
INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - N.W. SPENCER NASA-GSFC
OI - G.A. CARTNAGAN U OF MICHIGAN

BRIEF DESCRIPTION
The ionogeo experiment was designed to provide dense measurements of the temperature and density of the thermospheric molecular nitrogen. The experiment employed a small magnetometer mass spectrometer which was tuned to molecular nitrogen. The sensor elements were enclosed in a special orifice sphere over whose center lay in the equatorial plane of the satellite. The motion of the chamber during satellite roll caused a variation in chamber pressure, forcing the nitrogen concentration and particle energy distribution to be derived. Differentiation of the output current provided signals which were proportional to the density and the temperature of the gas and thus comprised the main data of the experiment. The experiment functioned correctly but the data obtained were too small (only a few minutes per orbit) to be of much value.

--- SAN MARCO 4 ---

SPACESHIP COMMON NAME - SAN MARCO 4 ALTERNATE NAMES - SAN MARCO-C-2, 371565-50-12

NSSDC ID - 74-009A

LAUNCH DATE - 02/18/74 WEIGHT - 164, KG
LAUNCH SITE - KENYA PLATFORM, OFF COAST OF KENYA
LAUNCH VEHICLE - SCOUT

SPONSORING COUNTRY/AGENCY
ITALY
UNITED STATES

INVESTIGATION NAME - NEUTRAL ATMOSPHERIC COMPOSITION

NSSDC ID - 74-009A-02 INVESTIGATIVE PROGRAM CODE EE=EO/DO, SCIENCE
INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - G.P. NEWTON NASA HEADQUARTERS
OI - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
This experiment was flown at equatorial latitudes to determine the temperature and density of molecular nitrogen at several altitudes in the upper atmosphere. The sensor was a small magnetron scanned to measure molecular nitrogen, and it had a knifed-edged orifice. Temperature was measured during a spin period by observing the response as a function of angle with the satellite velocity vector. The experiment performed correctly but the data obtained were too small (only a few minutes per orbit) to be of much value.

--- SAN MARCO 4, SPENCER---

INVESTIGATION NAME - NEUTRAL ATMOSPHERIC TEMPERATURE

NSSDC ID - 74-009A-03 INVESTIGATIVE PROGRAM CODE EE=EO/DO, SCIENCE
INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
This experiment was flown to measure directly the temperature and density of molecular nitrogen at several altitudes in the upper atmosphere. The sensor was a small magnetometer scanned to measure molecular nitrogen, and it had a knifed-edged orifice. Temperature was measured during a spin period by observing the response as a function of angle with the satellite velocity vector. The experiment performed correctly but the data obtained were too small (only a few minutes per orbit) to be of much value.

--- SAN MARCO 4 ---

SPACESHIP COMMON NAME - SME ALTERNATE NAMES - SOLAR MESOSPHERE EXPLORER 12887

NSSDC ID - 81-1004

LAUNCH DATE - 10/06/81 WEIGHT - 1455 KG
LAUNCH SITE - VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE - DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES

INVESTIGATION NAME - NEUTRAL ATMOSPHERIC TEMPERATURE

INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
This experiment was flown to measure directly the temperature and density of molecular nitrogen at several altitudes in the upper atmosphere. The sensor was a small magnetometer scanned to measure molecular nitrogen, and it had a knifed-edged orifice. Temperature was measured during a spin period by observing the response as a function of angle with the satellite velocity vector. The experiment performed correctly but the data obtained were too small (only a few minutes per orbit) to be of much value.

--- SAN MARCO 4 ---

SPACESHIP COMMON NAME - SAN MARCO 4 ALTERNATE NAMES - SAN MARCO-C-2, 371565-50-12

NSSDC ID - 74-009A

LAUNCH DATE - 02/18/74 WEIGHT - 164 KG
LAUNCH SITE - KENYA PLATFORM, OFF COAST OF KENYA
LAUNCH VEHICLE - SCOUT

SPONSORING COUNTRY/AGENCY
ITALY
UNITED STATES

INVESTIGATION NAME - NEUTRAL ATMOSPHERIC COMPOSITION

NSSDC ID - 74-009A-02 INVESTIGATIVE PROGRAM CODE EE=EO/DO, SCIENCE
INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - G.P. NEWTON NASA HEADQUARTERS
OI - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
This experiment was flown at equatorial latitudes to determine the temperature and density of molecular nitrogen at several altitudes in the upper atmosphere. The sensor was a small magnetometer scanned to measure molecular nitrogen, and it had a knifed-edged orifice. Temperature was measured during a spin period by observing the response as a function of angle with the satellite velocity vector. The experiment performed correctly but the data obtained were too small (only a few minutes per orbit) to be of much value.

--- SAN MARCO 4, SPENCER---

INVESTIGATION NAME - NEUTRAL ATMOSPHERIC TEMPERATURE

INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
This experiment was flown to measure directly the temperature and density of molecular nitrogen at several altitudes in the upper atmosphere. The sensor was a small magnetometer scanned to measure molecular nitrogen, and it had a knifed-edged orifice. Temperature was measured during a spin period by observing the response as a function of angle with the satellite velocity vector. The experiment performed correctly but the data obtained were too small (only a few minutes per orbit) to be of much value.

--- SAN MARCO 4 ---

SPACESHIP COMMON NAME - SME ALTERNATE NAMES - SOLAR MESOSPHERE EXPLORER 12887

NSSDC ID - 81-1004

LAUNCH DATE - 10/06/81 WEIGHT - 1455 KG
LAUNCH SITE - VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE - DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES

INVESTIGATION NAME - NEUTRAL ATMOSPHERIC TEMPERATURE

INVESTIGATION DISCIPLINE(S) AERONOMY

PERSONNEL
PI - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
This experiment was flown to measure directly the temperature and density of molecular nitrogen at several altitudes in the upper atmosphere. The sensor was a small magnetometer scanned to measure molecular nitrogen, and it had a knifed-edged orifice. Temperature was measured during a spin period by observing the response as a function of angle with the satellite velocity vector. The experiment performed correctly but the data obtained were too small (only a few minutes per orbit) to be of much value.
BRIEF DESCRIPTION
The Solar Mesosphere Explorer (SME) primary mission objective was to investigate the processes that create and destroy ozone in the upper mesosphere and lower thermosphere. Some specific goals were (1) to determine the nature and magnitude of changes in mesospheric ozone densities that are the result of changes in the solar ultraviolet flux; (2) to determine the interrelationship between solar flux, ozone and the temperature of the upper stratosphere and mesosphere; (3) to determine the interrelationship between ozone and water vapor; and (4) to determine the interrelationship between nitrogen oxides and ozone.

The satellite experiment complement consisted of a solar ultraviolet spectrometer, a UV ozone spectrometer, an infrared radiometer/1.27-micrometer spectrometer, and a nitrogen oxide spectrometer. In addition, a solar proton alarm detector was carried to measure the integrated solar flux in the range 30 to 500 MeV. The spin axis was oriented normal to the orbital plane. The command was capable of executing commands in real time or from stored program control. Power was supplied by a solar cell array. The telemetry system was used either in a real-time or in a tape-recorder mode.

INVESTIGATION NAME: UV OZONE

NSSDC ID-
01-1004-01
INVESTIGATIVE PROGRAM
CODE CE-86-CO-0P, SCIENCE
INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PB - C.A. BARTH
OE - G.J. ROTTMAN
OB - R.J. THOMAS
OL - J.C. GILLE
OC - A.L. STEWART
OD - C.W. HORD
OE - R.L. BAILEY
OA - G.E. THOMAS
OF - J.L. LONDON
OG - R.L. CRUTZEN
OH - R.F. DICKINSON

INVESTIGATION NAME: INFRARED RADIOMETER (4 CHANNELS)

NSSDC ID-
01-1004-02
INVESTIGATIVE PROGRAM
CODE CE-86-CO-0P, SCIENCE
INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PB - C.A. BARTH
OE - G.J. ROTTMAN
OB - R.J. THOMAS
OL - J.C. GILLE
OC - A.L. STEWART
OD - C.W. HORD
OE - R.L. BAILEY
OA - G.E. THOMAS
OF - J.L. LONDON
OG - R.L. CRUTZEN
OH - R.F. DICKINSON

INVESTIGATION NAME: SOLAR UV MONITOR

NSSDC ID-
01-1004-05
INVESTIGATIVE PROGRAM
CODE CE-86-CO-0P, SCIENCE
INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PB - C.A. BARTH
OE - G.J. ROTTMAN
OB - R.J. THOMAS
OL - J.C. GILLE
OC - A.L. STEWART
OD - C.W. HORD
OE - R.L. CRUTZEN
OH - R.F. DICKINSON

BRIEF DESCRIPTION
The objective of the Ultraviolet Solar Monitor Experiment was to monitor the incoming solar radiation to determine the effect of the ozone column concentration. A dual-channel Ebert-Fastie spectrometer measured solar radiation at 1216 A and between 1600 and 3100 A with a resolution of 1 A. The look direction was 45 deg to the spacecraft axis of rotation. In the 3-Am to 3-pm sun-synchronous orbits, the instrument scanned through the spectrum.
sun once per orbit. The full width at half maximum was 14 A. There were 512 grating steps per scan.

-------------------- SPUTNIK 3

INVESTIGATION NAME- SOLAR PROTON ALARM

NSSDC ID- 81-100A-06 INVESTIGATIVE PROGRAM CODE CC-80/GC-0F. SCIENCE INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS SOLAR PHYSICS

PERSONNEL
P1 - C.A. BARTH U OF COLORADO
O1 - G.A. ROITMAN U OF COLORADO
O2 - R.J. THOMAS U OF COLORADO
O1 - J.J. GILLES NATL CTR FOR ATMOS RES
O1 - P.L. BAILEY NATL CTR FOR ATMCS RES
O1 - D.P. VONK
O1 - A.G. STEWART U OF COLORADO
O1 - C.W. HODG U OF COLORADO
O1 - G.G. THOMAS U OF COLORADO
O1 - J. LONDON U OF COLORADO
O1 - P.J. CRUTZEN WPIC/CHIERNICY
O1 - R.E. DICKINSON NATL CTR FOR ATMOS RES

BRIEF DESCRIPTION
The Solar Proton Alarm Detector monitored the integrated solar proton flux in the 30 to 500 MeV range, when the flux exceeded a selected count rate value, the instrument responded by altering science commands to observe the effects of solar protons on atmospheric constituents.

--------------------- SPUTNIK 3

SPACECRAFT COMMON NAME- SPUTNIK 3 ALTERNATE NAMES- 1958 DELTA 2, 00088

NSSDC ID- 58-004B LAUNCH DATE- 07/09/58 WEIGHT- 1237. KG LAUNCH SITE- THURSTON (BAIKONUR COSMODROME), B.S.S.R.

SPONSORING COUNTRY/AGENCY
U.S.S.R.

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPDCY DATE- 07/09/58 ORBIT PERIOD- 100.9 MIN INCLINATION- 65.16 DEG PERIAPSE- 217. KM ALT APOLYSPES- 1664. KM ALT

PERSONNEL
PM - UNKNOWN PS - UNKNOWN

BRIEF DESCRIPTION
Sputnik 3 was an automatic-scientific-laboratory spacecraft. It was conically shaped and was 3.57 m long. The scientific instrumentation, 112 instruments, provided data on the pressure and composition of the upper atmosphere, concentration of charged particles, photons in cosmic rays, heavy nuclei in cosmic rays, gamma rays, magnetic and electrostatic fields, and meteoric particles. The outer radiation belts of the earth were detected during the flight. The spacecraft remained in orbit until April 6, 1960.

--------------------- SPUTNIK 3

INVESTIGATION NAME- BEACON

NSSDC ID- 58-004B-12 INVESTIGATIVE PROGRAM CODE SCIENCE

INVESTIGATION DISCIPLINE(S) IONOSPHERES AND RADIO PHYSICS

PERSONNEL
P1 - UNKNOWN

BRIEF DESCRIPTION
The onboard beacon operated at several frequencies including 20, 40, and 60 MHz. From the beacon operation at these frequencies, the total ionospheric electron content was determined using the Doppler effect.

--------------------- SPUTNIK 3

SPACECRAFT COMMON NAME- SPUTNIK 3 ALTERNATE NAMES- SPACE TEST PROGRAM 78-1, 78-1

NSSDC ID- 78-001A LAUNCH DATE- 07/24/79 WEIGHT- 849.6 KG LAUNCH SITE- VAN USSERBERG AFB, UNITED STATES LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPDCY DATE- 20/24/79 ORBIT PERIOD- 96.3 MIN PERIAPSE- 656. KM ALT

PERSONNEL
PM - R.R. KEHL
PS - W.L. WANG

BRIEF DESCRIPTION
The space test program (STP) 78-1 mission was designed to study selected scientific data from earth and sun-oriented experiments. The spacecraft was sun-oriented and had its spin axis perpendicular to the orbit plane and the satellite-sun line. The instrumentation consisted of (1) a gamma-ray spectrometer and particle detectors, (2) a white-light coronagraph and an extreme-ultraviolet heliograph, (3) solar X-ray spectrometer and spectrophotometer, (4) an extreme-ultraviolet spectrometer, (5) a high-altitude particle spectrometer, (6) an X-ray monitor, and (7) a preliminary aerosol monitor.

--------------------- SPUTNIK 3

INVESTIGATION NAME- EXTREME ULTRAVIOLET SPECTROMETER

NSSDC ID- 79-017A-02 INVESTIGATIVE PROGRAM CODE STP TEST PROGRAM

INVESTIGATION DISCIPLINE(S) AERONODY IONOSPHERES

PERSONNEL
P1 - C.A. BOWER U OF CALIF, BERKELEY

BRIEF DESCRIPTION
This investigation used an extreme ultraviolet spectrometer to measure airglow radiation in the upper atmosphere. The instrument had a 6-degree by 6-degree field of view and measured a selected 500-A bandwidth with 5-A resolution within the 200- to 1400-A range.

--------------------- SPUTNIK 3

INVESTIGATION NAME- GAMMA RAY SPECTROMETER

NSSDC ID- 79-017A-03 INVESTIGATIVE PROGRAM CODE STP TEST PROGRAM

INVESTIGATION DISCIPLINE(S) GAMMA-RAY ASTRONOMY PARTICLES AND FIELDS

PERSONNEL
P1 - W.L. IMHOF LOCKHEED PALO ALTO

BRIEF DESCRIPTION
This investigation used gamma-ray spectrometers to measure the distribution of gamma-ray sources and the characteristics of energetic particle fluxes at low altitudes. The instrument consisted of three different types of detectors. These were two Ge detectors cooled by a mechanical refrigerator, two LiF/plastic scintillation detectors, and an array of eight cadmium telluride detectors. Each Ge detector had a 4-degree field of view (FOV) of 45 degrees half angle, was 85 cm in volume and 15 cm in front area and measured energy loss from 0.2 keV to 2.5 MeV in 4096 channels. A time-of-flight gain change allowed the range to change from 0.12 to 7.5 MeV. The initial energy resolution was 3.5 keV at 1 MeV, but due to radiation damage and temperature cycling caused by the necessity to turn off the refrigerator for power conservation, the resolution degraded to about 40 keV at the 0.511-MeV line. The Phoswich detectors were 15 cm in diameter disks of 1.27 cm thickness; they measured energy loss from 40 keV to 2.5 MeV in 256 channels. The cadmium telluride detectors had a fan-shaped FOV of 90 degrees by 10 degrees and were equally spaced in the 10-degree widths around the circle. The energy loss range was 20 to 200 keV in a channel.

--------------------- SPUTNIK 3

INVESTIGATION NAME- SOLAR X-RAY SPECTROMETER

NSSDC ID- 79-017A-05 INVESTIGATIVE PROGRAM CODE STP TEST PROGRAM

INVESTIGATION DISCIPLINE(S) SOLAR PHYSICS

PERSONNEL
P1 - W.L. IMHOF AEROSPACE CORP
P2 - N.A. MCKENZIE US NAVAL RESEARCH LAB
O1 - C.A. DOCHER US NAVAL RESEARCH LAB

--------------------- SPUTNIK 3
BRIEF DESCRIPTION

This investigation was composed of four parts: Solfix, Solfix, Honey, and Magnap. The objective of these four experiments was the study of solar flares and active regions. Solfix observed spectra in the 3- to 25-A wavelength interval while pointed at a specific solar region, as well as maps of the sun in individual X-ray spectral lines using multicolor collimators and Bragg crystal spectrometers. Honey recorded full solar disk intensity with 32 ms time resolution from 0.1 to 12 A using uncollimated proportional counters. Magnap obtained full-disc solar maps from 0.1 to 12 A using filtered collimated proportional counters.

STP P78-1, MICHELSS

INVESTIGATION NAME: SOLAR WID MONITOR

PERSONNEL
PI - D. J. MICHELSS

US NAVAL RESEARCH LAB

BRIEF DESCRIPTION

This investigation used a white-light coronograph and an extreme ultraviolet (EUV) heliograph to monitor the sun's inner and outer corona. The purpose of the investigation was to determine the character of the plasma outflow at the source of the solar wind. The investigation also measured the size and structure of solar flares, coronal holes, and flares. Due to background light problems, the EUV heliograph data were completely compromised.

STP P78-1, PEPA

INVESTIGATION NAME: PRELIMINARY AEROSOL MONITOR

PERSONNEL
PI - T. J. PEPA

U OF WYOMING

BRIEF DESCRIPTION

This investigation used an aerosol-monitoring instrument to measure the concentration and vertical distribution of aerosols and ozone in the earth's stratosphere.

STP P78-1, SHULMAN

INVESTIGATION NAME: X-RAY MONITOR

PERSONNEL
PI - J. D. SHULMAN

US NAVAL RESEARCH LAB

BRIEF DESCRIPTION

This investigation used an X-ray monitor to determine the frequency and location of short-lived X-ray bursts from space. It provided a low-resolution mapping capability for auroral X-ray emissions.

STP P78-1, VANCOUVER

INVESTIGATION NAME: HIGH LATITUDE PARTICLE SPECTROMETER

PERSONNEL
PI - R. F. VANCOUVER

USAF GEOPHS LAB

BRIEF DESCRIPTION

This investigation used two sets of dual electrostatic analyzers, at right angles to acquire electron data in high-latitude auroral zones, primarily during magnetic storm and subsolar periods. Each analyzer in each set swept through the energy range 50 to 1000 eV while the other analyzer swept from 1 to 20 keV simultaneously. The total energy range 0.05 to 20 keV was divided into 16 channels.
INVESTIGATION NAME - TRANSIT 2A - IONOSPHERIC BEACON

NSSDC ID- 60-007A-03 INVESTIGATIVE PROGRAM NAVIGATION TECHNOLOGY

INVESTIGATION DISCIPLINE(s) IONOSPHERES AND RADIO PHYSICS

PERSONNEL PI - UNKNOWN

BRIEF DESCRIPTION
This experiment was not formally planned or funded in the spacecraft development activity. Two radio beacons at coherent frequencies 54 and 328 MHz were operated for the navigation experiment. Ionospheric physicists used the characteristics of these beams, such as Faraday rotation, phase shifts, Doppler shifts, signal intensity, etc., to determine ionospheric characteristics which included total electron content and location along the propagation path. Ground stations recorded the beacon signals as input to study the ionosphere.

************* TRANSIT 2A ****************************

SPACESHIP COMMON NAME - TRANSIT 4A ALTERNATE NAMES- 1961 OMICRON 1, 00116

NSSDC ID- 61-015A LAUNCH DATE- 06/29/61 WEIGHT- 79. KG
LAUNCH SITE- CAPE CANAVERAL UNITED STATES LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY UNITED STATES DOD-Navy

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
ORBIT PERIOD- 103.8 MIN PERIAPSE- 881.1 KM
APOLLE- 996.0 KM

PERSONNEL
PM - T. WATT
PS - T. WATT

APPLIED PHYSICS LAB
APPLIED PHYSICS LAB

BRIEF DESCRIPTION
Transit 4A was a relatively small spacecraft. It was launched with two other spacecraft from the same launch vehicle. Its shape was nearly cylindrical (22-foot right prism plus a base and top), 109 cm in diameter, and 79 cm in height. Most of the spacecraft surfaces were covered with solar cells for use with nickel-cadmium batteries. The primary mission was to serve as one of four operational navigational satellites for use by ships and aircraft. In addition, Transit 4A carried a nuclear power source for testing. This spacecraft operated normally after launch.

------ TRANSIT 4A, UNKNOWN -------------------------------

INVESTIGATION NAME- IONOSPHERIC BEACON

NSSDC ID- 61-015A-03 INVESTIGATIVE PROGRAM NAVIGATION TECHNOLOGY

INVESTIGATION DISCIPLINE(s) IONOSPHERES AND RADIO PHYSICS

PERSONNEL PI - UNKNOWN

APPLIED PHYSICS LAB

BRIEF DESCRIPTION
This experiment was not formally planned or funded in the spacecraft planning. The phase shift of two coherent RF signals due to ionospheric electrons was used to determine total electron content along the propagation path. Signal intensity variation was used to observe ionospheric scintillation. The Transit 4A navigation beacons signals (2 pairs of frequencies 54 and 328 MHz and 100 and 450 MHz were available) were recorded by numerous ground stations, and these data were used by ionospheric physicists to obtain total electron content and scintillation values.

************* VANGUARD 1 ****************************

SPACESHIP COMMON NAME- VANGUARD 1 ALTERNATE NAMES- 1958 BETA 2, 00005 VANGUARD 1V4

NSSDC ID- 58-002M LAUNCH DATE- 02/17/58 WEIGHT- 1.47 KG
LAUNCH SITE- CAPE CANAVERAL UNITED STATES LAUNCH VEHICLE- VANGUARD

SPONSORING COUNTRY/AGENCY UNITED STATES DOD-Navy

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
ORBIT PERIOD- 129.0 MIN PERIAPSE- 559.2 KM
APOLLE- 332.5 KM

PERSONNEL
PM - J.P. HAGEN(NASA)
PS - J.P. HAGEN(NASA)

US NAVAL RESEARCH LAB
US NAVAL RESEARCH LAB

BRIEF DESCRIPTION
Vanguard 1 was a small earth-orbiting satellite designed to test the launch capabilities of a three-stage launch vehicle. It was also used to obtain geodetic measurements through orbit analysis. The spacecraft was a 1.47-kg aluminum sphere 15.2 cm in diameter. It contained a 10-W, 106- MHz transponder and a 5-W, 108.03-MHz transmitter powered by its solar cells. The transmitters were used primarily for engineering and tracking data. It was discovered that solar radiation pressure produced significant perturbations in the perigee height of the satellites, which caused a significant decrease in its expected lifetime.

------ VANGUARD 1, JACCHIA ****************************

INVESTIGATION NAME- SATELLITE Drag Atmospheric Density

NSSDC ID- 58-002B-02 INVESTIGATIVE PROGRAM SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(s) AERONOMY

PERSONNEL
PI - L.G. JACCHIA
OI - J.J. SLOWEY

SAO
SAO

BRIEF DESCRIPTION
Vanguard 2, because of its symmetrical shape, was selected for the experimenters for use in determining upper atmospheric densities as a function of altitude, attitudes, seasons, and solar activity. This experiment was not planned prior to launch. Density values near perigee were deduced from sequential observations of the spacecraft positions using optical (Baker-Nunn camera network) and radar and/or radar tracking techniques. This experiment obtained reasonable density values. Vanguard 1 has an expected orbital lifetime of 400 yr.

************* VANGUARD 2 ****************************

SPACESHIP COMMON NAME- VANGUARD 2 ALTERNATE NAMES- 1959 ALPHA 1, 00011 VANGUARD 1V5

NSSDC ID- 59-001A LAUNCH DATE- 02/17/59 WEIGHT- 9.8 KG
LAUNCH SITE- CAPE CANAVERAL UNITED STATES LAUNCH VEHICLE- VANGUARD

SPONSORING COUNTRY/AGENCY UNITED STATES DOD-Navy

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC
ORBIT PERIOD- 129.0 MIN PERIAPSE- 559.2 KM
APOLLE- 332.5 KM

PERSONNEL
PM - J.P. HAGEN(NASA)
PS - J.P. HAGEN(NASA)

US NAVAL RESEARCH LAB
US NAVAL RESEARCH LAB

BRIEF DESCRIPTION
Vanguard 2, an earth-orbiting satellite designed to measure cloud cover distribution over the daylight portion of its orbit. The spacecraft was a 9.8-kg magnesium sphere 50.8 cm in diameter. It contained two optical telescopes with two photoreceivers. The sphere was internally gold-plated and externally covered with an aluminum deposit coated with silicon oxide of sufficient thickness to provide thermal control for the instrumentation. Radio communication was provided by a 1-W, 108.03-MHz telemetry transmitter and a 1-W, 106-MHz beacon transmitter that sent a continuous signal for tracking purposes. A command receiver was used to activate a tape recorder that related telescope experiment data to the telemetry transmitter. Both transmitters functioned normally for 19 days. The satellite was still stabilized at 50 rpm but telemetry data were poor because of an unsatisfactory orientation of the spin axis. The power supply for the instrumentation was provided by mercury batteries.

------ VANGUARD 2, JACCHIA ****************************

INVESTIGATION NAME- SATELLITE Drag Atmospheric Density
Because of its symmetrical shape, Vanguard 2 was selected by the experimenters for use in determining upper atmospheric densities as a function of altitude, latitude, seasons and solar activity. This experiment was not planned prior to launch. Density values near perigee were deduced from sequential observations of the spacecraft position, using optical (Baker-Hunn camera network) and radio and/or radar tracking techniques. This experiment obtained reasonable density values. Vanguard 2 has an expected orbital lifetime of 300 yr.

************** VAUGAR 3 **************

SPACECRAFT COMMON NAME: Vanguard 3
ALTERNATE NAMES: 1959 ETA 1; 002C
Vanguard TVA BACKUP

NSSC ID: 59-007A-04
INVESTIGATIVE PROGRAM CODE: EE-8, SCIENCE
INVESTIGATION DISCIPLINE(S): AERONOMY

PERSONNEL
PI = J.R. JACCHIA
OI = J.R. SLOWEY
SAO

BRIEF DESCRIPTION
Because of its symmetrical shape, Vanguard 3 was selected by the experimenters for use in determining upper atmospheric densities as a function of altitude, latitude, seasons and solar activity. This experiment was not planned prior to launch. Density values near perigee were deduced from sequential observations of the spacecraft position, using optical (Baker-Hunn camera network) and radio and/or radar tracking techniques. This experiment obtained reasonable density values. Vanguard 3 has an expected orbital lifetime of 300 yr.

-------- Vanguard 3: JACCHIA ------------------------

INVESTIGATION NAME: Proton Precession Magnetometer

NSSC ID: 59-007A-01
INVESTIGATIVE PROGRAM CODE: EE-8, SCIENCE
INVESTIGATION DISCIPLINE(S): PARTICLES AND FIELDS

PERSONNEL
PI = J.R. JACCHIA
OI = J.R. SLOWEY
SAO

BRIEF DESCRIPTION
This experiment had a proton precessional magnetometer to measure the earth's magnetic field at altitudes ranging from 254 to 3714 km and at latitudes between plus or minus 33.4 deg. The measurements were made on orbit as the spacecraft passed seven mid track stations in North and South America and one station in South Africa. When switched on by commands, the polarization coil around the proton sample (normal hexane) was turned on for 2 s followed by a 2-s readout of the precessional signal. Several readings were taken during each pass over a station. The experiment worked well during its 85-day active life, and approximately 4,313 readings were recorded. The experiment is described in J. C. Caspi et al., "Measurements of the geomagnetic field by the Vanguard 3 satellite, NASA 5A-01401, Goddard Space Flight Center, Greenbelt, Md., 1962." The overall accuracy of the field measurements was approximately 10 nT (gammas).

-------- Vanguard 3: JACCHIA ------------------------

INVESTIGATION NAME: Satellite Drag Atmospheric Density

NSSC ID: 59-007A-02
INVESTIGATIVE PROGRAM CODE: EE-8, SCIENCE
INVESTIGATION DISCIPLINE(S): AERONOMY

PERSONNEL
PI = J.R. JACCHIA
OI = J.R. SLOWEY
SAO

BRIEF DESCRIPTION
Because of its symmetrical shape, Vanguard 2 was selected by the experimenters for use in determining upper atmospheric densities as a function of altitude, latitude, seasons and solar activity. This experiment was not planned prior to launch. Density values near perigee were deduced from sequential observations of the spacecraft position, using optical (Baker-Hunn camera network) and radio and/or radar tracking techniques. This experiment obtained reasonable density values. Vanguard 2 has an expected orbital lifetime of 300 yr.

-------- Vanguard 3: JACCHIA ------------------------
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Appendix
APPENDIX A - DEFINITIONS

Investigation Discipline - The subject to which an investigation pertains. The possible entries are limited, and the NSSDC information files can be searched using this field.

Investigative Program - Code of the cognizant NASA Headquarters office, or name of other sponsoring agency program. "CO-OP" added to a code indicates a cooperative effort with another agency or a foreign country.

NLA - No Longer Affiliated. Used in the spacecraft personnel section to indicate that the person had the specified affiliation at the time of his participation in the project, but is no longer there. Used in the investigation personnel section to indicate that the affiliation shown is the last known scientific affiliation and that the given person is no longer there.

NSSDC ID - An identification code used in the NSSDC information system. In this system, each successfully launched spacecraft and experiment is assigned a code based on the launch sequence of the spacecraft. Subsequent to 1962, this code (e.g., 69-009A for the spacecraft ISIS 1) corresponds to the COSPAR international designation. The experiment codes are based on the spacecraft code. For example, the experiments carried aboard the spacecraft 69-009A are numbered 69-009A-01, 69-009A-02, etc. Similarly data sets corresponding to experiment 69-009A-01 are coded 69-009A-01A, -01B, etc. Each prelaunch spacecraft and experiment is also assigned an NSSDC ID code based on the name of the spacecraft. Prior to launch, for example, the approved NASA launch, Solar Mesosphere Explorer, was coded SME. The experiments carried aboard this spacecraft were coded SME -01, SME -02, etc. Once it was launched, its prelaunch designation was changed to a postlaunch one: 81-100A.

OI - Other Investigator.

PI - Principal Investigator.

A-1
PM - Project Manager. If a spacecraft has had several project managers, the initial and the latest project managers are both indicated in the spacecraft personnel section. For international programs there is usually a project manager in each of the two principal participating nations. The current or more recent PM is listed first.

PS - Project Scientist. The above comment for project managers also applies to project scientists.
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GREENBELT, MARYLAND 20771 U.S.A.

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☐ Ionospheric Physics
☐ Meteorology

☐ Report on Active and Planned Spacecraft and Experiments

☐ Spacecraft Program Bibliographies

☐ Reports on Models of the Near-Earth Environment

☐ World Data Center A for Rockets and Satellites Launch Summaries

☐ SPACEWARN Bulletins

☐ Satellite Situation Center (SSC) Reports

601-82 (6/80)
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☐ NSSDC Data Listing

☐ Particles and Fields

☐ Astronomy

☐ Planetary Atmospheres

☐ Geodesy and Gravimetry

☐ Planetology

☐ Ionospheric Physics

☐ Solar Physics

☐ Meteorology

☐ Report on Active and Planned Spacecraft and Experiments

☐ Spacecraft Program Bibliographies

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- [ ] Educational purposes (explain below)
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- [ ] Preparation of Doctoral thesis
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601-82 (6/80)
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- [ ] Other:
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  - [ ] Reference material
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NSSDC requests the submission of all publications resulting from studies in which data supplied by NSSDC have been used. Please state briefly the research projects in which you are engaged and if you plan to prepare any articles based on this research.

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601-28 (10/71)
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□ New tapes will be supplied prior to processing.
□ Original NSSDC tapes will be returned.
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**NSSDC DATA REQUEST FORM**

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<thead>
<tr>
<th>Scientists OUTSIDE the United States send order to:</th>
<th>Requesters WITHIN the United States send order to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>WORLD DATA CENTER A ROCKETS AND SATELLITES CODE 601</td>
<td>NATIONAL SPACE SCIENCE DATA CENTER CODE 601.4 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771, USA</td>
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REQUISITION INFORMATION (Please print)

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**INTENDED USE OF DATA** (check all that apply)

- Support of a NASA effort (project, study, etc.); Contract No. __________
- Support of a U.S. Government effort (other than NASA)
- Research and analysis project (individual or company sponsored)
- Educational purposes (explain below)
- Preparation of Master's thesis
- Preparation of Doctoral thesis
- Other: __________
  - Exhibit or display
  - Reference material
  - Use in publication

**NSSDC requests the submission of all publications resulting from studies in which data supplied by NSSDC have been used. Please state briefly the research projects in which you are engaged and if you plan to prepare any articles based on this research.**

---

*NSSDC has available special forms for ordering photographic data from the Surveyor, Lunar Orbiter, Apollo, and Mariner missions. These forms will be provided on request.*

---

601-28 (10/71)
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Additional Specifications

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