NSSDC

WDC-A-R&S

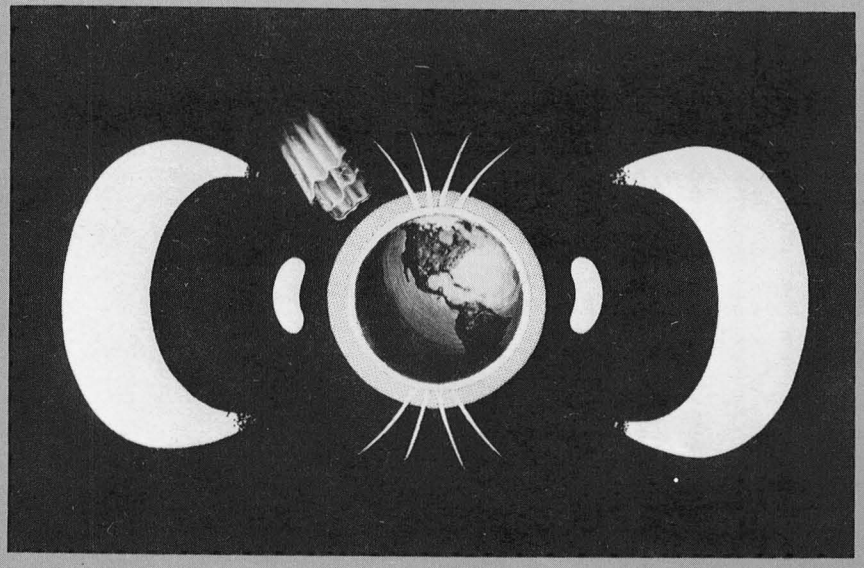
National Space Science Data Center/
World Data Center A For Rockets and Satellites

83-03

DATA CATALOG SERIES FOR SPACE SCIENCE AND APPLICATIONS FLIGHT MISSIONS

Volume 3A

Descriptions of Low- and Medium-Altitude Scientific Spacecraft and Investigations



May 1983

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 [illegible]
DATE/FILE    08-23-84/N
****** BEGIN SEARCH BYPASS ******
DATE/FILE    8-23-84/D
PRIMARY   DATA BASE ONLINE
SET  NO.OF  NO.OF   DESCRIPTION OF SET
NO.   REC.   OCC.   (+=OR, *=AND, -=NOT)
---  -----  -----  ----------------------
  1      3      3 UTP/CATALOG *+1 SERIES *+2 SPACE *+1 SCIENCE
          DISPLAY 01/2/1
      83N34981*#   ISSUE 23   PAGE 3746   CATEGORY 12   RPT#: NASA-TM-85417 NAS
      1.15:85417 NSSDC/WDC-A-R/S-83-03-VOL-3A   83/05/00   94 PAGES
      UNCLASSIFIED DOCUMENT
UTTL: Data catalog series for space science and applications flight missions.
      Volume 3A:  Descriptions of low- and medium-altitude scientific spacecraft
      and investigations
AUTH: A/HOROWITZ, R.:  R/JACKSON, J. F.   PAT: A/ed.:  R/ed.
CORP: National Aeronautics and Space Administration. Goddard Space Flight
      Center, Greenbelt, Md.    AVAIL.NTIS   SAP: HC A05/MF A01
MAJS: /*APOGEES/*EARTH ORBITS/*SPACECRAFT EXPERIMENTS
MINS: / EARTH ATMOSPHERE/ ENVIRONMENT EFFECTS
ABA:  Author
ABS:  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.
```

NSSDC/WDC-A-R&S 83-03

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

PREFACE

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

TABLE OF CONTENTS

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 investigation, 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.

1.2 ORGANIZATION

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.

1.3 NSSDC PURPOSE, FACILITIES, AND SERVICES

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.: 7108289716

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.: 7108289716

1.4 DATA ACQUISITION

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

********** 1963-030D**********

SPACECRAFT COMMON NAME- 1963-030D
ALTERNATE NAMES- DASH-2, 00624

NSSDC ID- 63-030D

LAUNCH DATE- 07/19/63 WEIGHT- KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 08/06/63
ORBIT PERIOD- 167.96 MIN INCLINATION- 88.42 DEG
PERIAPSIS- 3665. 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 orbit, originally circular, increased in eccentricity rapidly under the action of solar radiation pressure. Dash 2 reentered the earth's atmosphere on April 12, 1971.

------- 1963-030D, PRIOR----------

INVESTIGATION NAME- BALLOON ATMOSPHERIC DRAG 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.

********** 1963-038C**********

SPACECRAFT COMMON NAME- 1963-038C
ALTERNATE NAMES- SN 39, 5E 1
00671, TRANSIT 5E1

NSSDC ID- 63-038C

LAUNCH DATE- 09/28/63 WEIGHT- 59. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-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 APPLIED PHYSICS LAB
PS - C.O. BOSTROM APPLIED PHYSICS LAB

BRIEF DESCRIPTION
The magnetically aligned 1963-038C spacecraft was designed to measure energetic charged particles, magnetic fields, and the solar spectrum, and to accuire geodetic data. After August 1969, 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.

------- 1963-038C, BOSTROM----------

INVESTIGATION NAME- ENERGETIC ELECTRON AND PROTON DETECTORS

NSSDC ID- 63-038C-01 INVESTIGATIVE PROGRAM
NAVIGATION TECHNOLOGY

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - C.O. BOSTROM APPLIED PHYSICS LAB
OI - D.J. WILLIAMS APPLIED PHYSICS LAB

BRIEF DESCRIPTION
The charged particle experiment on 1963-038C consisted of an array of solid-state detectors. One electron spectrometer consisting of five detectors measured the directional intensity of electrons with energies greater than 0.28, 1.2, 2.4, 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 8.5 MeV, 8.5 to 25 MeV, and 25 to 100 MeV. Three omnidirectional detectors measured the sum of electron and proton intensities (Ie and Ip) according to the following: Ie (E>.28 MeV) plus Ip (E>2.2 MeV), Ie (E>.41 MeV) plus Ip (E>8.5 MeV), and Ie (E>1.8 MeV) plus Ip (E>25 MeV). The electron spectrometer and one proton spectrometer were oriented with their axes normal to the geomagnetic field. All other detectors were parallel to the field looking upward when in the northern hemisphere. Most detectors were sampled 22.9 times per min. The lowest energy omnidirectional detector was sampled 45.8 times per min. Except for the greater than 3.6-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 1970.

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

SPACECRAFT COMMON NAME- 1964-083C
ALTERNATE NAMES- 5E 5, 00959
TRANSIT 5E5

NSSDC ID- 64-083C

LAUNCH DATE- 12/13/64 WEIGHT- 78. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-NAVY

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- 1084. KM ALT

PERSONNEL
PM - J. DASSOULAS APPLIED PHYSICS LAB
PS - J. DASSOULAS APPLIED PHYSICS LAB

BRIEF DESCRIPTION
The scientific objectives of this USN-APL spacecraft were to accurately map the earth's magnetic field over the regions covered by the satellite orbit, to map the celestial sphere in the ultraviolet region, to study the solar spectrum, and to determine the sublimation 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 bps. Only real-time data were acquired from the satellite. Because of power limitations, it was necessary to switch the power from experiment to experiment and to the Doppler navigational 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(DECEASED) APPLIED PHYSICS LAB

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 radiation belts. The detector system consisted of a single-cell, optically pumped, self-oscillating, rubidium (85) vapor magnetometer. The magnetometer was mounted at the end 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 whole orbit with the single magnetometer. The detector output was counted for an interval of 0.08 s with successive intervals separated by 0.66 s. During these periods, the satellite traversed latitudinal arcs of 0.6 and 4.8 km, respectively. The boom did not extend to its full length in orbit, but inflight calibration (available on command) allowed determination of the bias field at the magnetometer.

Instrumental effects precluded the measurement of field magnitudes greater than 3.1E4 nT. Thus, data coverage was restricted to latitudes below about 60 degrees. The experiment provided useful data with an accuracy of plus or minus 18 nT for the periods December 13 to 31, 1964, and April 10 to June 26, 1965. For a detailed discussion of the instrumentation and some of the results, see A. J. Zmuda et al., "The scalar magnetic intensity at 1100 kilometers in middle and low latitudes," J. Geophys. Res., v. 73, pp. 2495-2503, April 1968.

********** 1972-032A**********

SPACECRAFT COMMON NAME- 1972-032A
ALTERNATE NAMES- 06003, SESP 71-3

NSSDC ID- 72-032A

LAUNCH DATE- 04/19/72 WEIGHT- 2000. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 04/20/72
ORBIT PERIOD- 88.85 MIN INCLINATION- 81.48 DEG
PERIAPSIS- 155. KM ALT APOAPSIS- 277. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
This spacecraft contained two known experiments, a neutral density gauge and nightglow photometers. Little information is available on the spacecraft, but orbit adjustments (presumably by firing an onboard motor) were made to extend the satellite 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
PI - V.L. CARTER(NLA) AEROSPACE CORP

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 field, and particle flux. Noon-midnight observations were taken during the spring. Observations were made with a Redhead gauge, which measures ion current to a collector, after incoming particles have been ionized just inside the entrance aperture. Details of instrument structure and calibration are in B. K. Ching et al., "Upper atmospheric density inferred from magnetron data from the satellite 1972-032a," Aerosp. Corp., TR-0074(4260-10)-7, El Segundo, California, April 1974.

********** AD-A**********

SPACECRAFT COMMON NAME- AD-A
ALTERNATE NAMES- EXPLORER 19, 00714

NSSDC ID- 63-053A

LAUNCH DATE- 12/19/63 WEIGHT- 7. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/19/63
ORBIT PERIOD- 115.9 MIN INCLINATION- 78.6 DEG
PERIAPSIS- 590. KM ALT APOAPSIS- 2394. KM ALT

PERSONNEL
PM - C.W. COFFEE, JR. NASA-LARC
PS - R.F. FELLOWS(RETIRED) NASA HEADQUARTERS

BRIEF DESCRIPTION
Explorer 19 was the second in a series of 3.66-m inflatable spheres placed into orbit to determine atmospheric densities. Explorer 19 was launched while Explorer 9, 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 5.1-cm dots of white paint for thermal control. A 136.620-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 beacon did not have sufficient power to be received by ground tracking stations, making it necessary to rely solely on the SAO Baker-Nunn camera network for tracking.

------- AD-A, JACCHIA----------

INVESTIGATION NAME- NONSYSTEMATIC CHANGES OF AIR DENSITY

NSSDC ID- 63-053A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - L.G. JACCHIA SAO

BRIEF DESCRIPTION
This experiment was designed to determine nonsystematic changes of upper atmospheric density by conducting studies of the drag on a 3.6-m 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-Nunn 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. Slowey, "Accurate drag determination for eight artificial satellites of atmospheric densities and temperatures," Smithsonian Astrophysical Observatory special report no. 100, Cambridge, Mass., July 1962.

********** AD-B**********

SPACECRAFT COMMON NAME- AD-B
ALTERNATE NAMES- 00931, EXPLORER 24

NSSDC ID- 64-076A

LAUNCH DATE- 11/21/64 WEIGHT- 8.6 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 11/21/64
ORBIT PERIOD- 116.3 MIN INCLINATION- 81.4 DEG
PERIAPSIS- 525. KM ALT APOAPSIS- 2498. KM ALT

PERSONNEL
PM - C.W. COFFEE, JR. NASA-LARC
PS - R.F. FELLOWS(RETIRED) NASA HEADQUARTERS

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, was built of alternating layers 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 136-MHz tracking beacon. The satellite reentered the earth's atmosphere on October 18, 1968.

------- AD-B, JACCHIA----------

INVESTIGATION NAME- NONSYSTEMATIC CHANGES OF AIR DENSITY

NSSDC ID- 64-076A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - L.G. JACCHIA SAO

BRIEF DESCRIPTION
This experiment was designed to determine nonsystematic changes of the density of the upper atmosphere from studies of the drag on a 3.6-m diameter low-density sphere caused by short-term differences in solar activity. Density values near perigee were deduced from sequential observations of the spacecraft position, using optical (Baker-Nunn camera network) and radio and/or radar tracking techniques. The general techniques used to deduce 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 Astrophysical Observatory special report no. 100, Cambridge, Mass., July 1962. This experiment resulted in the successful determination of reasonable density values until spacecraft re-entry.

********** AD-C**********

SPACECRAFT COMMON NAME- AD-C
ALTERNATE NAMES- PL-683J, EXPLORER 39
03337

NSSDC ID- 68-066A

LAUNCH DATE- 08/08/68 WEIGHT- 9.4 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 08/11/68
ORBIT PERIOD- 118.2 MIN INCLINATION- 80.6 DEG
PERIAPSIS- 670. KM ALT APOAPSIS- 2538. KM ALT

PERSONNEL
PM - C.W. COFFEE, JR. NASA-LARC
PS - R.F. FELLOWS(RETIRED) NASA HEADQUARTERS

BRIEF DESCRIPTION
Explorer 39 was an inflatable sphere, 3.6 m in diameter. It was orbited to make atmospheric density determinations. The spacecraft was successfully launched into a nearly polar, highly elliptical orbit. It was folded and carried into orbit, together with ejection and inflation equipment, as part of the payload of Explorer 40. Two density experiments were performed. One involved the study of systematic density variation, and the other was concerned with nonsystematic density changes. The upper atmospheric densities were derived from sequential observations of the sphere by use of an attached 136.620-MHz radio tracking beacon and by optical tracking. The radio beacon ceased transmitting in June 1971. Since that time it has been necessary to rely solely on the SAO Baker-Nunn camera network for tracking. Explorer 39 has an expected orbital lifetime of 50 years.

------- AD-C, JACCHIA----------

INVESTIGATION NAME- NONSYSTEMATIC CHANGES OF AIR DENSITY

NSSDC ID- 68-066A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - L.G. JACCHIA SAO

BRIEF DESCRIPTION
This experiment was designed to determine nonsystematic upper atmospheric density changes. The data are derived from studies of the drag on a 3.6-m diameter low-density sphere caused by short-term differences in solar activity. Density values near perigee were deduced from sequential observations of the spacecraft position using optical (Baker-Nunn camera network) and radio and/or radar tracking techniques. The general techniques used to deduce 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 Astrophysical Observatory special report no. 100, Cambridge, Mass., July 1962. This experiment has determined reasonable density values, and it is capable of yielding long-term atmospheric density values, as Explorer 39 has an expected orbital lifetime of 50 years.

********** AE-A**********

SPACECRAFT COMMON NAME- AE-A
ALTERNATE NAMES- EXPLORER 17, S 6
ATMOSPHERE EXPLORER-A, 00564

NSSDC ID- 63-009A

LAUNCH DATE- 04/03/63 WEIGHT- 184. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 04/03/63
ORBIT PERIOD- 96.39 MIN INCLINATION- 57.6 DEG
PERIAPSIS- 255. KM ALT APOAPSIS- 916. KM ALT

PERSONNEL
PM - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
Explorer 17 was a spin-stabilized sphere 0.95 m in diameter. The spacecraft was vacuum sealed in order to prevent contamination of the local atmosphere. Explorer 17 carried four pressure gauges for the measurement of total neutral particle density, two mass spectrometers for the measurement of certain neutral particle concentrations, and two electrostatic probes for ion concentration and electron temperature measurements. Battery power failed on July 10, 1963. Three of the four pressure gauges and both electrostatic probes operated normally. One spectrometer malfunctioned, and the other operated intermittently.

------- AE-A, BRACE----------

INVESTIGATION NAME- LANGMUIR PROBES

NSSDC ID- 63-009A-02 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL
PI - L.H. BRACE NASA-GSFC
OI - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
The Explorer 17 experiment payload included two independent Langmuir probe systems. One of the sensors was used to provide measurements of the positive ion density, and the other measured electron temperature. Each system used a two-element sensor consisting of an outer cylindrical guard electrode 10-cm long which was concentric with an inner collector electrode 0.056 cm in diameter and 23-cm long. The potentials of the electrodes were varied with respect to the satellite shell. The electron temperature probe was swept at a rate of 10 sweeps per second over two different voltage intervals, 0 to 0.75 V and 0 to 1.5 V. The ion density probe was swept from minus 3 to plus 2 V in 2 s. The currents to the collectors were measured and telemetered. The ion concentration and electron temperature could be determined from the current vs voltage information. The experiment operated normally from launch until July 10, 1963, when the spacecraft batteries failed. More details can be found in L. H. Brace et al., Planet. Space Sci., v. 13, n. 7, p. 647, 1965. NSSDC has all the useful data that exist from this investigation.

------- AE-A, NEWTON----------

INVESTIGATION NAME- PRESSURE GAUGE

NSSDC ID- 63-009A-03 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - G.P. NEWTON NASA HEADQUARTERS

BRIEF DESCRIPTION
Two Redhead (cold cathode) and two Bayard-Alpert (hot filament) ionization vacuum gauges were used to measure the neutral particle density and ambient pressure of the upper atmosphere between 260 km and 900 km. The pressure gauges were operated for 4-min periods when the satellite was within range of a ground telemetry station. The neutral particles were ionized by electron bombardment, and the resulting ion currents were detected and converted to voltages suitable for telemetry. These two types of sensors together were capable of measuring over the pressure range 10.E-4 torr (10.E12 molecules/cc) to 10.E-11 torr. One Bayard-Alpert gauge suffered a loss in sensitivity, and no useful data were obtained from it. The remaining three gauges operated normally. A more detailed description of the experiment can be found in G. P. Newton et al., Planet. Space Sci., v. 13, n. 7, p. 599, 1965. NSSDC has all the useful data that exist from this investigation.

------- AE-A, REBER----------

INVESTIGATION NAME- MASS SPECTROMETER

NSSDC ID- 63-009A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - C.A. REBER NASA-GSFC

BRIEF DESCRIPTION
Two identical double-focusing magnetic mass spectrometers were used to measure the concentrations of the major neutral particle constituents of the upper atmosphere, namely, atomic and molecular oxygen, atomic and molecular nitrogen, helium, and water vapor. These neutral particles were ionized by electron bombardment. Measurements of the six different ion currents and the total current 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 any dc drift of 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 output, and, consequently, the data were good only during certain periods. This degeneration was not a result of instrument malfunction but of an unexpected spacecraft 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 proceoures can be found in C. A. Reber et al., Planet. Space Sci., v. 13, n. 7, p. 617, 1965. NSSDC has all the useful data that exist from this investigation.

********** AE-B**********

SPACECRAFT COMMON NAME- AE-B
ALTERNATE NAMES- S 6A, ATMOSPHERE EXPLORER-B
EXPLORER 32, 02183

NSSDC ID- 66-044A

LAUNCH DATE- 05/25/66 WEIGHT- 225. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 05/25/66
ORBIT PERIOD- 116. MIN INCLINATION- 64.67 DEG
PERIAPSIS- 276. KM ALT APOAPSIS- 2725. KM ALT

PERSONNEL
PM - D.W. GRIMES(NLA) NASA-GSFC
PS - L.H. BRACE NASA-GSFC

BRIEF DESCRIPTION
Explorer 32 was an aeronomy satellite which was designed to directly measure temperatures, composition, densities, and pressures in the upper atmosphere on a global basis. The satellite was a stainless steel, vacuum-sealed sphere, 0.889 m in diameter. The experimental payload included one ion and two neutral mass spectrometers, three magnetron density gauges, and two electrostatic probes. Additional equipment included optical and magnetic aspect sensors, magnetic attitude and spin rate control systems, and a tape recorder for data acquisition at locations remote from ground receiving statiors. Power was supplied by silver-zinc batteries anc a solar cell array mounted on the satellite exterior. Two identical pulse-modulated telemetry systems and a canted turnstile 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.

------- AE-B, BRACE----------

INVESTIGATION NAME- ELECTRON TEMPERATURE AND DENSITY

NSSDC ID- 66-044A-05 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES
IONOSPHERES

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

BRIEF DESCRIPTION
The objective of this experiment was to measure the distribution of electron temperature and censities from 10.E3 to 10.E6 electrons/cc using a swept voltage electron probe. Geophysical data were published. The data base no longer exists.

------- AE-B, BRINTON----------

INVESTIGATION NAME- ION MASS SPECTROMETER

NSSDC ID- 66-044A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - H.C. BRINTON NASA HEADQUARTERS
OI - H.A. TAYLOR, JR. NASA-GSFC
OI - R.A. PICKETT(NLA) NASA-GSFC

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 and geomagnetic activity. The experiment operated nominally. The data were acquired in real time by 13 ground stations and over remote areas by use of a spacecraft tape recorder. The useful satellite lifetime of 10 months permitted a global study of the diurnal variation of the atmosphere during nearly two complete diurnal cycles, since the orbit plane precessed one revolution each 5.5 months. With the data obtained, several 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 similar in design to ion spectrometers flown on the Orbiting Geophysical Observatory (OGO) satellite series. The spectrometer sensor consisted of a 5-3 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 sweep voltage to cover the ion mass range 12 to 19, and 1 and 4 atomic mass units (u) assuring detection of the primary ionic constituents of the topside ionosphere. An experiment turn-on consisted of one complete mass scan in 208 s followed by recycling of the sweep voltage 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 voltage 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 about 10 to 1.E6 ions/cc. An automatic calibrator functioned once during each turn-on to supply two known signals to the amplifier system and to the sweep monitor. Amplifier characteristics were calculated from the response 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 orifice was aligned with the satellite velocity vector once each rotation. The spin rate was 29 plus or minus 1 rpm. Since the mass range was scanned slowly compared with the spin period, each peak in the ion spectrum was modulated at the spin frequency, with the ion current maxima occurring when the angle between the spectrometer axis and velocity vector was a minimum. NSSDC has all the useful data that exist from this investigation,

------- AE-B, NEWTON----------

INVESTIGATION NAME- PRESSURE GAUGES

NSSDC ID- 66-044A-04 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - G.P. NEWTON NASA HEADQUARTERS

BRIEF DESCRIPTION
Three cold-cathode magnetron type density gauges (Redhead ionization gauges), each with its own high voltage supply and output electrometer, were flown to measure the density of the neutral atmosphere as a function of altitude, time, latitude, and solar and geomagnetic activity. One gauge was designated as NRC-528 and the other two as GCA-R5 to reflect different origins. Mounted on the satellite equator was one gauge of each designation, with the third gauge mounted 55 deg above the equator. The metal-ceramic GCA-R5 gauges had an internal magnetic field of about 0.1 T and contained radioactive material deposited on the anode to permit operation at low atmospheric censities (less than 10.E-17 g/cc) with the anode potential fixed at 3500 V. The GCA-R5 equatorially mounted gauge had a linear range switchable electrometer output, and high-resolution current measurements were obtained. The remaining two gauge outputs were through logarithmic electrometers. All electrometers were calibrated once each turn-on. The time resolution of the measurements was 2 s, which was equal to the satellite spin period and corresponded to a spatial resolution of 16 km along the orbit path. Further details regarding the experiment operation can be found in G. P. Newton et al., "Direct in situ measurements of wave propagation in the neutral thermosphere," J. Geophys. Res., v. 74, n. 1, p. 183, 1969. Data from this investigation no longer exist. The geophysical results were published.

------- AE-B, REBER----------

INVESTIGATION NAME- NEUTRAL PARTICLE MAGNETIC MASS SPECTROMETER

NSSDC ID- 66-044A-02 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - C.A. REBER NASA-GSFC
OI - J.E. COOLEY NASA-GSFC

BRIEF DESCRIPTION
Two double-focusing magnetic mass spectrometers were used to measure the composition of the neutral atmosphere between 285 and 1000 km. One was mounted on the equator of the spherical satellite normal to the spin axis, and the other was mountec on the top of the satellite parallel to the spin axis. The neutral particles were ionized by electron bombardment and separated according to mass-to-charge ratio (M/Q) in the analyzer section of the instrument. There was one collector cup for each of seven different ion species. Ar electrometer amplifier, which had two sensitivity ranges differing by a factor of 100, sampled the seven collectors sequentially. The dwell time on a specific mass and sensitivity range was 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 electrometer and to recording the low- and high-sensitivity zero levels. The ion currents were then measurec in high sensitivity for M/Q equal to 2 (molecular hydrogen), 4 (helium), and 14 (atomic nitrogen) and in high and low sensitivity for M/Q equal to 28 (molecular nitrogen), 32 (molecular oxygen), 16 (atomic oxygen), and 18 (water vapor). The time for one complete cycle was 36 s. Real-time data were obtained in programmed 4-min turn-ons. The experiment was also operated for 4-min periods 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. NSSDC has all the useful data that exist from this investigation.

------- AE-B, WULF-MATHIES----------

INVESTIGATION NAME- SATELLITE DRAG ATMOSPHERIC DENSITY

NSSDC ID- 66-044A-03 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - C.H. WULF-MATHIES U OF TUBINGEN
OI - L.G. JACCHIA SAC

BRIEF DESCRIPTION
Because of its symmetrical shape, Explorer 32 was selected by the experimenters for use in determining upper atmospheric density as a function of altitude, latitude, season, and solar activity. This experiment was planned prior to launch. Density values near perigee were deduced from sequential observations of the spacecraft position, using optical (Baker-Nunn camera network) and radio and/or radar tracking techniques. This experiment resulted in the successful determination of reasonable density values.

********** AE-C**********

SPACECRAFT COMMON NAME- AE-C
ALTERNATE NAMES- S 6C, PL-721C
ATMOSPHERE EXPLORER-C, EXPLORER 51
6977

NSSDC ID- 73-101A

LAUNCH DATE- 12/16/73 WEIGHT- 658. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/16/73
ORBIT PERIOD- 132.3 MIN INCLINATION- 68.1 DEG
PERIAPSIS- 149.0 KM ALT APOAPSIS- 4294.0 KM ALT

PERSONNEL
PM - J.P. CORRIGAN NASA-GSFC
PM - D.W. GRIMES(NLA) NASA-GSFC
PS - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
The purpose of the AE-C mission was to investigate the thermosphere, with emphasis on the energy transfer and processes that govern its state. The study of photochemical processes accompanying the absorption of solar UV radiation in the earth's atmosphere was accomplished by making closely coordinated measurements of reacting constituents and the solar input. The AE-C spacecraft was a multi-sided polyhedron with a diameter of approximately 1.4 m. It weighed about 660 kg including 85 kg of instrumentation. The initial elliptical orbit was altered many times in the first year of life by means of an onboard propulsion system employing a 3.5-lb thruster. The purpose of these changes was to alter the perigee height to 129 km. After this period, the orbit was circularized and was raised periodically to about 390 km when it would decay to 250 km altitude. During the first year, the latitude of perigee moved from about 10 deg up to 68 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: spinning at a nominal 4 rpm or despun to 1 revolution per orbit. The spin axis was perpendicular to the orbit plane. Power was supplied by a solar cell array. The spacecraft used a PCM telemetry data system that operated in real time or in a tape recorder mode. The payload included instrumentation for the measurement of solar UV; the composition of positive ions and neutral particles; the density and temperature of neutral particles, positive ions and electrons; the measurement of airglow emissions, photoelectron energy spectra, and proton and electron fluxes up to 25 keV. More details can be found in A. Dalgarno et al., Radio Sci.,v. 8, n. 4, p. 263, 1973.

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

INVESTIGATION NAME- ULTRAVIOLET NITRIC-OXIDE (UVNO)

NSSDC ID- 73-101A-13 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - C.A. BARTH U OF COLORADO

BRIEF DESCRIPTION
This Ultraviolet Nitric-Oxide Experiment (UVNO) consisted of a two-channel fixed-grating Ebert-Fastie spectrometer which measured the airglow in the (1, 0) Gamma band in a 15-A region centered at 2149 A. The observed intensity was produced by resonance fluorescence of sunlight by the nitric-oxide molecules in the instrument's field of view. The intensity profiles obtained yielded altitude profiles of nitric-oxide density as a function of time and location. Profiles were 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 UVNO experiment permitted measurements of nitric-oxide to be made at altitudes both above and below satellite perigee. As the spacecraft spun, the spectrometer, which looked outward through the rim 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 some 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-A region centered at 2190 A. The two channels were optically and electrically independent. Nitric-oxide airglow intensity was determined by taking the difference between these two measurements. The sensor's spherical fused-quartz telescope mirror had a 125-mm focal length, and focused incident light on the entrance slit of the spectrometer. From this slit the light struck one half of the Ebert mirror and was collimated onto the grating. The 3600-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 4 deg X 1/4 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 ms and was read out alternately at 10.4-ms intervals. The instrument was protected against contamination from internal scattering of off-axis undispersed light. More experiment details can be found in C. A. Barth et al., Radio Sci., v. 8, n. 4, p. 379, 1973. NSSDC has all the useful data that exist from this investigation.

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

INVESTIGATION NAME- CYLINDRICAL ELECTROSTATIC PROBES (CEP)

NSSDC ID- 73-101A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - L.H. BRACE NASA-GSFC
OI - R.F. THEIS 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 (normally 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 automatic or fixed adjustment of collector voltage limits (anc/or electrometer output) such that the region of interest on the I-V profile provided high resolution. Each system was cesigned for use with only one of the probes, but they could be interswitched to provide backup redundancy. The best measurements in the most favorable modes provided 1-s time resolution; electron temperature between 300 and 1.0E4 deg K (10% accuracy); ion density between 1.0E4 and 1.0E7 ions/cc (10-20% accuracy); electron density between 50 and 1.0E6

electrons/cc; and ion mass at ion censities above 1.0E4 ions/cc. Each probe had a collector electrode extending from the central axis of a cylindrical guard ring. The 2.5-cm-long guard ring was at the end of a 25-cm boom, and the collector extended another 7.5 cm beyond the guard rirg. The boom, guard, and collector were 0.2 cm in diameter. More detailed information can be found in L. H. Brace et al., Radio Sci., v. 8, n. 4, p. 341, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-C, BRINTON----------

INVESTIGATION NAME- BENNETT ION-MASS SPECTROMETER (BIMS)

NSSDC ID- 73-101A-11

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL

PI - H.C.	BRINTON	NASA HEACQUARTERS
OI - L.R.	SCOTT(NLA)	NOAA-NESS
OI - M.W.	PHARO, III	NASA-GSFC
CI - H.A.	TAYLOR, JR.	NASA-GSFC

BRIEF DESCRIPTION

This experiment was flown to measure, throughout the AE-C orbit, the individual concentrations of all thermal ion species in the mass range of 1 to 72 atomic mass units (u), and in the ambient density range from 8.E1 to 5.E6 ions/cc. Any combination of the following three mass ranges, expressed in u, were selected by ground commanc: range A, -1 to 4, range B, -2 to 18, range C, -8 to 72. Each range was normally scanned in 1.7 s (approximately 12 km along orbit). Normal operation consisted in sequence ABCABC (1 to 72 u in 5.1 s). Laboratory and inflight determination of spectrometer efficiency and mass discrimination permitted direct conversion of measured ion currents to ambient concentrations. The experiment's four primary mechanical components were guarc ring and ion-analyzer tube, collector and preamplifier assembly, vent, and main electronics housing. The guard ring was normally at ground potential, but it could be placed at -6 V by command if desirable, e.g., if the spacecraft acquired a positive charge. A three-stage Bennett tube with 7 to 5 cycle drift spaces was flown and was modified to permit ion concentration measurements to be obtained at low altitudes. The frequency of the 30 V peak-tc-peak RF voltage varied with the mass range measured: range A, -10 MHz, range B, -5 MHz, and range C, -2.5 MHz. Primary analog instrument output was a compressed ion current spectrum which displayed the full dynamic range of the amplifier system on a single telemetry channel. Onboarc data processing provided a readout of primary experiment 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 sweep position, i.e., species identification. More complete details can be found in H. C. Brinton et al., Radio Sci., v. 8, n. 4, p. 323, 1973. NSSDC has all the useful data that exist from this investigatior.

------- AE-C, CHAMPION----------

INVESTIGATION NAME- ATMOSPHERIC DENSITY ACCELEROMETER (MESA)

NSSDC ID- 73-101A-02

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

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - K.S.W.	CHAMPION	USAF GEOPHYS LAB
OI - F.A.	MARCOS	USAF GEOPHYS LAB

BRIEF CESCRIPTION

The miniature electrostatic analyzer (MESA) obtained data on the neutral density of the atmosphere in the altitude range of 120 to 400 km from the measurements of satellite deceleration due to aerodynamic drag. The instrument consisted of three single-axis accelerometers, mounted mutually at right angles, two in the spacecraft X-Y plane and the other along the Z-axis. The instrument determined the applied acceleration from the electrostatic force required to recenter a proof mass. The output of the device was a digital pulse rate proportional to the applied acceleration. The measurements allowed determination of the density of the neutral atmosphere, monitored the thrust of the orbit-adjust propulsion system (OAPS), determined the satellite minimum altitude, measured spacecraft roll, and provided some attitude-sensing information. Spacecraft nutations of less than 0.01 deg were monitored. The instrument had three sensitivity ranges: 8.E-3 earth's gravity (G) in OAPS monitor moce; 4.E-4 G between 120 (plus or minus 2%) and 280 km (plus or minus 10%); and 2.E-5 G between 180 km (plus or minus 2%) and 400 km (plus or minus 10%). Numbers in parentheses represent errors; in addition, there may be a systematic error of up to plus or minus 5% due to drag coefficient uncertainty. The highest measurement altitude was determined assuming the instrument could sense to 0.2% of full scale. More details can be fourd in K. S. W. Champion et al., Radio Sci., v. 8, n. 4, p. 297, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-C, DOERING----------

INVESTIGATION NAME- PHOTOELECTRON SPECTROMETER (PES)

NSSDC ID- 73-101A-03

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - J.P.	DOERING	JOHNS HOPKINS U
OI - C.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 30 operating modes. Each spectrometer had a relative energy resolution of plus or minus 2.5% and a geometric factor on the order of 0.001 sq cm sr, independent of electron energy. Three separate energy ranges could be sensed: 0 to 25, 0 to 100, or 0 to 500 eV. Measurements from these intervals could be sequenced in five different ways. Data could be taken from either sensor separately, or alternately with time resolution varying from 0.25 to 8 s. There were two deflection voltage scan rates determined by spacecraft clock. This voltage was changed in 64 steps, and was done at 4 or 16 steps per telemetry frame. With 16 frames/s, this allowed a choice of either one 64-point spectrum, or four 16-point spectra in 1 s. The longest (8 s) cycle of data involved observations using increasing voltage steps for the lowest, middle, lowest, then highest energy ranges (in that order) for 1 s each. A repeat for decreasing voltage step completed the cycle. A more detailed description of this experiment may be found in J. P. Doering et al., Radio Sci., v. 8, n. 4, p. 387, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-C, HANSON----------

INVESTIGATION NAME- RETARDING POTENTIAL ANALYZER/DRIFT METER (RPA)

NSSDC ID- 73-101A-04

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - W.B.	HANSON	U OF TEXAS, DALLAS
OI - D.R.	ZUCCARO	U OF TEXAS, DALLAS
OI - S.	SANATANI	U OF TEXAS, DALLAS

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 ion concentration sensor. The experiment consisted of a retarding potential analyzer with four planar sensor heads. The sensor head used for ion drift measurements was co-located with another head, and all were spaced nearly equally, looking outward from 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 mode of the spacecraft. The primary objective of this experiment was to provide accurate ion temperatures with other measurements being of secondary importance. Three of 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 (32 or 22 to 0 V, up or down) was normally applied to the retarding grids in 0.75 s. Interpretation of the resulting current-voltage profiles provided the ion temperature, the ion and electron concentration, some ion composition information, vehicle potential and plasma drift velocity parallel 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 ion 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 grid at constant zero volts, current changes could be observed for 3-s periods to obtain gradients of ion concentration. Electron parameters were measured in a manner similar to ions. Ions in mass ranges 1 to 4, 14 to 16, 24 to 32 and greater than 40 atomic mass units could be identified. The fourth sensor head was for the ion-drift velocity measurements, and consisted of four grounded grids, a negatively biased suppressor grid, and a four-segment collector. Differences in various collector segment currents provided ion-drift directional component information. More details of this experiment are available in W. B. Hanson et al., Radio Sci., v. 8, n. 4, p. 333, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-C, HAYS----------

INVESTIGATION NAME- VISIBLE AIRGLOW PHOTOMETER (VAE)

NSSDC ID- 73-101A-14

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI -	P.B.	HAYS	U OF MICHIGAN
OI -	G.G.	SHEPHERD	YORK U

BRIEF DESCRIPTION

This experiment contained a filter photometer designed to measure various airglow anc auroral features ir the spectral range between 3000 and 7500 A. The primary information obtained from this experiment was the rates of excitation of the atomic and molecular constituents of the therrosphere. 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, 4278, 5200, 5577, 6300, ard 7319. The emissions were measured in pairs: 5577 and 6300, 7319 and calibration, 3371 and 5577, 5200 and 7319, 4278 and 3371, calibration and 5200, and 6300 and 4278. Two optical systems viewed at right angles to each other. Each one employed a combination of a simple objective lens and 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, dayglow above the satellite, and other weak emission features. The less sensitive system (desigrated channel 1) had a field of view of approximately 3/4 deg half-angle and was used for dayglow and nightglow horizon measurements, as well as discrete auroral features which showed strong spatial gradients. Both optical channels had a diameter of 2.2 cm. They shared a filter wheel that contained six interference filters at the wavelengths identified above, and two other positions. One was a dark position for noise measurements, and the other was a calibrate position. The dynamic range of the instrument was 1.E16 photons per s sq m (1.E6 rayleighs). 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 an electronic circuit to back-bias 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. 369, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-C, HEATH----------

INVESTIGATION NAME- EXTREME SOLAR UV MONITOR (ESUM)

NSSDC ID- 73-101A-05

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY
SOLAR PHYSICS

PERSONNEL

PI -	D.F.	HEATH	NASA-GSFC
OI -	J.F.	OSANTOWSKI	NASA-GSFC

BRIEF DESCRIPTION

The Extreme Solar Ultraviolet Monitor (ESUM) made absolute 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 windowless EUV photodiodes with aluminum oxide cathodes and a filter wheel containing two sets of unbacked metallic filters (aluminum, tin, indium) and an open position. A visible light diode measured the pinhole transmittance of the filters to determine the white light background. The tilt angle of the instrument relative to the +Z spacecraft axis was optimized for the maximum viewing time of the sun in both spinning and despun spacecraft modes. The instrument field of view was 60 deg. The nominal bandwidths (for 50% of signal) were 270 to 550 A, 570 to 584 A, 800 to 935 A, and 1216 A. More experiment details can be found in D. F. Heath 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-C, HINTEREGGER----------

INVESTIGATION NAME- SOLAR EUV SPECTROPHOTOMETER (EUVS)

NSSDC ID- 73-101A-06

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY
SOLAR PHYSICS

PERSONNEL

PI -	H.E.	HINTEREGGER	USAF GEOPHYS LAB
OI -	D.E.	BEDO	USAF GEOPHYS LAB
OI -	L.A.	HALL	USAF GEOPHYS LAB
OI -	C.W.	CHAGNON	USAF GEOPHYS LAB
OI -	J.E.	MANSON(RETIRED)	USAF GEOPHYS LAB

BRIEF DESCRIPTION

The Extreme Ultraviolet Spectrometer (EUVS) was used to observe the variations in the solar EUV flux in the wavelength range 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 grazing-incidence grating 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, 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 modes. More details can be found in H. E. Hinteregger et al., Radio Sci., v. 8, n. 4, p. 349, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-C, HOFFMAN----------

INVESTIGATION NAME- MAGNETIC ION-MASS SPECTROMETER (MIMS)

NSSDC ID- 73-101A-10

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI -	J.H.	HOFFMAN	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 (u). 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 mode. The electric and magnetic fields were arranged to produce a mass spectrum along the focal plane following the magnetic analyzer. Three slits were placed along the focal plane in appropriate places to simultaneously collect ions in the mass ratios 1 to 4 to 16. Ionospheric ions 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 90 u. Following each slit was an electron multiplier and a logarithmic electrometer-amplifier detector. The detector output 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 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 s. Other modes of operation were possible. In the analog short mode, the three mass ranges were swept in 4 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 locked mode 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. Hoffman et al., Radio Sci., v. 8, n. 4, p. 315, 1975. NSSDC has all the useful data that exist from this experiment.

------- AE-C, HOFFMAN----------

INVESTIGATION NAME- LOW-ENERGY ELECTRONS (LEE)

NSSDC ID- 73-101A-12

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI -	R.A.	HOFFMAN	NASA-GSFC
OI -	D.S.	EVANS	NOAA-ERL
OI -	J.L.	BURCH	SOUTHWEST RES 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 acquired differential measurements of the energy influx and 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 5 keV electrons continuously. Each detector consisted of a cylindrical electrostatic analyzer for species and energy selection, and a Spiraltron electron multiplier for particle detection. Energy distributions were obtained by applying different fixed or stepped voltages to the deflection plates. Distributions in angle were measured using the spacecraft spin and the analyzers' positions on the spacecraft. In the despun modes, measurements were obtained at 45 deg to the spacecraft equator, and radially away from the earth. Detector look angles were chosen to give optimum magnetic pitch-angle coverage 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 55.7 ms and read out each main telemetry frame (62.5 ms). The two stepped detectors moved one energy step once 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., v. 8, n. 4, p. 393, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-C, NIER----------

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

NSSDC ID- 73-101A-07

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - A.O.C.NIER		U OF MINNESOTA
OI - F.J.	HEYDEN	MANILA OBS
OI - K.	MAUERSBERGER	U OF MINNESOTA
OI - W.E.	POTTER	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 an impact ion source was flown. Two ion collectors were included to measure ions differing in mass by a factor of 8, i.e., the two mass ranges covered were 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 swept, in the common mode of operation peak stepping was employed, with readings on the principal peaks in the mass spectrum being repeated approximately every 0.5 s and on other species less frequently. Data below 380 km were measured using an electrometer. In addition to the peak stepping mode, there were several other operating modes which were selected by ground command. In the fly-through mode, the ion source voltages were adjusted so that there was no electric field to draw ions out of the electron beam when they were formed. 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 beam. Those ambient particles that did not strike the ion source retained their incoming energy of several eV after ionization and escaped into the accelerating region of the analyzer. The electron accelerating potential was 75 eV in normal mode operation and was 25 eV in the fly-through mode. In another operating mode, the instrument switched automatically to a sequence of masses of particular interest such as, e.g., between masses 16 and 32 or between masses 28 and 32. More details can be found in A. O. Nier et al., Radio Sci., v. 8, n. 4, p. 271, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-C, PELZ----------

INVESTIGATION NAME- CLOSED-SOURCE NEUTRAL MASS SPECTROMETER

NSSDC ID- 73-101A-08

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - D.T.	PELZ(NLA)	NASA-GSFC
OI - C.A.	REBER	NASA-GSFC
OI - G.R.	CARIGNAN	U OF MICHIGAN

BRIEF DESCRIPTION

This experiment measured in situ the spatial distribution and temporal changes of the concentrations of the neutral atmospheric species. In addition, new insight into in situ measurement techniques was obtained from comparisons of these measurements with those obtained from other on-board experiments: namely, open source spectrometer (73-101A-07), solar EUV spectrophotometer (73-101A-06), and density accelerometer (73-101A-02). The mass-spectrometer sensor had a gold-plated stainless steel thermalizing chamber and ion source, a hyperbolic-rod quadrupole analyzer, and an off-axis electron multiplier. Five different sequences of mass selections were available and, expressed in atomic mass units (u), were (a) geophysical -1, 2, 4, total, 16, 28, 32, selected, 40, (b) analytical -12, 14, 18, 20, 22, 30, 44, calibrate, zero, (c) individual -selected, selected, selected, ... (any mass 1 to 44), (d) sweep digital -1, 2, 3, 4, 5, ... 45 (in 3/16 u steps), (e) sweep analog -2, 3, 4, 5, ... 45 (continuous). Five operational formats were available and selected by ground command, and each one contained a different combination of the five mass selection sequences listed above. When operating in the "normal format," the analyzer measured all masses in the range 1 to 44 with emphasis on hydrogen, helium, oxygen, nitrogen, and argon. Another format was optimized for minor constituent studies of any individual gas species in the measured range. Spatial resolution was determined primarily by the mode of spacecraft operation. In orbit, the presealed spectrometer was opened, and the atmospheric constituents passed through a knife-edged orifice into the thermalization chamber and ion source. Selected ions left the quadrupole analyzer through a weak focusing lens and were accelerated into a 14-stage electron multiplier, where they were turned 90 deg to strike the first dynode. For each impacting ion, the multiplier output was a pulse of 2.E6 electrons. These output pulses constituted the measurement, and the count rate was proportional to the chamber density of the selected species. These density values were then converted to ambient concentrations. The analyzer normally operated at a resolution of 1 u over the mass range. Pulses occurring during 0.015-s integration intervals were accumulated in a 16-bit counter. Multiple integration periods (up to 16) were assigned to each measurement for less dense atmospheric species. Automatically selected ranges of ionizing electron currents were used. The overall dynamic range of the measurements was greater than 1.E7. More experiment details can be found in D. T. Pelz et al., Radio Sci., v. 8, n. 4, p. 277, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-C, SPENCER----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE TEMPERATURE (NATE)

NSSDC ID- 73-101A-09

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - N.W.	SPENCER	NASA-GSFC
OI - G.R.	CARIGNAN	U OF MICHIGAN

BRIEF DESCRIPTION

This experiment measured 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 spin cycle with a knowledge of the satellite's motion and orientation led to a determination of the ambient temperature, independent of scale height. A measurement of the ambient nitrogen density was also obtained. An alternate measurement of neutral temperature was also undertaken, using a baffle inserted in front of the orifice to intercept a portion of the gas particle stream entering the chamber. When the satellite was in the despun mode, the baffle was made to oscillate in the stepwise fashion to interrupt the particle stream seen by the orificed chamber. These chamber density variations were interpreted to yield the neutral gas kinetic temperature. A dual-filament ion source sampled the thermalized molecular nitrogen in the chamber and produced an ion beam density proportional to the nitrogen chamber density. From the source, this ionized nitrogen beam was directed from a quadrupole analyzer, tuned to pass those particles whose mass-to-charge ratio (M/Q) is 28, on to an electron multiplier. The output pulses were amplified and counted 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 values were determined by measurement of the "stream" position relative to the satellite velocity. When the spacecraft was in the despun mode, the nitrogen density was measured except when the particle stream was interrupted by the baffle. 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. NSSDC has all the useful data that exist from this investigation.

********** AE-D**********

SPACECRAFT COMMON NAME- AE-D
ALTERNATE NAMES- S 60, PL-723B
ATMOSPHERE EXPLORER-D, EXPLORER 54

NSSDC ID- 75-096A

LAUNCH DATE- 10/06/75 WEIGHT- 681. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 10/07/75
ORBIT PERIOD- 126.9 MIN INCLINATION- 90.1 DEG
PERIAPSIS- 154. KM ALT APOAPSIS- 3816. KM ALT

PERSONNEL
PM - D.W. GRIMES(NLA) NASA-GSFC
PS - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
The purpose of the AE-D mission was to continue the investigation begun by AE-C of the chemical processes and energy transfer mechanisms that control the structure and behavior of the earth's atmosphere and ionosphere in the region of high absorption of solar energy. This mission was planned to sample the high latitude regions at the same time that the AE-E mission was sampling the equatorial and low latitude regions. The same type of spacecraft as AE-C was used, and the payloac consisted of the same types of instruments except for deletion of the extreme solar UV monitor and the Bennett ion mass spectrometer, which were part of the AE-E payload. The polar orbit provided the sampling of all latitudes ard the perigee moved through all latitudes in 3 months and all local times in 4 months. Unfortunately, a failure in the solar power panels resulted in the termination of operations on January 29, 1976, after slightly less than 4 months of useful life. However, all the regions at the perigee altitudes were sampled during this time. The spacecraft re-entered the atmosphere about 1 month after cessation of telemetry. To continue the correlated observations with the AE-E mission, AE-C was reactivated on February 28, 1976, to replace AE-D. More details can be found in A. Dalgarno et al., Radio Sci., v. 8, n. 4, p. 263, 1973.

------- AE-D, BARTH----------

INVESTIGATION NAME- ULTRAVIOLET NITRIC-OXIDE EXPERIMENT

NSSDC ID- 75-096A-11 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - C.A. BARTH U OF COLORADO
OI - D.W. RUSCH U OF COLORADO
OI - A.I. STEWART U OF COLORADO

BRIEF DESCRIPTION
This Ultraviolet Nitric-Oxide Experiment (UVNO) consisted of a two-channel fixed-grating Ebert-Fastie spectrometer, which measured the airglow in the (1, 0) Gamma band in a 15-A region centered at 2149 A. The observed intensity was produced by resonance fluorescence of sunlight by the nitric-oxide molecules in the instrument's field of view. The intensity data obtained yielded altitude profiles of nitric-oxide density as a function of time and location. The remote sensing character of the UVNO experiment permitted measurements of nitric-oxide to be made at altitudes both above and below satellite perigee. As the spacecraft spun, the spectrometer, which looked outward through the rim 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 some altitude the measured signal at 2149 A was cortaminated by rayleigh-scattered sunlight. To correct for this contamination, a second channel measured only scattered light intensity in a 12-A region centered at 2190 A. The two channels were optically and electrically incependent. Nitric-oxide airglow intensity was determined by taking the difference between these two measurements. The sensor's spherical fused-quartz telescope mirror had a 125-mm focal length, and focused incident light on the entrance slit of the spectrometer. From this slit the light struck one-half of the mirror and was collimated onto the grating. The 3600-lines-per-mm grating returned the light collimated to the other half of the mirror, and the light was focused on two exit slits. The spectrometer field of view was 4 deg X 1/4 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 ms and read out alternately at 10.4-ms intervals. The instrument was protected against contamination from internal scattering of off-axis undispersed light. More experiment details can be found in C. A. Barth et al., Radio Sci., v. 8, n. 4, p. 379, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-D, BRACE----------

INVESTIGATION NAME- CYLINDRICAL ELECTROSTATIC PROBE (CEP)

NSSDC ID- 75-096A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

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

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 (normally 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 automatic or fixed adjustment of collector voltage limits (and/or electrometer output) 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 interswitched to provide backup redundancy. The best measurements in the most favorable modes provided one-second time resolution; electron temperature between 300 and 1.E4 deg K (10% accuracy); ion density between 1.E4 and 1.E7 ions/cc (10-20% accuracy); electron density between 50 and 1.E6 electrons/cc; and ion mass at ion densities above 1.E4 ions/cc. Each probe had a collector electrode extending from the central axis of a cylindrical guard ring. The 2.5-cm-long 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, guard, and collector were 0.2 cm in diameter. More detailed information can be found in L. H. Brace et al., Radio Sci., v. 8, n. 4, p. 341, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-D, CHAMPION----------

INVESTIGATION NAME- ATMOSPHERIC DENSITY ACCELEROMETER (MESA)

NSSDC ID- 75-096A-02 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - K.S.W.CHAMPION USAF GEOPHYS LAB
OI - F.A. MARCOS USAF GEOPHYS LAB

BRIEF DESCRIPTION
The Miniature Electrostatic Analyzer (MESA) obtained data on the neutral density of the atmosphere in the altitude range of 120 to 400 km by the measurements of satellite deceleration cue to aerocynamic drag. The instrument consisted of three single-axis accelerometers, mounted mutually at right angles, two in the spacecraft X-Y plane and the other in the Z-axis. The instrument determined the applied acceleration from the electrostatic force required to recenter a proof mass. The output of the device was a digital pulse rate proportional to the applied acceleration. The sample time of each measurement was 0.25 s. The measurements allowed determination of the density of the neutral atmosphere, monitored the thrust of the orbit-adjust propulsion system (OAPS), determined the satellite minimum altitude, measured spacecraft roll, and provided some attitude-sensing information. Spacecraft nutations of less than 0.01 deg were monitored. The instrument had three sensitivity ranges: 8.E-3 earth's gravity (G) in OAPS monitor mode; 4.E-4 G between 120 km (plus or minus 2%) and 280 km (plus or minus 10%); and 2.E-5 G between 180 km (plus or minus 2%) and 400 km (plus or minus 10%). Numbers in parentheses represent errors. A systematic error of up to plus or minus 5% due to drag coefficient uncertainty was also possible. The highest measurement altitude was determined assuming the instrument could sense to 0.2% of full scale. More details can be found in K. S. W. Champion et al., Radio Sci., v. 8, n. 4, p. 297, 1973. NSSDC has all the data that exist from this investigation.

------- AE-D, DOERING----------

INVESTIGATION NAME- PHOTOELECTRON SPECTROMETER (PES)

NSSDC ID- 75-096A-03 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - J.P.	DOERING	JOHNS HOPKINS U
OI - C.O.	BOSTROM	APPLIED PHYSICS LAB
OI - J.C.	ARMSTRONG(DECEASED)	APPLIED PHYSICS LAB

BRIEF DESCRIPTION

This experiment was designed to provide information on the intensity, angular distribution, energy spectrum, and net flows 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 it had 30 operating modes. Each spectrometer had a relative energy resolution plus or minus 2.5% and a geometric factor on the order of 0.001 sq cm sr, independent of electron energy. Three separate energy ranges could be sensed: 0 to 25, 0 to 100, or 0 to 500 eV. Measurements from these intervals could be sequenced in 5 different ways. Data could be taken from either sensor separately, or alternately with time resolution varying from 0.25 to 8 s. There were two deflection voltage scan rates determined by spacecraft clock. This voltage was changed in 64 steps, and was done at 4 or 16 steps per telemetry frame. With 16 frames/s, this allowed a choice of either one 64-point spectrum, or four 16-point spectra in 1 s. The longest (8 s) cycle of data involved observations using increasing voltage steps for the lowest, middle, lowest, then highest energy ranges (in that order) for 1 s each. A repeat for decreasing voltage steps completed the cycle. A more detailed description of this experiment may be found in J. P. Doering et al., Radio Sci., v. 8, n. 4, p. 387, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-D, HANSON----------

INVESTIGATION NAME- RETARDING POTENTIAL ANALYZER/DRIFT METER (RPA)

NSSDC ID- 75-096A-04

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - W.B.	HANSON	U OF TEXAS, DALLAS
OI - D.R.	ZUCCARO	U OF TEXAS, DALLAS
OI - S.	SANATANI	U OF TEXAS, DALLAS
OI - C.R.	LIPPENCOTT	U OF TEXAS, DALLAS

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 ion concentration sensor. The experiment consisted of a retarding potential analyzer with four planar sensor heads. The sensor head used for ion drift measurements was co-located with another head, and all heads were spaced almost equally, looking outward from 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 mode of the spacecraft. The primary purpose of this experiment was to provide accurate ion temperatures with other measurements being of secondary importance. Three of 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 (32 or 22 to 0 V, up or down) was normally applied to the retarding grids in 0.75 s. Interpretation of the resulting current-voltage profiles provided the ion temperature, the ion and electron concentration, some ion composition information, vehicle potential and plasma drift velocity parallel 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 ion 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 grid at constant zero volts, current changes could be observed for 3-s periods to obtain gradients of ion concentration. Electron parameters were measured in a manner similar to ions. Ions in mass ranges 1 to 4, 14 to 16, 24 to 32 and greater than 40 atomic mass units could be identified. The fourth sensor head was for the ion-drift velocity measurements, and consisted of four grounded grids, a negatively biased suppressor grid, and a 4-segment collector. Differences in various collector segment currents provided ion-drift directional component information. More details of this experiment are available in W. B. Hanson et al., Radio Sci., v. 8, n. 4, p. 333, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-D, HAYS----------

INVESTIGATION NAME- VISIBLE AIRGLOW PHOTOMETER (VAE)

NSSDC ID- 75-096A-13

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL

PI - P.B.	HAYS	U OF MICHIGAN
OI - G.G.	SHEPHERD	YORK U
OI - G.R.	CARIGNAN	U OF MICHIGAN
OI - J.C.G.	WALKER	U OF MICHIGAN

BRIEF DESCRIPTION

The visible airglow experiment provided volume emission rates for several dayglow, nightglow, and auroral optical emission features. A photometer containing two separate optical channels was used. Spectral selection was accomplished with a common filter wheel that contained six interference filters and a dark and calibrate position. The wavelengths measured in pairs (in Angstroms) were 7319 and 4861, 5200 and dark, 5577 and 7319, 4278 and 5200, 6300 and 5577, calibration and 4278, and 4861 and 6300. The two channels were separated in angle by 90 deg. One channel had a large field of view (3 deg half-angle) for high sensitivity, normally pointing toward the local zenith, and the second channel had a small field of view (0.75 deg half-angle) for high spatial resolution, pointing tangent to the surface of the earth when the satellite was in the despun mode. Both channels were protected from stray light contamination during daytime by multistage baffle systems. Photons that had been spectrally and spatially selected were sensed by a pulse-counting photomultiplier system capable of counting at a rate of 5.E6 counts/s. The filters could be operated in several modes, e.g., fixed filter, and automatic filter changes could be synchronized either to satellite orientation or to a fixed-time base. More experiment details can be found in P. B. Hays et al., Radio Sci., v. 8, n. 4, p. 369, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-D, HEDIN----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE COMPOSITION (NACE)

NSSDC ID- 75-096A-08

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - A.E.	HEDIN	NASA-GSFC
OI - C.A.	REBER	NASA-GSFC
OI - G.R.	CARIGNAN	U OF MICHIGAN

BRIEF DESCRIPTION

This experiment measured in situ the spatial distribution and temporal changes of the concentrations of the neutral atmospheric species. In addition, new insight into in situ measurement techniques was obtained from comparisons of these measurements with other onboard experiments: namely, open-source spectrometer (75-096A-07), solar EUV spectrophotometer (75-096A-06), and density accelerometer (75-096A-02). The mass-spectrometer sensor included a gold-plated stainless steel thermalizing chamber and ion source, a hyperbolic-rod quadrupole analyzer, and an off-axis electron multiplier. Five different sequences of mass selection were available and, expressed in atomic mass units (u), were as follows: (1) geophysical -1, 2, 4, total, 16, 28, 32, selected, 40, (2) analytical -12, 14, 18, 20, 22, 30, 44, calibrate, zero, (3) individual -selected, selected, selected, ... (any mass 1 to 44), (4) sweep digital -1, 2, 3, 4, 5, ... 45 (in 3/16-u steps), (5) sweep analog 2, 3, 4, 5, ... 45 (continuous). Five operational formats were available and selected by ground command. When operating in the "normal" format, the analyzer measured all masses in the range 1 to 44 with emphasis on hydrogen, helium, oxygen, nitrogen, and argon. Another format was optimized for minor constituent studies of any individual gas species in the measured range. Spatial resolution was determined primarily by the mode of spacecraft operation. In orbit, the presealed spectrometer was opened, and the atmospheric constituents passed through a knife-edged orifice into the thermalization chamber and ion source. Selected ions left the quadrupole analyzer through a weak focusing lens and were accelerated into a 14-stage electron multiplier, where they were turned 90 deg to strike the first dynode. For each impacting ion, the multiplier output was a pulse of 2.E6 electrons. These output pulses constituted the measurement and the count rate was proportional to the chamber density of the selected species. These density values were converted to ambient concentrations. The analyzer normally operated at a resolution of 1 u over the mass range, so that a mass peak one-thousandth the amplitude of an adjacent peak could be measured. For the dynamic range required, pulses occurring during 0.015-s integration intervals were accumulated in a 16-bit counter. Multiple integration periods (up to 16) were assigned to each measurement for less dense atmospheric species. Automatically selected ranges of ionizing electron currents were used. The overall range of the measurements was planned to be greater than 1.E7. There was a provision for the instrument orifice to be covered during spacecraft thruster operations. More experiment details can be found in D. T. Pelz et al., Radio Sci., v. 8, n. 4, p. 277, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-D, HINTEREGGER----------

INVESTIGATION NAME- SOLAR EUV SPECTROPHOTOMETER (EUVS)

NSSDC ID- 75-096A-06

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY
SOLAR PHYSICS

PERSONNEL

PI - H.E.	HINTEREGGER	USAF GEOPHYS LAB
OI - D.E.	BEDO	USAF GEOPHYS LAB
OI - L.A.	HALL	USAF GEOPHYS LAB
OI - C.W.	CHAGNON	USAF GEOPHYS LAB
OI - J.E.	MANSON(RETIRED)	USAF GEOPHYS LAB

BRIEF DESCRIPTION

The Extreme Ultraviolet Spectrometer (EUVS) was used to observe the variations in the solar EUV flux in the wavelength range 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 grazing-incidence grating 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 point 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 modes. More details can be found in H. E. Hinteregger et al., Radio Sci., v. 8, n. 4, p. 349, 1973.

------- AE-D, HOFFMAN----------

INVESTIGATION NAME- MAGNETIC ION-MASS SPECTROMETER (MIMS)

NSSDC ID- 75-096A-10

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - J.H.	HOFFMAN	U OF TEXAS, DALLAS
OI - E.E.	FERGUSON	NOAA-ERL
OI - W.B.	HANSON	U OF TEXAS, DALLAS
OI - C.R.	LIPPENCOTT	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 (u). Mounted on the satellite equator normal to the spin axis, the entrance aperture faced forward when the spacecraft was in the despun mode. The electric and magnetic 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 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 14 to 72 u. Following each slit was an electron multiplier and logarithmic electrometer-amplifier detector. The detector output was either measured directly for an analog output, or was supplied to a "peak" circuit that determined the amplitude of each peak in the spectrum. Only the amplitude of each peak was telemetered in the "peak" mode, and in this mode the time required to simultaneously sweep all three mass ranges was 1 s. Other modes of operation were possible. In the analog short mode, the three mass ranges were swept in 2 s, alternating with 1-s "peak" mode scans. An 8-s sweep time was required in the analog long mode, again alternating with 1-s "peak" mode scans. An option existed in the locked mode to continuously measure any set of mass numbers in the ratio 1-4-16 to give high spatial resolution. More experiment detail can be found in J. H. Hoffman et al., Radio Sci., v. 8, n. 4, p. 315, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-D, HOFFMAN----------

INVESTIGATION NAME- LOW-ENERGY ELECTRONS (LEE)

NSSDC ID- 75-096A-12

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - R.A.	HOFFMAN	NASA-GSFC
OI - D.S.	EVANS	NOAA-ERL
OI - J.L.	BURCH	SOUTHWEST RES INST

BRIEF DESCRIPTION

This experiment furnished direct measurements of the energy input into the upper atmosphere due to electrons and protons (ions) in the energy range 0.2 to 25 keV. The fluxes of electrons and ions were measured with cylindrical electrostatic analyzers and Spiraltron electron multipliers. There were 19 detectors, one ion stepped-energy analyzer, and two electron stepped analyzers mounted at different angles. In addition, there were 16 fixed energy detectors which obtained high-time-resolution angular distributions, in the spacecraft one revolution-per-orbit mode, at five energies between 0.72 and 18 keV. More details can be found in R. A. Hoffman et al., Radio Sci., v. 8, n. 4, p. 393, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-D, NIER----------

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

NSSDC ID- 75-096A-07

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - A.O.C.	NIER	U OF MINNESOTA
OI - W.E.	POTTER	U OF MINNESOTA
OI - K.	MAUERSBERGER	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 an impact ion source was flown. Two ion collectors were included to measure ions differing in mass by a factor of 8, i.e., the two mass ranges covered were 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 swept, in the common mode of operation peak stepping was employed, with readings on the principal peaks in the mass spectrum being repeated approximately every 0.5 s and on other species less frequently. Data below 380 km were measured using an electrometer. In addition to the peak-stepping mode, there were several other operating modes which were selected by ground command. In the fly-through mode, the ion source voltages were adjusted so that there was no electric field to draw ions out of the electron beam when they were formed. Ambient particles striking the ion source retained energies less than 0.1 eV, which is not high enough to overcome the negative space charge potential holding the ions in the beam. Those ambient particles that did not strike the ion source retained their incoming energy of several eV 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 masses of particular interest such as, e.g., between masses 16 and 32 or between masses 28 and 32. More experiment details can be found in A. O. Nier et al., Radio Sci., v. 8, n. 4, p. 271, 1973. NSSDC has all the useful data that exist from this investigation.

------- AE-D, SPENCER----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE TEMPERATURE (NATE)

NSSDC ID- 75-096A-09

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - N.W.	SPENCER	NASA-GSFC
OI - G.R.	CARIGNAN	U OF MICHIGAN
OI - H.B.	NIEMANN	NASA-GSFC

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-edge orifice. Analysis of the measured molecular nitrogen density variation over a spin cycle with a knowledge of the satellite's motion and orientation led to a determination of the ambient temperature, independent of scale height. The NATE also provided measurements of the neutral composition, when commanded into the appropriate mode. In addition, values for the zonal wind were obtained, from measurement of the "stream" position relative to the satellite velocity. An alternate measurement of neutral temperature also was undertaken, using a baffle inserted in front of the orifice to intercept a portion of the gas particle stream entering the chamber. When the satellite was in the despun mode, the baffle was made to oscillate in the stepwise fashion in order to interrupt the particle stream seen by the orificed chamber. These chamber density variations were interpreted to yield the neutral gas kinetic temperature also. A dual-filament ion source samoled the thermalized molecular nitrogen in the chamber and produced an ior beam density proportional to the nitrogen chamber density. From the source, the ionized beam was directed to a quadrupole analyzer, tuned to pass those particles whose mass-to-charge ratio (M/Q) was 28. 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 experimert details can be found in N. W. Spencer et al., Radio Sci., v. 8, n. 4, p. 287, 1973. NSSDC has all the useful data that exist from this investigation.

********** AE-E**********

SPACECRAFT COMMON NAME- AE-E
ALTERNATE NAMES- S 6E, ATMOSPHERE EXPLORER-E
EXPLORER 55, AE 5

NSSDC ID- 75-107A

LAUNCH DATE- 11/20/75 WEIGHT- 735. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 11/25/75
ORBIT PERIOD- 117.29 MIN INCLINATION- 19.7 DEG
PERIAPSIS- 156. KM ALT APOAPSIS- 2983. KM ALT

PERSONNEL
PM - J.P. CORRIGAN NASA-GSFC
PM - D.W. GRIMES(NLA) NASA-GSFC
PS - N.W. SPENCER NASA-GSFC

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 and ionosphere in the region of high absorption of solar energy at low and equatorial latitudes. The simultaneous sampling at higher latitudes was carried out by the AE-D spacecraft until its failure on January 29, 1976, and then by AE-C, until it reentered on December 12, 1978. The same type of spacecraft as AE-C was used, and the payload consisted of the same types of instruments except that the low-energy electron and UV nitric oxide experiments were deleted and a backscatter UV spectrometer was added to monitor the ozone content of the atmosphere. The two experiments that were deleted were more appropriate for the high-latitude regions. The perigee swept through more than six 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 between 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-E reentered on June 10, 1981. More details can be found in A. Dalgarno et al., Radio Sci., v. 8, n. 4, p. 263, 1973.

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

INVESTIGATION NAME- CYLINDRICAL ELECTROSTATIC PROBE (CEP)

NSSDC ID- 75-107A-01
INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

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

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 (usually 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 automatic or fixed adjustment of collector voltage limits (anc/or electrometer output) 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 interswitched to provide backup redundancy. The best measurements in the most favorable modes provided 1-s time resolution; electron temperature between 300 and 1.E4 deg K (10% accuracy); ion density between 1.E4 and 1.E7 ions/cc (10-20% accuracy); electron density between 50 and 1.E6 electrons/cc; and ion mass at ion densities above 1.E4. Each probe had a collector electrode extending from the central axis of a cylindrical guard ring. The 2.5-cm-long 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, guard, and collector were 0.2 cm in diameter. More detailed information can be found in L. H. Brace et al., Radio Sci., v. 8, n. 4, p. 341, 1973.

------- AE-E, BRINTON----------

INVESTIGATION NAME- BENNETT ION-MASS SPECTROMETER (BIMS)

NSSDC ID- 75-107A-10
INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - H.C. BRINTON NASA HEADQUARTERS
OI - M.W. PHARO, III NASA-GSFC
OI - H.A. TAYLOR, JR. NASA-GSFC

BRIEF DESCRIPTION
This experiment was flown to measure, throughout the orbit, the incividual concentrations of all thermal ion species in the mass range 1 to 72 atomic mass units (u) and in the ambient density range from 5 to 5.E6 ions/cc. The mass range was normally scanned in 1.7 s, but the scan time per range could be increased by command. Laboratory and inflight determination of spectrometer efficiency and mass discrimination permitted direct conversion of measured ion currents to ambient concentrations. Correlation of these measured data with the results from companion experiments, CEP (75-107A-01) and RPA (75-107A-04) permitted individual ion concentrations to be determined with high accuracy. The experiment's four primary mechanical components were guard ring and ion-analyzer tube, collector and preamplifier assembly, vent, and mair electronics housing. A three-stage Bennett tube with 7- to 5-cycle drift spaces was flown; it was modified to permit ion concentration measurements to be obtained at low altitudes. The balance between ion-current sensitivity and mass resolution in a Bennett spectrometer may be altered by changing appropriate voltages. These voltage changes were controlled irdependently by ground command for each one of the three mass ranges: 1 to 4, 2 to 18, and 8 to 72. More complete experiment details can be found in H. C. Brinton et al., Radio Sci., v. 8, n. 4, p. 369, 1973.

------- AE-E, CHAMPION----------

INVESTIGATION NAME- ATMOSPHERIC DENSITY ACCELEROMETER (MESA)

NSSDC ID- 75-107A-02
INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - K.S.W.CHAMPION USAF GEOPHYS LAB
OI - F.A. MARCOS USAF GEOPHYS LAB

BRIEF DESCRIPTION
The Miniature Electrostatic Analyzer (MESA) obtained data on the neutral density of the atmosphere in the altitude range of 120 to 400 km, by the measurements of satellite deceleration due to aerocynamic drag, which is directly proportional to atmospheric density. The instrument consisted of three single-axis accelerometers, mounted mutually at right angles, two in the spacecraft X-Y plane and the other along the Z-axis. The instrurert determined the applied acceleration from the electrostatic force required to recenter a proof mass. The output of the device was a digital pulse rate proportional to the applied acceleration. The sample time of each instrument was 0.25 s. The measurements allowed determination of the density of the neutral atmosphere, monitored the thrust of the Orbit-Adjust Propulsion System (OAPS), determined the satellite minimum altitude, measured spacecraft roll, and provided some attitude-sensing information. Spacecraft nutations of less

than 0.01 deg were monitored. The instrument had three sensitivity ranges: 8.E-3 earth's gravity (G) in OAPS monitor mode; 4.E-4 G between 120 km (plus or minus 2%) and 280 km (plus or minus 10%); and 2.E-5 G between 180 km (plus or minus 2%) and 400 km (plus or minus 10%). Numbers in parentheses represent errors. There may be a systematic error of up to plus or minus 5% due to drag coefficient uncertainty. The highest measurement altitude was determined assuming the instrument could sense to 0.2% of full scale. More details can be found in K. S. Champion et al., Radio Sci., v. 8, n. 4, p. 297, 1973.

------- AE-E, DOERING----------

INVESTIGATION NAME- PHOTOELECTRON SPECTROMETER (PES)

NSSDC ID- 75-107A-03

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - J.P.	DOERING	JOHNS HOPKINS U
OI - C.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 30 operating modes. Each spectrometer had a relative energy resolution of plus or minus 2.5% and a geometric factor on the order of 0.001 sq cm-sr, independent of electron energy. Three separate energy ranges could be measured: 0 to 25, 0 to 100, and 0 to 500 eV. Measurements from these intervals could be sequenced in five different ways. Data could be taken from either sensor separately, or alternately with time resolution varying from 0.25 to 8 s. There were two deflection voltage scan rates determined by the spacecraft clock. This voltage was changed in 64 steps, and was done at 4 or 16 steps per telemetry frame. With 16 frames/s, this allowed a choice of either one 64-point spectrum, or four 16-point spectra in one second. The longest (8 s) cycle of data involved observations using increasing voltage steps for the lowest, middle, lowest, then highest energy ranges (in that order) for 1 s each. A repeat for decreasing voltage steps completed the cycle. A more detailed description of this experiment is found in J. P. Doering et al., Radio Sci., v. 8, n. 4, p. 387, 1973.

------- AE-E, HANSON----------

INVESTIGATION NAME- RETARDING POTENTIAL ANALYZER/DRIFT METER (RPA)

NSSDC ID- 75-107A-04

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL

PI - W.B.	HANSON	U OF TEXAS, DALLAS
OI - D.R.	ZUCCARO	U OF TEXAS, DALLAS
OI - S.	SANATANI	U OF TEXAS, DALLAS
OI - C.R.	LIPPENCOTT	U OF TEXAS, DALLAS

BRIEF DESCRIPTION

This experiment was designed to determine vector ion drift velocities, ion concentration and temperature, total ion concentration roughness, 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 mode of the spacecraft. Three of 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 (32 or 22 to 0 V, up or down) was normally applied to the retarding grids in 0.75 s. Interpretation of the resulting current-voltage profiles provided the ion temperature, the ion and electron concentration, some ion composition information, and vehicle potential and plasma drift velocity parallel to the velocity vector. With the retarding grid at constant zero volts, current changes could be observed for 3-s periods to obtain gradients of ion concentration. Electron parameters were measured in a manner similar to ions. Ions in mass ranges 1 to 4, 14 to 16, 24 to 32 and greater than 40 atomic mass units could be identified. The fourth sensor head was for the ion-drift velocity measurements, and consisted of four grounded grids, a negatively biased suppressor grid, and a four-segment collector. Differences in the collector segments' currents provided ion-drift directional component information. More details of this experiment are available in W. B. Hanson et al., Radio Sci., v. 8, n. 4, p. 333, 1973.

------- AE-E, HAYS----------

INVESTIGATION NAME- VISIBLE AIRGLOW PHOTOMETER (VAE)

NSSDC ID- 75-107A-11

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL

PI - P.B.	HAYS	U OF MICHIGAN
OI - G.G.	SHEPHERD	YORK U
OI - G.R.	CARIGNAN	U OF MICHIGAN
OI - J.C.G.	WALKER	U OF MICHIGAN

BRIEF DESCRIPTION

This experiment provided detailed data on the rates of excitation of the atomic and molecular constituents of the thermosphere. The wavelength range, expressed in Angstroms, was measured in pairs: 7319 and 6563, 5300 and dark, 5577 and 7319, 2800 and 5200, 6300 and 5577, calibrate and 2800, and 6563 and 6300. A photometer was used which contained two separate optical channels, a narrow field of view and a wide field of view. Spectral selection was accomplished with a filter wheel that contained six interference filters and a dark and calibrate position. The two channels were separated by 90 deg. One channel had a 3-deg half-angle cone field of view for high sensitivity and pointed normally toward the local zenith. The second had a field of view of 0.75-deg half cone for high spatial resolution, pointing tangentially to the surface of the earth when the satellite was in the oriented mode. Both channels were protected from stray light contamination during the daytime with multistage baffle systems. Filters were operated in several modes. The two separate optical channels were monitored at time intervals consistent with their angular resolution in the spinning mode. More experiment details can be found in P. B. Hays et al., Radio Sci., v. 8, n. 4, p. 369, 1973.

------- AE-E, HEATH----------

INVESTIGATION NAME- EXTREME SOLAR UV MONITOR (ESUM)

NSSDC ID- 75-107A-05

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS
AERONOMY
IONOSPHERES

PERSONNEL

PI - D.F.	HEATH	NASA-GSFC
OI - J.F.	OSANTOWSKI	NASA-GSFC

BRIEF DESCRIPTION

The Extreme Solar Ultraviolet Monitor (ESUM) experiment made absolute 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. The instrument consisted of two identical windowless EUV photodiodes with aluminum oxide cathodes and a filter wheel containing two sets of unbacked metallic filters (aluminum, tin, indium) and an open position. A visible light diode measured the pinhole transmittance of the filters to determine the white light background. The tilt angle of the instrument relative to the +Z spacecraft axis was optimized for the maximum viewing time of the sun in both spinning and despun spacecraft modes. The instrument field of view was 60 deg. The nominal bandwidths in Angstroms for 50% of the signal were 270 to 550, 570 to 584, 800 to 935, and 1216 A. More experiment details can be found in D. F. Heath and J. F. Osantowski, Radio Sci., v. 8, n. 4, p. 361, 1973.

------- AE-E, HEATH----------

INVESTIGATION NAME- BACKSCATTER UV SPECTROMETER (BUV)

NSSDC ID- 75-107A-16

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
METEOROLOGY

PERSONNEL

PI - D.F.	HEATH	NASA-GSFC

BRIEF DESCRIPTION

The backscatter ultraviolet instrument (BUV) monitored the spatial distribution of atmospheric ozone by measuring the intensity of the UV radiation backscattered from the earth's atmosphere. To obtain this ozone distribution, the BUV subsystem measured direct solar radiation and backscattered UV radiation from the daytime sun-illuminated atmosphere. The instrument consisted of a spectrometer (monochromator) and a photometer. The monochromator measured the intensity of UV radiation backscatter and reflected radiation from the earth's atmosphere in 12 wavelengths (2555 to 3398 A) in which ozone attenuation occurs. The photometer measured the reflected UV radiation in a single wavelength span in which attenuation by ozone does not occur. The BUV had four operating modes.

------- AE-E, HEDIN----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE COMPOSITION (NACE)

NSSDC ID- 75-107A-08

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - A.E.	HEDIN	NASA-GSFC
OI - C.A.	REBER	NASA-GSFC
OI - G.R.	CARIGNAN	U OF MICHIGAN

BRIEF DESCRIPTION

This experiment measured in situ the spatial distribution and temporal changes of the concentrations of the neutral atmospheric species. In addition, new insight into in situ measurement techniques was obtained from comparisons of these measurements with those obtained from other onboard experiments; namely, open source spectrometer (75-107A-07), solar EUV spectrometer (75-107A-06), and atmospheric density accelerometer (75-107A-02). The mass-spectrometer sensor had a gold-plated stainless steel thermalizing chamber and ion source, a hyperbolic rod quadrupole analyzer, and an off-axis electron multiplier. When operating in the "normal" format, the analyzer measured all masses in the range 1 to 44 atomic mass units with emphasis on hydrogen, helium, oxygen, nitrogen, and argon. Another format was optimized for minor constituent studies of gas species in the measured range. Spatial resolution was determined primarily by the mode of spacecraft operation. In orbit, the presealed spectrometer was opened, and the atmospheric constituents passed through a knife-edged orifice into the thermalization chamber and ion source. Selected ions left the quadrupole analyzer through a weak focusing lens and were accelerated into an electron multiplier, where they were turned 90 deg to strike the first dynode. The spectrometer had a resolution of better than 1 u for all masses between 1 and 44, and the measurement system had a planned dynamic range of approximately 1.E8. There was provision for the instrument orifice to be covered during spacecraft thruster operations. More experiment details can be found in D. T. Pelz et al., Radio Sci., v. 8, n. 4, p. 277, 1973.

------- AE-E, HINTEREGGER----------

INVESTIGATION NAME- SOLAR EUV SPECTROPHOTOMETER (EUVS)

NSSDC ID- 75-107A-06

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

INVESTIGATION DISCIPLINE(S)
AERONOMY
SOLAR PHYSICS
IONOSPHERES

PERSONNEL

PI - H.E.	HINTEREGGER	USAF GEOPHYS LAB
OI - D.E.	BEDO	USAF GEOPHYS LAB
OI - L.A.	HALL	USAF GEOPHYS LAB
OI - J.E.	MANSON(RETIRED)	USAF GEOPHYS LAB
OI - C.W.	CHAGNON	USAF GEOPHYS LAB

BRIEF DESCRIPTION

The Extreme Ultraviolet Spectrometer (EUVS) was used to observe the variations in the solar EUV flux in the wavelength range 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 grazing-incidence grating 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 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, 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 modes. More details can be found in H. E. Hinteregger et al., Radio Sci., v. 8, n. 4, p. 349, 1973.

------- AE-E, NIER----------

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

NSSDC ID- 75-107A-07

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - A.O.C.	NIER	U OF MINNESOTA
OI - W.E.	POTTER	U OF MINNESOTA
OI - K.	MAUERSBERGER	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 an impact ion source was flown. Two ion collectors were included to measure ions differing in mass by a factor of 8; i.e., 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; 75 eV for the high-eV mode and 25 eV for the low-eV mode. At altitudes greater than 380 km, ion currents were measured with an electron multiplier. Counts were accumulated for 1/20 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; readings on principal peaks in the mass spectrum were repeated approximately every 0.5 s and on other species less frequently. Data below 380 km were measured using an electrometer. In addition to the peak stepping mode, there were several other operating modes which were selected by ground command. In the fly-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 beam. Those ambient 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. More experiment details can be found in A. O. Nier et al., Radio Sci., v. 8, n. 4, p. 271, 1973.

------- AE-E, SPENCER----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE TEMPERATURE (NATE)

NSSDC ID- 75-107A-09

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - N.W.	SPENCER	NASA-GSFC
OI - G.R.	CARIGNAN	U OF MICHIGAN
OI - H.B.	NIEMANN	NASA-GSFC

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 spin cycle with a knowledge of the satellite's motion and orientation led to a determination of the ambient temperature, independent of scale height. Measurements of the ambient neutral composition were obtained when the instrument was commanded into the appropriate mode. Approximate values for the meridional wind were obtained from the measurement of the "stream" position relative to the satellite velocity. An alternate measurement of neutral temperature was also undertaken, using a baffle inserted in front of the orifice to intercept a portion of the gas particle stream entering the chamber. When the satellite was in the despun mode, the baffle was made to oscillate in a stepwise fashion in order to interrupt the particle stream seen by the orificed chamber. These chamber density variations were interpreted to yield the neutral gas kinetic temperature too. A dual-filament ion source sampled the thermalized molecular nitrogen in the chamber and produced an ion beam density proportional to the nitrogen chamber density. From the source, this ionized nitrogen beam was directed into a quadrupole analyzer, tuned to pass those particles with a mass-to-charge ratio of 28. The beam then struck an electron multiplier, and the output pulses were amplified and counted. 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.

********** AEROS**********

SPACECRAFT COMMON NAME- AEROS
ALTERNATE NAMES- GRS-A2, 625-A2
PL-722A, 06315

NSSDC ID- 72-100A

LAUNCH DATE- 12/16/72 WEIGHT- 125. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
FED REP OF GERMANY BMBW
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/18/72
ORBIT PERIOD- 95.6 MIN INCLINATION- 96.9 DEG
PERIAPSIS- 223.0 KM ALT APOAPSIS- 867.0 KM ALT

PERSONNEL
PM - H. SCHREIBER, JR. DFVLR
PM - C.L. WAGNER, JR. NASA-GSFC
PS - P. LAEMMERZAHL MPI-NUCLEAR PHYS
PS - S.J. BAUER(NLA) NASA-GSFC

BRIEF DESCRIPTION
The AEROS satellite had a circular cylirdrical shape, 0.914 m in diameter and 0.710 m in height. It was launched into an elliptical, polar, nearly sun-synchronous earth orbit. 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 state and behavior of the upper atmosphere and ionospheric F region, especially with regard to the influence of solar ultraviolet radiation. Five experiments provided data on the temperature and density of electrons, ions, and neutral particles, the composition of ions and neutral particles, and solar ultraviolet flux.

------- AEROS, SCHMIDTKE----------

INVESTIGATION NAME- SOLAR EUV RADIATION

NSSDC ID- 72-100A-04 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY
SOLAR PHYSICS

PERSONNEL
PI - G. SCHMIDTKE INST FUR PHYS WELTRAUM
OI - W. SCHWEIZER INST FUR PHYS WELTRAUM

BRIEF DESCRIPTION
This experiment consisted of a grating spectrometer, a solar collimator, and a photomultiplier. It operated in 2 channels, 150 to 510 A, and 300 to 1070 A, and was used to measure the flux and spectral distribution of the solar EUV radiation and its temporal and spatial variations. An onboard calibration device was included. A cescription of the instrument can be found in G. Schmidtke et al., J. Geophys., v. 40, n. 5, p. 577, 1974. NSSDC has all the useful data that exist from this investigation.

------- AEROS, SPENCER----------

INVESTIGATION NAME- NEUTRAL GAS TEMPERATURE IN THE THERMOSPHERE

NSSDC ID- 72-100A-05 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - N.W. SPENCER NASA-GSFC
OI - D.T. PELZ(NLA) NASA-GSFC
OI - G.P. NEWTON NASA HEADQUARTERS
OI - G.R. CARIGNAN U OF MICHIGAN
OI - H.B. NIEMANN NASA-GSFC

BRIEF DESCRIPTION
This experiment, which was designed primarily to make in situ measurements of temperature, also functioned in an alternate mode as a neutral mass spectrometer to measure argon, atomic oxygen, nitrogen, and helium densities. Mounted at the satellite periphery was a spherical antechamber with a knife-edged orifice facing normal to the spin axis. This chamber, sealed under vacuum before launch, was opened to the atmosphere on command when the spacecraft was in orbit. The incoming atmospheric species underwent collisions with the chamber walls, and some of this thermalized gas entered a small dual-filament ion source that produced an ion beam proportional to the chamber density. The beam was directed into a quadrupole analyzer, that transmitted selectec ions to an electron multiplier where individual ions at the input were converted to pulses of electrons, which were counted at the multiplier output. These output pulses were amplified and sent to a data processor that provided digital output signals to the telemetry system. Because of a difficulty in the timing system of the spacecraft, proper synchronization of the data frame with the spin position was not achieved--a requirement essential for the analysis of the data in the temperature mode. The instrument performed well as a mass spectrometer throughout the lifetime of the spacecraft, and good quality nitrogen, oxygen, and helium data were obtained from perigee to an altitude of about 550 km. For argon, the signal-to-noise ratio decreased rapidly above 350 km, and useful data were obtained only up to that altitude. NSSDC has all the useful data that exist from this investigation.

------- AEROS, SPENNER----------

INVESTIGATION NAME- ENERGY DISTRIBUTION OF IONS AND ELECTRONS

NSSDC ID- 72-100A-02 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL
PI - K. SPENNER INST FUR PHYS WELTRAUM
OI - A. DUMBS INST FUR PHYS WELTRAUM

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 instrumert was essentially a collector shielded by plane parallel grids. Spectra of the ionospheric-charged particles were obtainec by sweeping the retarding voltage of the grid. The particles would pass through the grid and reach the collector only if their kinetic energy exceeded the retarding potential. NSSDC has almost all the useful data that exist from this investigation.

********** AEROS 2**********

SPACECRAFT COMMON NAME- AEROS 2
ALTERNATE NAMES- AEROS-B

NSSDC ID- 74-055A

LAUNCH DATE- 07/16/74 WEIGHT- 125. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
FED REP OF GERMANY GFW
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 07/17/74
ORBIT PERIOD- 95.7 MIN INCLINATION- 97.4 DEG
PERIAPSIS- 217. KM ALT APOAPSIS- 879. KM ALT

PERSONNEL
PM - C.L. WAGNER, JR. NASA-GSFC
PM - N. KIEHNE GES FUR WELTRAUMFORSCH
PS - P. LAEMMERZAHL MPI-NUCLEAR PHYS
PS - S.J. BAUER(NLA) NASA-GSFC

BRIEF DESCRIPTION
The AEROS 2 satellite had a cylindrical shape, a diameter of 0.914 m, and a height of 0.710 m. It was launched into an elliptical, polar, nearly sun-synchronous earth orbit. 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 state and behavior of the upper atmosphere and ionospheric F region, especially with regard to the influence of the solar ultraviolet radiation. Five experiments provided data which included the temperature and density of electrons, ions, and neutral particles, the composition of ions and neutral particles, and solar ultraviolet flux.

------- AEROS 2, SCHMIDTKE----------

INVESTIGATION NAME- SOLAR EUV RADIATION

NSSDC ID- 74-055A-04 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS
AERONOMY
IONOSPHERES

PERSONNEL
PI - G. SCHMIDTKE INST FUR PHYS WELTRAUM
OI - W. SCHWEIZER INST FUR PHYS WELTRAUM

BRIEF DESCRIPTION
This experiment consisted of a grating spectrometer, a solar collimator, and a photomultiplier. It operated in two channels, 150 to 510 A and 300 to 1070 A, and measured the flux and spectral distribution of the solar EUV radiation and its temporal and spatial variations. An onboard calibration device was included. A description of the instrument can be found in G. Schmidtke et al., J. Geophys., v. 40, n. 5, p. 577, 1974. NSSDC has all the useful data that exist from this investigation.

------- AEROS 2, SPENCER----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE TEMPERATURE

NSSDC ID- 74-055A-05 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - N.W.	SPENCER	NASA-GSFC
OI - D.T.	PELZ(NLA)	NASA-GSFC
OI - G.P.	NEWTON	NASA HEADQUARTERS
OI - G.R.	CARIGNAN	U OF MICHIGAN
CI - H.B.	NIEMANN	NASA-GSFC

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 conductance path to a spherical stainless steel antechamber, 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 antechamber. 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 electronics system included a pulse counter, data processor, power supplies, and logic. Because of the failure of the onboard tape recorder only 3 weeks of useful data were obtained. The limited data analyzed for AEROS 2 is published in S. Chandra et al., Geophys. Res. Lett., v. 3, n. 12, p. 718, 1976, and in S. Chandra et al., J. Geophys. Res., v. 84, n. A5, p. 1891, 1979.

------- AEROS 2, SPENNER----------

INVESTIGATION NAME- ENERGY DISTRIBUTION OF IONS AND ELECTRONS

NSSDC ID- 74-055A-02 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - K.	SPENNER	INST FUR PHYS WELTRAUM
OI - A.	DUMBS	INST FUR PHYS WELTRAUM

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 plane grids. By sweeping the retarding voltage of the grid, the energy spectra of the ionospheric charged particles were obtained. The particles only passed through the grid and reached the collector if their kinetic energy exceeded the retarding potential.

********** ALOUETTE 1**********

SPACECRAFT COMMON NAME- ALOUETTE 1
ALTERNATE NAMES- 1962 BETA ALPHA 1, S 27
ALOUETTE-A, 00424
S 27A

NSSDC ID- 62-049A

LAUNCH DATE- 09/29/62 WEIGHT- 145.7 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY

CANADA	DRB-DRTE
UNITED STATES	NASA-OSSA

INITIAL ORBIT PARAMETERS

ORBIT TYPE- GEOCENTRIC	EPOCH DATE- 10/17/62
ORBIT PERIOD- 105.5 MIN	INCLINATION- 80.5 DEG
PERIAPSIS- 996. KM ALT	APOAPSIS- 1032. KM ALT

PERSONNEL

PM - J.E.	JACKSON	NASA-GSFC
PM - R.K.	BROWN(NLA)	DRB-DRTE
PS - J.E.	JACKSON	NASA-GSFC
PS - E.S.	WARREN(DECEASED)	DRB-DRTE

BRIEF DESCRIPTION
Alouette 1 was a small ionospheric observatory instrumented with an ionospheric sounder, a VLF receiver, an energetic particle detector, and a cosmic noise experiment. Extended from the satellite shell were two dipole antennas (45.7- and 22.8-m long, respectively) which were shared by three of the experiments on the spacecraft. The satellite was spin-stabilized at about 1.4 rpm after antenna extension. After about 500 days, the spin slowed more than had been expected, to about 0.6 rpm when satellite spin-stabilization failed. It is believed that the satellite gradually progressed toward a gravity gradient stabilization with the longer antenna pointing earthward. Attitude information was deduced only from a single magnetometer and temperature measurements on the upper and lower heat shields. (Attitude determination could have been in error by as much as 10 deg.) There was no tape recorder, so data were available only from the vicinity of telemetry stations. Telemetry stations were located to provide primary data coverage near the 80 deg W meridian and in areas near Hawaii, Singapore, Australia, Europe, and Central Africa. Initially, data were recorded for about 6 h per day. In September 1972, spacecraft operations were terminated.

------- ALOUETTE 1, BELROSE----------

INVESTIGATION NAME- VLF RECEIVER

NSSDC ID- 62-049A-03 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)

IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - J.S.	BELROSE	DOC-CRC
OI - F.H.	PALMER	DEFENCE RESEARCH ESTAB
OI - H.G.	JAMES	DOC-CRC

BRIEF DESCRIPTION
The purpose of the VLF experiment was to investigate the propagation characteristics of natural and manmade VLF signals. This experiment was a wideband high-gain receiver with a passband from 0.4 to 10 kHz using only the longest (45.7 m) sounder antenna. The receiver output, which sensed the electric field component of the signal strength, was maintained constant by means of an AGC loop. The standard VLF data form was a sonogram (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 nominal since launch, except for interference from the sounder which had not prevented observation of useful data. The sounder operation was most frequent, but a small percentage of observations were VLF only or both VLF and sounder.

------- ALOUETTE 1, HARTZ----------

INVESTIGATION NAME- COSMIC RADIO NOISE

NSSDC ID- 62-049A-04 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS
ASTRONOMY

PERSONNEL

PI - T.R.	HARTZ(RETIRED)	DOC-CRC
PI - H.G.	JAMES	DOC-CRC

BRIEF DESCRIPTION
This experiment utilized the ionosonde receiver automatic gain control (AGC) voltage to measure the galactic and solar radio noise levels. The sweep-frequency receiver covered the range from 0.5 to 12 MHz in 18 s, 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 22.8 m long, located orthogonal to the spacecraft spin axis. The experiment functioned satisfactorily, providing relatively good frequency resolution with relatively poor flux resolution.

------- ALOUETTE 1, MCDIARMID----------

INVESTIGATION NAME- ENERGETIC PARTICLES DETECTORS

NSSDC ID- 62-049A-02 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - I.B.	MCDIARMID	NATL RES COUNC OF CAN

BRIEF DESCRIPTION
This experiment consisted of six detectors whose objectives were to determine the intensity structure of the lower portion of the outer Van Allen radiation belt at high latitudes and measure intensity changes associated with solar and geophysical phenomena, particularly auroras. The first, an Anton 302 Geiger counter, was in a shielded part of the package and was used only for omnidirectional measurements of protons and electrons with energies greater than 33 and 2.8 MeV,

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 500 keV, respectively. A second Anton 223 Geiger counter, pointed parallel to the spacecraft spin axis and coupled to a magnetic broom, responded directionally to electrons and protons with energies greater than 250 and 500 keV. Omnidirectionally, both Geiger counters responded to electrons and protons with energies greater than 2.8 and 33 MeV, respectively. The fourth detector, a silicon junction, was collimated to look 10 deg off the spin axis. Directionally, it responded to protons and alpha particles in the energy ranges 1.3 to 7 and 4.3 to 28 MeV, respectively. Omnidirectionally, the silicon junction responded to protons in the energy range 55 to 60 MeV. The last two detectors, a Geiger telescope consisting of two trays of Philips 18509 Geiger counters and a plastic scintillator located between the two Geiger counter trays of the telescope, were pointed 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, 1968, though still performing normally. No alpha particle data were obtained from this experiment.

------- ALOUETTE 1, WARREN----------

INVESTIGATION NAME- SWEEP-FREQUENCY SOUNDER

NSSDC ID- 62-049A-01

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - E.S.	WARREN(DECEASED)	DOC-CRC
PI - D.B.	MULDREW	DOC-CRC
OI - J.H.	WHITTEKER	DOC-CRC
OI - J.E.	JACKSON	NASA-GSFC
OI - L.	COLIN	NASA-ARC
OI - J.W.	KING	RUTHERFORD/APPLTON LAB
OI - R.W.	KNECHT	NATL BUREAU OF STD
OI - 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 instrumentation 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 12 MHz was sampled once every 18 s. Several delay times were usually observed for each frequency due to ground reflections, plasma resonances, birefringence of the ionosphere, nonvertical propagation, etc. Delay time was primarily a function of distance traversed by the signal, the electron density along the propagation path, and the mode of propagation. The standard data form was an ionogram (graph) showing time (virtual distance of signal reflection from the satellite) vs radio frequency. Two other common forms of data were prepared from the ionograms. They were (1) digital frequency data and/or virtual height values of characteristic ionospheric features and (2) computations of electron density profiles. Performance far exceeded expectations for the experiment. Initially, observations were recorded for about 6 h per day. The experiment provided data for 10 full years.

********** ALOUETTE 2**********

SPACECRAFT COMMON NAME- ALOUETTE 2
ALTERNATE NAMES- ALOUETTE-B, S 27B
ISIS-X, 01804

NSSDC ID- 65-098A

LAUNCH DATE- 11/29/65 WEIGHT- 146. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY

CANADA	DRB-DRTE
UNITED STATES	NASA-OSSA

INITIAL ORBIT PARAMETERS

ORBIT TYPE- GEOCENTRIC	EPOCH DATE- 11/30/65
ORBIT PERIOD- 121.4 MIN	INCLINATION- 79.8 DEG
PERIAPSIS- 505. KM ALT	APOAPSIS- 2987. KM ALT

PERSONNEL

PM - E.D.	NELSEN(NLA)	NASA-GSFC
PM - C.D.	FLORIDA(DECEASED)	DRB-DRTE
PS - I.	PAGHIS(RETIRED)	DRB-DRTE
PS - J.E.	JACKSON	NASA-GSFC

BRIEF DESCRIPTION

Alouette 2 was a small ionospheric observatory instrumented with a sweep-frequency ionospheric sounder, a VLF receiver, an energetic particle experiment, a cosmic noise experiment, and an electrostatic probe. The spacecraft used two long dipole antennas (73 m and 22.8 m, respectively) for the sounder, VLF, and cosmic noise experiments. The satellite was spin-stabilized at about 2.25 rpm after antenna deployment. End plates on the 73 m antenna corrected the rapid despin that had occurred on Alouette 1, and which was believed to result from thermal distortion of the antenna and from radiation pressure. There was no tape recorder, so that data were available only when the spacecraft was in line of sight of telemetry stations. Telemetry stations were located so that primary data coverage was near the 80 deg W meridan plus areas near Hawaii, Singapore, Australia, England, India, Norway, and Central Africa. Initially data were recorded about 8 h per day. Degradation of the power supply system had, by June 1975, recuced the operating time to about 1/2 h per day. Routine operations were terminated in July 1975. The spacecraft was successfully reactivated on November 28 and 29, 1975, in order to obtain data on its 10th annniversary.

------- ALOUETTE 2, BELROSE----------

INVESTIGATION NAME- VLF RECEIVER

NSSDC ID- 65-098A-02

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - J.S.	BELROSE	DOC-CRC
OI - F.H.	PALMER	DEFENCE RESEARCH ESTAB
OI - H.G.	JAMES	DOC-CRC

BRIEF DESCRIPTION

The purpose of the VLF experiment was to investigate the VLF radio spectrum for whistlers, chorus, hiss, and resonance effects. The VLF experiment was a wideband high-gain receiver with a passband from 0.05 to 30 kHz that used the long sounder antenna. The instrument was a considerably improved version of the Alouette 1 receiver. The standard VLF data form was a sonogram (graph) that showed signal as a function of time and frequency. Whistlers, ionospheric noise, VLF noise, etc. were observed in this very low region of the radio frequency spectrum.

------- ALOUETTE 2, BRACE----------

INVESTIGATION NAME- CYLINDRICAL ELECTROSTATIC PROBES

NSSDC ID- 65-098A-05

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - L.H.	BRACE	NASA-GSFC

BRIEF DESCRIPTION

Two cylindrical electrostatic probes were used to measure local electron temperature and density at the satellite. The main purpose of this experiment, however, was to determine the feasibility of placing direct measurements on a spacecraft equipped with the long antennas required for topside sounding. The sensors were operated as Langmuir probes and consisted each of a collector electrode extending from the central axis of a cylindrical guard ring. The guard ring extended 23 cm from the spacecraft and the collector electrode extended 46 cm. The two sensors were mounted on opposite sides of the lower portion of the satellite and both extended downward at an angle of 45 deg to the spacecraft spin axis, which was oriented in a northward direction in the orbital plane. The sensors were operated sequentially. NSSDC has all the useful data that exist from this investigation.

------- ALOUETTE 2, HARTZ----------

INVESTIGATION NAME- COSMIC RADIO NOISE

NSSDC ID- 65-098A-03

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
ASTRONOMY
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - T.R.	HARTZ(RETIRED)	DOC-CRC
PI - H.G.	JAMES	DOC-CRC

BRIEF DESCRIPTION

This experiment used the ionosonde receiver automatic gain control (AGC) voltage to measure background radio noise from the ionosphere, galaxy, and sun. The antennas were dipoles 23 and 73 m long. The receiver swept the range 0.1 to 15 MHz every 32 s. The receiver bandwidth was 40 kHz, and the dynamic range was 80 dB. The receiver sensitivity permitted galactic radio emission observations at frequencies greater than 0.6 MHz. The experiment functioned satisfactorily, providing good frequency resolution with relatively poor flux resolution.

------- ALOUETTE 2, MCDIARMID----------

INVESTIGATION NAME- ENERGETIC PARTICLE DETECTORS

NSSDC ID- 65-098A-04

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - I.B.	MCDIARMID	NATL RES COUNC OF CAN

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 3.9 MeV and protons greater than 40 MeV. The second had a magnetic broom 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. These three GM tubes were perpendicular to the spin axis. The fourth GM tube was 10 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 100 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- SWEEP-FREQUENCY SOUNDER

NSSDC ID- 65-098A-01

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - E.S.	WARREN(DECEASED)	DOC-CRC
PI - D.B.	MULDREW	DOC-CRC
OI - J.H.	WHITTEKER	DOC-CRC
OI - J.E.	JACKSON	NASA-GSFC
OI - J.W.	KING	RUTHERFORD/APPLTON LAB
OI - L.	COLIN	NASA-ARC
OI - J.	TURNER	IONOSPHERIC PRED SERV
OI - C.	TAIEB	CNET
OI - O.	HOLT	AURORAL OBS
OI - G.L.	NELMS	DOC-CRC
OI - Y.	OGATA	RADIO RESEARCH LAB
OI - R.	RAGHAVARAO	PHYSICAL RESEARCH LAB
OI - G.E.K.	LOCKWOOD	DOC-CRC

BRIEF DESCRIPTION

The purpose of the sweep-frequency sounder 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 sounder was also designed to provide greatly improved observations of plasma resonances. The sweep-frequency ionosonde was a radio transmitter/receiver that recorded the time delay between a transmitted and returned radio frequency pulse. A continuum of frequencies between 0.12 and 14.5 MHz were sampled once every 32 s. A multiplicity of delay times was usually observed due to birefringence of the ionosphere, nonvertical propagation, ground echoes, plasma resonances, etc. Delay time was primarily a function of distance traversed by the signal, 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 reflection from the satellite) versus frequency. Two other common forms of data were prepared from the ionograms. They are digital frequency and/or virtual height values of characteristic ionospheric features and computations of electron density profiles.

********** ARIEL 1**********

SPACECRAFT COMMON NAME- ARIEL 1
ALTERNATE NAMES- S 51, UK 1
1962 OMICRON 1, 00285

NSSDC ID- 62-015A

LAUNCH DATE- 04/26/62 WEIGHT- 62. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY

UNITED STATES	NASA-OSSA
UNITED KINGDOM	SRC

INITIAL ORBIT PARAMETERS

ORBIT TYPE- GEOCENTRIC	EPOCH DATE- 04/28/62
ORBIT PERIOD- 100.86 MIN	INCLINATION- 53.85 DEG
PERIAPSIS- 389. KM ALT	APOAPSIS- 1214. KM ALT

PERSONNEL

PM - M.O.	ROBBINS	SCIENCE RES COUNCIL
PM - R.C.	BAUMANN	NASA-GSFC
PS - R.L.F.	BOYD	MULLARD SPACE SCI LAB
PS - R.E.	BOURDEAU(RETIRED)	NASA-GSFC
PS - J.T.	SHEA(NLA)	NASA-GSFC

BRIEF DESCRIPTION

Ariel 1 was designed to contribute to the current knowledge of the ionosphere and of sun-ionosphere relationships. The satellite was a 62-kg cylinder with a 58-cm diameter and a height of 22 cm. A tape recorder and instrumentation for one cosmic-ray, two solar emissions, and three ionospheric experiments were on board the satellite. Except for failure at launch of the solar Lyman-alpha experiment, the spacecraft operated nominally until July 9, 1962. Between that date and September 8, 1962, spacecraft operation was limited. The spacecraft was operated again from August 25, 1964, to November 9, 1964, to obtain data concurrent in time with Explorer 20 (64-051A).

------- ARIEL 1, BOWLES----------

INVESTIGATION NAME- LYMAN ALPHA GAUGE

NSSDC ID- 62-015A-05

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS

PERSONNEL

PI - J.A.	BOWLES	U COLLEGE LONDON

BRIEF DESCRIPTION

There were three flush-mounted detectors on Ariel 1 to measure solar Lyman-alpha radiation. Two of them were aligned 60 deg from the satellite equator, one above and one below, and one sensor was mounted on the equator. All three were in the same vertical plane and in the same 180-deg sector. This experiment failed at launch.

------- ARIEL 1, ELLIOT----------

INVESTIGATION NAME- COSMIC-RAY DETECTOR

NSSDC ID- 62-015A-03

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
COSMIC RAYS

PERSONNEL

PI - H.	ELLIOT	IMPERIAL COLLEGE
OI - J.J.	QUENBY	IMPERIAL COLLEGE
OI - R.J.	HYNDS	IMPERIAL COLLEGE
OI - A.C.	DURNEY	ESA-ESTEC

BRIEF DESCRIPTION

The experiment was designed to study the primary cosmic-ray rigidity spectrum with Z>4 and rigidities between 2.5 and 16.0 GV using an omnidirectional Cerenkov counter and an Anton type 302 Geiger tube detector (used for background monitoring). The detector accumulators were read out every 31 s. The initial spacecraft spin period was 1.7 s. The experiment performed normally from launch to July 12, 1962. After that date, transmission was intermittent until mid-August 1962, after which no further information was received. For further details, see A. C. Durney et al., "Energy spectrum of the heavy primary cosmic rays," Proc. Roy. Soc. A., v. 281, pp. 553-564, 1964.

------- ARIEL 1, SAYERS----------

INVESTIGATION NAME- RADIO FREQUENCY CAPACITANCE PROBE

NSSDC ID- 62-015A-01

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - J.	SAYERS	U OF BIRMINGHAM
OI - P.H.M.	ROTHWELL	U OF SOUTHAMPTON
OI - J.H.	WAGER	U OF BIRMINGHAM

BRIEF DESCRIPTION

This experiment consisted of a capacitance probe used to observe the density of thermal electrons in the topside ionosphere. The probe consisted of two flat, circular wire mesh grids placed parallel to each other. It could observe electron number densities from 2.5E3 to 8.E4 electrons/cc. The performance was nominal until July 8, 1962, after which time the Starfish explosion caused observations to be intermittent and of degraced quality. The last useful data were received on July 31, 1962, just prior to failure of the tape recorder.

********** ARIEL 3**********

SPACECRAFT COMMON NAME- ARIEL 3
ALTERNATE NAMES- UK 3, UK-E
02773, S 53

NSSDC ID- 67-042A

LAUNCH DATE- 05/05/67 WEIGHT- 89.8 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA
UNITED KINGDOM SRC

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 05/05/67
ORBIT PERIOD- 95.69 MIN INCLINATION- 80.17 DEG
PERIAPSIS- 497. KM ALT APOAPSIS- 608. KM ALT

PERSONNEL
PM - A.C. LADD SCIENCE RES COUNCIL
PM - R.C. BAUMANN NASA-GSFC
PS - H. MASSEY U COLLEGE LONDON
PS - S.J. BAUER(NLA) NASA-GSFC

BRIEF DESCRIPTION
Ariel 3 was designed to continue and extend the previous UK satellite investigations in space. It was a small observatory with five experiments. The spacecraft consisted of a 57-cm-high, 12-sided prism with 69.6 cm between any pair of parallel sides. A 24.2-cm-high conical structure bearing various antennas was mated to the top of the prism. From the lower end of the prism, four paddles extended diagonally downward at an angle of 25 deg from the spin axis normal. Two sets of antennas were strung around the outer ends of these paddles. The paddles also served as mounts for some of the instrument sensors. Solar cells for power were mounted on both the sides of the prism and the paddles. The spacecraft was initially spin stabilized at about 31 rpm but slowed to about 12 rpm by the end of the first year in orbit. Attitude and spin were monitored by a combination of onboard sun sensors and by optical observations of solar reflection from a series of six mirrors mounted near the satellite equator. A tape recorder was included to obtain data for global surveys of observed variables. Experiment output for over one orbit could be recorded in a low-speed mode, with one complete set of sensor data each 0.9 s. A high-speed mode of observation provided for real-time telemetry with a complete set of sensor sampling 55 times per second. 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 considerable 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 Winkfield, 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, KAISER----------

INVESTIGATION NAME- VLF RECEIVER, FIXED-FREQUENCY SIGNAL STRENGTH

NSSDC ID- 67-042A-05 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - T.R. KAISER U OF SHEFFIELD
OI - A.R.W.HUGHES U OF NATAL
OI - K. BULLOUGH U OF SHEFFIELD

BRIEF DESCRIPTION
The purpose of this experiment was to make a worldwide survey of certain VLF signals and to study the effects of the propagation path on a 16-kHz, ground-based VLF transmitter. The experiment consisted of a fixed-frequency VLF receiver operating on frequencies of 3.2, 9.6, and 16 kHz. Bandwidths were 1 kHz on all frequencies with an additional narrow band (NB) of 0.1 kHz at 16 kHz. The observed parameters were minimum, mean, and maximum signal strengths at each frequency, except for the NB 16-kHz channel which observed minimum signal strength only. Time constants were 30 s for the mean values, 1 s for the NB minimum, 0.1 s for the other three minimum readings, and 0.01 s for the three maxima readings. Impulsive noise produced large variations in minimum, maximum, and mean readings in contrast to small variations for continuous signals. These signal strength observations were recorded each 28 s (about 2 deg) along the orbital path and read out on command each orbit. The experiment operated normally after launch and was operable until satellite reentry on December 14, 1970. For a more extensive description of this experimert see K. Bullough et al., "Sheffield University VLF experiment on the satellite Ariel 3," J. of Scientific Instruments, v. 1, pp. 77-85, 1968.

------- ARIEL 3, MURPHY----------

INVESTIGATION NAME- TERRESTRIAL RADIO (THUNDERSTORM) NOISE

NSSDC ID- 67-042A-04 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
METEOROLOGY
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - J.A. MURPHY UNKNOWN

BRIEF DESCRIPTION
The terrestrial radio noise experiment was designed to measure the flux of radio frequency energy, at satellite altitude, from thunderstorms and other natural terrestrial sources at six selected frequencies. The experiment incorporated three pairs of crystal controlled high-frequency receivers that operated at 4.998 and 5.002 MHz, 9.998 and 10.002 MHz, and 14.996 and 15.004 MHz. Each receiver had a bandwidth of 1580 Hz and measured the average voltage of the terrestrial radio noise generated. The receivers also measured, up to a specified maximum rate, the number of lightning discharges received. An onboard tape recorder stored the outputs from the experiment every 28 s throughout an orbit. The most useful information was obtained at the frequency that was just greater than the ionospheric critical frequency at that time. At lower frequencies, the radio noise did not penetrate the ionosphere, and at much higher frequencies, the radio noise was received from too large an area. The experiment was supported by ground observations from which thunderstorms were plotted by a direction-finding network in Europe. The experiment functioned satisfactorily from launch until it was programmed off in August 1969. For a more complete description of the experiment, see F. Horner and R. B. Bent, "Reception in space of H.F. noise from thunderstorms," Proc. Ariel III symposium (held May 22 and 23, 1968, GSFC, Greenbelt, Maryland), pp. 181-200, 1968.

------- ARIEL 3, SAYERS----------

INVESTIGATION NAME- LANGMUIR PROBE

NSSDC ID- 67-042A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - J. SAYERS U OF BIRMINGHAM

BRIEF DESCRIPTION
Electron temperatures were determined by employing an extension of the Langmuir probe technique. Two identical rhodium-plated spherical probes, 3.2 cm in diameter and with a 6.4-cm center-to-center distance, were linearly swept from -6.0 to +6.0 V in 5.2 s. This sweep voltage was modulated by a low-level sine wave signal of 6.0 kHz. The two probes, however, were kept at slightly different 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 through the retarding region. The experiment was operated for 5.2 s and then turned off for 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. H. Wagner, "University of Birmingham electron density and temperature experiments on the satellite Ariel 3," Radio and Electronic Engineer, v. 35, n. 1, pp. 55-63, January 1968.

------- ARIEL 3, SAYERS----------

INVESTIGATION NAME- RADIO FREQUENCY CAPACITANCE PROBE

NSSDC ID- 67-042A-06 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - J. SAYERS 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 5.7 cm apart, was operated at 29 MHz. The electron density could be obtained from the observed permittivity when these grids were at space potential. To ensure that at some time the potential on the grids would be equivalent to the space potential, a linear sweep voltage from -6 V to +6 V was applied to the sensor in 5.2 s. The permittivity at 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 while the electron temperature experiment was turned on. There were two outputs, one low speed to a tape recorder and the other high speed real time, available only within range of a telemetry station. Only 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 Engineer, v. 35, n. 1, pp. 55-63, January 1968.

------- ARIEL 3, STEWART----------

INVESTIGATION NAME- MOLECULAR OXYGEN DISTRIBUTION

NSSDC ID- 67-042A-03 INVESTIGATIVE PROGRAM
CODE EE-8, 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 150 km to about 300 km, with wide geographical coverage. At these heights, solar ultraviolet light (1425 to 1490 A) 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's shadow, the distribution of molecular oxygen in the atmosphere could be deduced. The sensors consisted of four gas-filled ionization chambers. The instrument was mounted on the top of the satellite with the chambers displaced at right angles to each other. The output from each chamber connected into a single electrometer amplifier that then fed straight to the telemetry, the data being telemetered only on a real-time basis. Approximately 30 observations a day were taken, but only about one-third of the measurements could be recorded because many of the observations were taken beyond range of a telemetry station. The experiment was a success in spite of the rapid deterioration of the sensors under the action of solar radiation. The observed half-life of 20 days was close to that predicted as a result of laboratory tests on the ionization chambers. For a further description of the experiment, see K. H. Stewart and P. J. L. Wildman, "Preliminary results of molecular oxygen observations from the Ariel III satellite," Proc. Roy. Soc. A, v. 311, pp. 591-600, 1969.

********** ARIEL 4**********

SPACECRAFT COMMON NAME- ARIEL 4
ALTERNATE NAMES- UK 4, 05675

NSSDC ID- 71-109A

LAUNCH DATE- 12/11/71 WEIGHT- 99.5 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED KINGDOM SRC
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/12/71
ORBIT PERIOD- 95.1 MIN INCLINATION- 83.0 DEG
PERIAPSIS- 480. KM ALT APOAPSIS- 590. KM ALT

PERSONNEL
PM - J.F. SMITH SCIENCE RES COUNCIL
PM - H.L. EAKER(RETIRED) NASA-GSFC
PS - R. DALZIEL RUTHERFORD/APPLTON LAB
PS - G.F. PIEPER NASA-GSFC
PS - D.S. EVANS NOAA-ERL

BRIEF DESCRIPTION
The United Kingdom Research Satellite 4 (UK 4) was a small observatory designed to investigate the interactions between electromagnetic waves, plasmas, and energetic particles present in the upper ionosphere. Experiments included observations of radio noise, electron density and temperature, very low frequency (VLF) and extremely low frequency (ELF) propagation, VLF impulses, and characteristics of low-energy charged particles. The satellite structure was similar to that of previous UK satellites, with four paddles extending out and downward from the base of the main satellite body. These paddles served as solar power cell mountings and as mounting for experiments. The satellite was a right cylinder attached to a right conical structure with solar cells placed on the cylindrical surface. The satellite was spin stabilized with an attitude control system that maintained the spacecraft's spin axis within 5 degrees of parallel alignment with the geomagnetic axis. With the particle experiment mounted at the apex of the cone, it looked at the northern geomagnetic pole. Tape-recorded data of global coverage were of low resolution, while the real-time observations taken within telemetry range of read-out stations were of high resolution. The satellite had a design lifetime of 1 yr.

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

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

NSSDC ID- 71-109A-04 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - L.A. FRANK U OF IOWA
OI - J.D. CRAVEN U OF IOWA
OI - D.M. YEAGER(NLA) U OF IOWA
OI - M.A. SCHIELD U OF IOWA

BRIEF DESCRIPTION
A Low-Energy Proton and Electron Differential Energy Analyzer (LEPEDEA) measured the differential energy spectra of proton and electron intensities, 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 orboard VLF 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 Eon 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 (E>500 keV) and electrons (E>45 keV). The experiment operated normally from launch until April 29, 1972, when a transistor failure caused certain energy level and experiment mode identification to be lost in the high speed telemetry. However, all but one of the functions lost because of the failure (experiment temperature) were recovered in the spacecraft low speed encoder mode. Some details of high-energy electron intensities were lost due to the lower temporal resolution.

------- ARIEL 4, KAISER----------

INVESTIGATION NAME- VLF-ELF RECEIVER

NSSDC ID- 71-109A-03 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - T.R. KAISER 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 3.2, 9.6, 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 0.75 and 1.25 kHz, each with a bandwidth of 0.50 kHz. A seventh channel at 17.8 kHz (minimum reading) was included for transmissions from the NAA station (Maine). On some channels, peak, mean, and minimum signals were measured in successive 28-s sampling intervals. A multi-turn receiving antenna was included.

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

INVESTIGATION NAME- MHZ BAND NOISE (E FIELD)

NSSDC ID- 71-109A-02 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - F.G. SMITH U OF CAMBRIDGE
OI - R. DALZIEL RUTHERFORD/APPLTON LAB
OI - V.A.W.HARRISON U OF MANCHESTER
CI - D. WALSH U OF MANCHESTER

BRIEF DESCRIPTION
A radio receiver operated either at a fixed frequency, 2.0 MHz, or in a sweep frequency mode, 0.25-4.0 MHz, 16-s sweep rate, and measured the galactic radio noise received by a 15-meter dipole.

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

INVESTIGATION NAME- LANGMUIR PROBE

NSSDC ID- 71-109A-01 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL
PI - A.P. WILLMORE U OF BIRMINGHAM

BRIEF DESCRIPTION
The electron density measurements were obtained using a double Langmuir probe (capacitance probe) consisting of two plane 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.E8 to 10.E12 electrons/cubic meter. Further details can be found in C. V. Goodall et al., "Topside ionosphere electron density measurements on Ariel 4.," Proc. Royal Soc., v. A342, 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

NSSDC ID- 64-069A

LAUNCH DATE- 10/24/64 WEIGHT- 400. KG
LAUNCH SITE- KAPUSTIN YAR, U.S.S.R.
LAUNCH VEHICLE- B-1

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

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 10/24/64
ORBIT PERIOD- 91.8 MIN INCLINATION- 48.59 DEG
PERIAPSIS- 264. KM ALT APOAPSIS- 466. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
Cosmos 49 was instrumentec with proton magnetometers to map the earth's magnetic field. This spacecraft, along with Cosmos 26, represented the U.S.S.R. contribution to the IQSY World Magnetic Survey. The corresponding U.S. measurements were performed on OGO 2 and OGO 4. The shape of the spacecraft was almost an ellipsoid and measured 1.8 m long and 1.2 m in diameter. A boom 3.3 m long was attached from one end of the spacecraft to the magnetometers. The performance of the spacecraft was satisfactory.

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

INVESTIGATION NAME- PROTON PRECESSIONAL MAGNETOMETERS

NSSDC ID- 64-069A-01 INVESTIGATIVE PROGRAM
SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - SH.SH.DOLGINOV IZMIRAN
OI - V.I. NALIVAYKO IZMIRAN

BRIEF DESCRIPTION
The Cosmos 49 spacecraft carried two proton magnetometers with the axes of their polarized-sensing coils oriented perpendicular to each other. An onboard timer turned on the two magnetometers alternately, and a measurement was obtained once 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- 04308

NSSDC 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. UNKNOWN

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 01/21/70
ORBIT PERIOD- 92. MIN INCLINATION- 71. DEG
PERIAPSIS- 280. KM ALT APOAPSIS- 507. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
Cosmos 321 was one of a series of Soviet Earth Satellites whose objective was to study outer space, the upper layers of the atmosphere, and the earth. Scientific data and other measurements were relayed to earth by multichannel telemetry systems equipped with memory units. The spacecraft carried scientific apparatus, telemetry, and a radio system for precise measurements of orbital elements.

------- COSMOS 321, DOLGINOV----------

INVESTIGATION NAME- MAGNETOMETER

NSSDC ID- 70-006A-01 INVESTIGATIVE PROGRAM
SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - SH.SH.DOLGINOV IZMIRAN

BRIEF DESCRIPTION
A Cesium Vapor Magnetometer was flown to provide magnetic field data. It had a precision at the frequency meter of 1.7 nT (gammas). The instrument was calibrated against a proton magnetometer with an error margin of less than 2 nT. The magnetometer sensors were mounted at the end of a 3.6-m boom. The data were affected by noise. At some angles of the spacecraft body with the geomagnetic field, non-compensated magnetic deviations could reach 8 to 10 nT for the scalar field. In general, the instrument functioned properly.

********** COSMOS 900**********

SPACECRAFT COMMON NAME- COSMOS 900
ALTERNATE NAMES- 09898, OVAL

NSSDC ID- 77-023A

LAUNCH DATE- 03/30/77 WEIGHT- 900. KG
LAUNCH SITE- PLESETSK, U.S.S.R.
LAUNCH VEHICLE- C-1

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

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 03/31/77
ORBIT PERIOD- 94.4 MIN INCLINATION- 83. DEG
PERIAPSIS- 460. KM ALT APOAPSIS- 523. KM ALT

PERSONNEL
PM - K.I. GRINGAUZ IKI
PS - B.A. TVERSKOY INST NUCLEAR PHYSICS

BRIEF DESCRIPTION
Cosmos 900 carried scientific apparatus, a radio system for precise measurements of orbit elements, and a radio telemetry system.

------- COSMOS 900, SOSNOVETS----------

INVESTIGATION NAME- DIFFERENTIAL ENERGY SPECTROMETER

NSSDC ID- 77-023A-05 INVESTIGATIVE PROGRAM
SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - E.N. SOSNOVETS INST NUCLEAR PHYSICS
OI - M.I. PANASYUK INST NUCLEAR PHYSICS

BRIEF DESCRIPTION
This experiment measured trapped electrons and protons using junction 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 device with an 18-deg angular aperture (geometric factor of 0.0084 sq cm sr) covered the range 80 to 130 keV. The electron detector with an angular aperture of 15 deg (geometric factor of 0.0034 sq cm sr) covered the range 80 to 130 keV. The angle between the MeV proton detector axis and the geomagnetic field was 80, plus or minus 10 deg.

********** DISCOVERER 25**********

SPACECRAFT COMMON NAME- DISCOVERER 25
ALTERNATE NAMES- 1961 XI 1, 00108

NSSDC ID- 61-014A

LAUNCH DATE- 06/16/61 WEIGHT- 1150. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 06/17/61
ORBIT PERIOD- 90.87 MIN INCLINATION- 82.11 DEG
PERIAPSIS- 222. KM ALT APOAPSIS- 409. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
Discoverer 25 was launched by the U.S. Air Force Ballistic Missile Division (AFBMD) 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 rocket body (approximately 6 m long and 1.5 m in diameter) equipped with a liquid propellant rocket engine, propellant tanks, and nose cone which housed the telemetry, the guidance and control systems, and the experiment package. Once in orbit, the satellite could be reoriented in a nose-down position facing earthward. The nose cone could be separated from the spacecraft while in orbit. The cone was equipped with retrorockets to slow it down and allow for reentry. The spacecraft performed normally after launch. The nose cone separated on orbit number 33 (June 18, 1961) and was successfully recovered from the ocean that same day. The satellite itself was burned up during reentry on July 12, 1961.

------- DISCOVERER 25, MCISAAC----------

INVESTIGATION NAME- AEROSPACE DENSITY (DENSITY GAUGE-2)

NSSDC ID- 61-014A-03 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - J.P. MCISAAC USAF GEOPHYS LAB

BRIEF DESCRIPTION
The Discoverer 25 Aerospace density experiment was designed to yield atmospheric pressure and densities between approximately 130 to 250 km above the earth's surface. The experiment consisted of a single manometer gauge and associated telemetry. The experiment performed satisfactorily and produced good data during the spacecraft's 2-day lifetime.

********** DME-A**********

SPACECRAFT COMMON NAME- DME-A
ALTERNATE NAMES- EXPLORER 31, ISIS-X
01806, S 30A

NSSDC ID- 65-098B

LAUNCH DATE- 11/29/65 WEIGHT- 99.0 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 11/30/65
ORBIT PERIOD- 121.4 MIN INCLINATION- 79.8 DEG
PERIAPSIS- 505. KM ALT APOAPSIS- 2978. KM ALT

PERSONNEL
PM - E.D. NELSEN(NLA) NASA-GSFC
PS - J.E. JACKSON NASA-GSFC

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: a thermal ion 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 when the spacecraft was in sight of the telemetry station and when commanded on. Experiments were operated either simultaneously or sequentially, as desired. The satellite was spin-stabilized with the spin axis perpendicular to the orbit plane. The 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 nominal amount. Some difficulties were encountered in obtaining attitude information that was necessary for the reduction of the experiment observations. On July 1, 1969, the satellite data observations were terminated with five of the seven experiments operating. Responsibility for standby monitoring of the satellite was given to the ESSA telemetry station at Boulder, Colorado, on July 8, 1969. During this standby operation, experiment data were collected only once on October 1, 1969, for 9 min from the electrostatic probe for use 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-A, BRACE----------

INVESTIGATION NAME- CYLINDRICAL ELECTROSTATIC PROBES

NSSDC ID- 65-098B-02 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL
PI - L.H. BRACE 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 extending from the central axis of a cylindrical guard ring. The guard rings extended 23 cm from the spacecraft and the collector electrode extended 46 cm. The two sensors were mounted on opposite sides of the spacecraft, and were perpendicular to the spin axis and in the orbit plane. Data sets are no longer available from this experiment.

------- DME-A, DONLEY----------

INVESTIGATION NAME- THERMAL ION PROBE

NSSDC ID- 65-098B-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - J.L. DONLEY NASA-GSFC
PI - E.J. MAIER NASA-GSFC

BRIEF DESCRIPTION
The purpose of the thermal ion probe experiment was to measure ion density, temperature, and composition at the satellite. The sensor consisted of a planar ion trap with three circular mesh grids and a collector. With the innermost suppressor grid maintained at -15 V to exclude electrons and the middle retarding grid swept from zero to 6.3 V, the resulting current-voltage curve due to ion current was interpreted to obtain ion temperature, ion composition, and density. Determination of these parameters was made by curve fitting, assuming various models of ion parameters and assuming that the model with the least rms residual was correct. The associated electronics were shared with experiment 65-098B-06. Further details are given in J. L. Donley, "The thermal ion and electron trap experiments on the Explorer XXXI satellite," Proc. IEEE, v. 57, n. 6, pp. 1061-1067, June 1969. NSSDC has all the useful data that exist from this investigation.

------- DME-A, DONLEY----------

INVESTIGATION NAME- THERMAL ELECTRON PROBE

NSSDC ID- 65-098B-06 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - J.L. DONLEY NASA-GSFC
PI - E.J. MAIER 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

20%. The electron temperature could normally be obtained with an accuracy of about 150 ceg K, but a computer curve-fitting analysis improved the accuracy to about 10 deg K. The associated electronics were shared with experiment 65-098B-01. Further details can be founc in J. L. Donley, "The thermal ion and electron trap experiments on the Explorer XXXI satellite," Proc. IEEE, v. 57, n. 6, pp. 1061-1067, June 1969. NSSDC has all the useful data that exist from this investigation.

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

INVESTIGATION NAME- MAGNETIC ION-MASS SPECTRCMETER

NSSDC ID- 65-098B-05

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - J.H. 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 cecreasing accelerating voltage, which varied from -4000 to -150 volts. The ions were separated according to mass-to-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 cutput ion current from the multiplier was measured by a logarithmic electrometer amplifier anc 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. NSSDC has all the useful data that exist from this investigation.

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

INVESTIGATION NAME- ENERGETIC ELECTRON CURRENT MONITOR

NSSDC ID- 65-098B-07

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - E.J. 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. Two three-grid retarding potential analyzers were used, one providing analog data in the 0.2 to 200 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 digital measurement included an electron multiplier and a digital pulse countirg system. Because of moisture contamination cf the detector in the launch tower prior to launch, the gain of the electron multiplier was so degraded that no geophysical measurements could be obtained. The instrumentation fcr the analog measurement included a range-changing electrometer. 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 E. J. R. Maier, "Explorer XXXI total current monitor experiments," Proc. IEEE, v. 57, n. 6, pp. 1068-1071, June 1969. NSSDC has all the useful data that exist from this investigation.

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

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

NSSDC ID- 81-070A

LAUNCH DATE- 08/03/81 WEIGHT- 409. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-CSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 08/03/81
ORBIT PERIOD- 410.8 MIN INCLINATION- 89.9 DEG
PERIAPSIS- 567.6 KM ALT APOAPSIS- 23289. KM ALT

PERSONNEL
PM - J.P. CORRIGAN NASA-GSFC
PM - G.D. HOGAN NASA-GSFC
PS - R.A. HOFFMAN NASA-GSFC

BRIEF DESCRIPTION
The gereral objective of the Dynamics Explorer (DE) mission was to investigate the strong interactive processes coupling the hot, tenuous, convecting plasmas of the magnetosphere and the cooler, denser plasmas and gases corotating in the earth's ionosphere, upper atmosphere, and plasmasphere. Two satellites, DE 1 and DE 2, were launched together and were placed in polar coplanar orbits, permitting simultaneous measurements at high and low altitudes in the same field-line region. The DE 1 spacecraft (high-altitude mission) used an elliptical orbit selected to allow (1) measurements extending from the hot magnetospheric plasma through the plasmasphere to the cool ionosphere; (2) global auroral imaging, wave measurements in the heart of the magnetosphere, and crossing of auroral field lines at several earth radii, and (3) measurements for significant periods along a magnetic field flux tube. The spacecraft approximated a short polygon 137 cm in diameter and 115 cm high. The antennas in the X-Y plane were 200-m tip-to-tip, and on the Z-axis were 9-m tip-to-tip. Two 6-m booms were provided for remote measurements. The weight of the spacecraft was 409 kg. Power was supplied by a solar cell array, mounted on the side and end panels. The spacecraft was spin stabilized. The spin axis was 90 deg from the orbit normal and the spin rate was 10 plus or minus 0.1 rpm. A pulse code modulation (PCM) telemetry data system was used that operated in real time or a tape recorder mode. Data were acquired on a science-problem-oriented basis, with closely coordinated operations of the various instruments, both satellites, and supportive experiments. Data acquired from the instruments were temporarily stored on tape recorders before transmission at an 8:1 playback-to-record ratio. Additional operational flexibility allowed a playback-to-record ratio of 4:1. The primary data rate was 16,384 bits per second. Since commands were stored in a command memory unit, spacecraft operations were not real time, except for the transmission of the wideband analog data from the Plasma Wave Instrument (81-070A-02). Additional details are found in R. A. Hoffman et al., Space Sci. Instrum., v. 5, n. 4, p. 349, 1981.

------- DYNAMICS EXPLORER 1, BURCH----------

INVESTIGATION NAME- HIGH ALTITUDE PLASMA INSTRUMENT

NSSDC ID- 81-070A-05

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
MAGNETOSPHERIC PHYSICS
PARTICLES AND FIELDS

PERSONNEL
PI - J.L. BURCH SOUTHWEST RES INST
OI - R.A. HOFFMAN NASA-GSFC
OI - J.D. WINNINGHAM SOUTHWEST RES INST
OI - D.M. KLUMPAR U OF TEXAS, DALLAS
OI - P.H. REIFF RICE U

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/charge range from 5 eV to 32 keV as a function of pitch angle. This investigation provided data contributing to the studies of (1) the composition and energy cf Birkelanc current charge carriers, (2) the dynamic configuration of high-latitude magnetic flux tubes, (3) auroral particle source regions and acceleration mechanisms, (4) the role of E parallel to B and E perpendicular to B in the magnetosphere-ionosphere system, (5) the sources and the effect of polar cap particle fluxes, (6) the transport of plasma within and through the magnetospheric clefts, (7) wave-particle interactions, and (8) hot-cold 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 heacs were mounted on the main body. One of the detector heads was mounted in the spin plane, two were offset by plus and minus 12 deg, and two were offset by plus and minus 45 deg. One detector swept within a few deg of the field line during each rotation of the spacecraft, except when the magnetic field was greatly deformed from its meridian plane. The basic mode of operation provided a 32-point energy spectrum from each sensor, but the voltages on the electrostatic analyzers were programmable to allow for operation over limited portions of the energy spectrum, or at higher time resolution with reduced energy resolution. The energy resolution was 32%. The angular resolution was 2.5 deg FWHM (in the plane of detection) by 10 deg (polar angle). The sampling rate was 64 per second, and the total acceptance angle was 5 by 20 deg. More details can be found in J. L. Burch et al., Space Sci. Instrum., v. 5, n. 4, p. 455, 1981.

------- DYNAMICS EXPLORER 1, CHAPPELL----------

INVESTIGATION NAME- RETARDING ION MASS SPECTROMETER

NSSDC ID- 81-070A-04

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
MAGNETOSPHERIC PHYSICS
IONOSPHERES

PERSONNEL

PI - C.R. CHAPPELL		NASA-MSFC
OI - P.M. BANKS		STANFORD U
OI - W.B. HANSON		U OF TEXAS, DALLAS
OI - J.H. HOFFMAN		U OF TEXAS, DALLAS
OI - A.F. NAGY		U OF MICHIGAN
OI - G.R. CARIGNAN		U OF MICHIGAN

BRIEF DESCRIPTION

The Retarding Ion Mass Spectrometer (RIMS) consisted of a retarding potential analyzer for energy analysis in series with a magnetic ion-mass spectrometer for mass analysis. Multiple sensor heads permitted the determination of the thermal plasma flow characteristics. This instrument was designed to operate in two basic commandable modes: a high-altitude mode in which the density, temperature, and bulk-flow characteristics of principally H+, He+, and O+ ions were measured, and a low-altitude mode that concentrated on the composition in the 1-to 32-u (atomic mass units) range. This investigation provided information on (1) the densities of H+, He+, and O+ ions in the ionosphere, plasmasphere, plasma trough, and polar cap (including the density distribution along the magnetic vector in the vicinity of the satellite apogee); (2) the temperature of H+, He+, and O+ ions in the ionosphere, plasmasphere, plasma trough, and polar cap (energy range 0-45 eV); (3) the bulk flow velocities of H+, He+, and O+ in the plasmapause, plasma trough and polar cap; (4) the changing character of the cold plasma density, temperature, and bulk flow in regions of interaction with hot plasma such as at the boundary between the plasmasphere and the ring current; and (5) the detailed composition of ionospheric plasma in the 1- to 32-u range. He++ and O++ were also measured. The instrument consisted of three detector heads. One looked out in the radial direction, and the other two were along the plus and minus spin axis direction. Each detector had a 55 deg half-cone acceptance angle. The detector heads had a gridded weakly collimating aperture where the retarding analysis was performed, followed by a parallel plate ceramic magnetic mass analyzer with two separate exit slits corresponding to ion masses in the ratio 1:4. Ions exiting from these slits were detected with electron multipliers. In the apogee mode, the thermal particle fluxes were measured while the potential on a set of retarding grids was stepped through a sequence of settings. In the perigee mode, the retarding grids were grounded and the detector utilized a continuous acceleration potential sweep that focused the mass ranges from 1 to 8, and 4 to 32 u. Additional details can be found in C. R. Chappell et al., Space Sci. Instrum., v. 5, n. 4, p. 477, 1981.

------- DYNAMICS EXPLORER 1, FRANK----------

INVESTIGATION NAME- GLOBAL AURORAL IMAGING AT VISIBLE AND ULTRAVIOLET WAVELENGTHS

NSSDC ID- 81-070A-03

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES
MAGNETOSPHERIC PHYSICS
PARTICLES AND FIELDS

PERSONNEL

PI - L.A. FRANK		U OF IOWA
OI - K.L. ACKERSON		U OF IOWA
OI - R.L. CAROVILLANO		BOSTON COLLEGE
OI - R.H. EATHER		BOSTON COLLEGE

BRIEF DESCRIPTION

The Spin-Scan Auroral Imager (SAI) provided global auroral imaging at visible and ultraviolet wavelengths. It acquired (1) images at several visible wavelengths; (2) images within a vacuum ultraviolet "window", which allowed usable imaging of the aurora in the sunlit ionosphere; and (3) photometric measurements of the hydrogen corona. This investigation provided data that advanced the knowledge of (1) the spatial and temporal character of the entire auroral oval at both visible and vacuum ultraviolet wavelengths (with good time resolution); (2) the association of auroral and magnetospheric plasmas with the diverse auroral emission features; (3) the relationship of the auroral emissions with field-aligned currents; (4) the energy deposited in the auroral ionosphere by charged particles; (5) the acceleration mechanism responsible for "inverted-V" precipitation events; (6) the role of the polar cap and magnetotail in auroral and magnetospheric dynamics, and (7) the time-dependent distribution of neutral hydrogen in the ring current and polar regions. Of the three photometers, two measured radiation in the visible wavelength range and one measured it in the UV. A full image was 36 deg by 120 deg. In Angstroms (A) some of the wavelengths were 3914, 5577, 6300, 3175, 1304, 1216, 1400-1600, and 1400-1700. 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 3.9 Re altitude this resolution was 109 km. For each photometer, the time resolution was minutes per image. For visible wavelengths, the photometers had a wide-angle collimator; a super-reflecting scanning mirror; a mirror-drive motor; a quartz field lens; an image-viewing assembly of field-stop, pinhole and collimating lens; a filter wheel with narrow-band interference filters; and a small photomultiplier tube with an extended red photocathode. The vacuum ultraviolet imaging photometer was a spin-scan Newtonian telescope. The first optical element was an aluminum scanning mirror with a MgF2 overcoat. The collimation and mirror drive were similar to that mentioned previously for the visible imaging photometer. A filter wheel with MgF2, CaF2, and BaF2 filters allowed global imaging from 1370 to 1700, at 1304, 1356, and 1216 A. The detector was a photomultiplier tube with a CsI photocathode and a MgF2 window. Additional details are found in L. A. Frank et al., Space Sci. Instrum., v. 5, n. 4, p. 369, 1981.

------- DYNAMICS EXPLORER 1, HELLIWELL----------

INVESTIGATION NAME- CONTROLLED AND NATURALLY OCCURING WAVE PARTICLE INTERACTIONS

NSSDC ID- 81-070A-08

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

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

PERSONNEL

PI - R.A. HELLIWELL		STANFORD U
OI - T.F. BELL		STANFORD U
OI - D.L. CARPENTER		STANFORD U
OI - C.G. PARK		STANFORD U
OI - J.B. REAGAN		LOCKHEED PALO ALTO

BRIEF DESCRIPTION

This investigation used a ground-based very-low-frequency/low-frequency (VLF/LF) (0.5-200 kHz) transmitter located at Siple, Antarctica, at an L value of about 4, and the broad-band magnetic field detector from experiment 81-070A-02. The primary objective of the investigation was to determine the relationship between VLF/LF waves and energetic electrons in the magnetosphere with emphasis on wave growth, stimulated emissions, and wave-induced perturbations of the energetic electrons. Other objectives were (1) to determine how wave propagation from both ground and magnetospheric sources was affected by field-aligned plasma structures such as the plasmapause and ducts of enhanced ionization, (2) to use the wave data to describe the structure of the plasmapause and the distribution of ionization along field-aligned ducts, and (3) to study the effects of earth power-line radiation and other VLF wave activity. The spacecraft instrumentation for this experiment consisted of the Linear Wave Receiver (LWR) provided by the Plasma Wave Instrument (81-070A-02). The LWR provided a waveform output with a 30 dB linear amplitude response for bands of 1.5-3.0, 3.11 plus or minus 7 1/2%, 3-6, or 10-16 kHz for a selected magnetic or electric sensor. This receiver was used to measure growth rates for waves stimulated by the Siple VLF transmitter or by natural wave phenomena. More details can be found in S. D. Shawhan et al., Space Sci. Instrum., v. 5, n. 4, p. 535, 1981.

------- DYNAMICS EXPLORER 1, MAGGS----------

INVESTIGATION NAME- AURORAL PHYSICS

NSSDC ID- 81-070A-07

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY
PARTICLES AND FIELDS

PERSONNEL

PI - J.E. MAGGS		U OF CALIF, LA
OI - C.F. KENNEL		U OF CALIF, LA

BRIEF DESCRIPTION

The primary goal of this investigation was to use the results from other experiments, particularly 81-070A-03 to test previous theoretical models and to develop new ones, with emphasis on research areas related to auroral arcs, field-aligned currents, plasma wave turbulence associated with anomalous resistance, generation of auroral electron beams, production of kilometric and VLF hiss radiation, and spread-F. In addition, correlation studies were organized by selecting events that were interesting to the various investigators and data reduction procedures were suggested to facilitate comparison and interpretation of the data.

------- DYNAMICS EXPLORER 1, SHAWHAN----------

INVESTIGATION NAME- PLASMA WAVES

NSSDC ID- 81-070A-02

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

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

PERSONNEL

PI - S.D.	SHAWHAN	U OF IOWA
OI - D.A.	GURNETT	U OF IOWA

BRIEF DESCRIPTION

The Plasma Wave Instrument (PWI) measured ac electric fields over the frequency range from 1 Hz to 2 MHz, and an amplitude range of 0.03 microvolt per meter to 100 millivolts per meter. Magnetic fields were measured too from 1 Hz to 400 kHz over an approximately 100 dB range. The objectives of this investigation were to measure the spatial, temporal, spectral, and wave characteristics (particularly the Poynting 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 and VLF hiss, 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 Z axis and a magnetic loop antenna. A single-axis search coil magnetometer and a short electric antenna were included for low-frequency measurements and electrostatic noise at short wavelengths. The electronics consisted of (1) a wideband/long baseline receiver with a bandwidth of 10 or 40 kHz in the range 0-2 MHz; (2) a sweep-frequency correlator, containing two sweep-frequency receivers and phase detectors, sweeping 100 Hz to 400 kHz in 32 s, and giving the phase between magnetic and electric components of the field; (3) a low-frequency correlator containing two filter receivers and phase detectors, (eight filters in the range 1.78-100 Hz were swept in 8 s); (4) dc monitors that measured the voltage difference between the two sets of long dipole antennas; and (5) a linear wideband receiver, selectable from 1.5 to 3.0, 3 to 6, or 10 to 16 kHz bands. The wideband receiver was flown to transmit wideband waveform signals to the ground via an analog transmitter, so that detailed high-resolution frequency-time analysis could be performed. More details are found in S. D. Shawhan et al., Space Sci. Instrum., v. 5, n. 4, p. 535, 1981.

------- DYNAMICS EXPLORER 1, SHELLEY----------

INVESTIGATION NAME- HOT PLASMA COMPOSITION

NSSDC ID- 81-070A-06

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

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
IONOSPHERES
MAGNETOSPHERIC PHYSICS

PERSONNEL

PI - E.G.	SHELLEY	LOCKHEED PALO ALTO
OI - R.G.	JOHNSON	LOCKHEED PALO ALTO
OI - R.D.	SHARP	LOCKHEED PALO ALTO
OI - J.	GEISS	U OF BERNE
OI - P.X.	EBERHARDT	U OF BERNE
OI - H.	BALSIGER	U OF BERNE
OI - D.T.	YOUNG	LOS ALAMOS NAT LAB
OI - A.	GHIELMETTI	U OF BERNE
OI - B.A.	WHALEN	NATL RES COUNC OF CAN

BRIEF DESCRIPTION

The Energetic 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 from less than 1 to greater than 150 atomic mass units/charge. This investigation provided data used in investigating the strong coupling mechanism between the magnetosphere and the ionosphere that results in large fluxes of energetic O+ ions being accelerated from the ionosphere and injected into the magnetosphere during magnetic storms. The properties of the minor ionic 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, transport, and loss processes that may be mass- or charge-dependent. One of the primary objectives was to measure the energy and pitch angle distributions of the principal mass constituents (O+ and H+) of the upward flowing ions from the auroral acceleration region. An important area for study was the cusp region. The instrument was similar to one flown on the ISEE 1 satellite. It consistec of a curved-plate electrostatic energy analyzer, followed by a combined cylindrical electrostatic-magnetic mass analyzer. Open electron multipliers were used with pulse-amplituce discrimination as the mass analyzer detectors in order to improve the mass separation characteristics of the spectrometer. The energy resolution (delta E)/E (internal) was 5%. The mass resolution M/(delta M) was less than or equal to 10 on the focus line. Additional details can be found in E. G. Shelly et al., Space Sci. Instrum., v. 5, n. 4, p. 443, 1981.

------- DYNAMICS EXPLORER 1, SUGIURA----------

INVESTIGATION NAME- MAGNETIC FIELD OBSERVATIONS

NSSDC ID- 81-070A-01

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
MAGNETOSPHERIC PHYSICS

PERSONNEL

PI - M.	SUGIURA	NASA-GSFC
OI - B.G.	LEDLEY	NASA-GSFC
OI - W.H.	FARTHING	NASA-GSFC
OI - L.J.	CAHILL, JR.	U OF MINNESOTA

BRIEF DESCRIPTION

This investigation used a triaxial fluxgate magnetometer (MAG-A), similar to one on board DE 2, to obtain vector magnetic field data needed to study the magnetosphere-ionosphere-atmosphere coupling. The primary objective of this investigation was to obtain measurements of field-aligned currents in the auroral oval and over the polar cap at two different altitudes. This was accomplished using the two spacecraft and correlations of these measurements with observations of electric fields, plasma waves, suprathermal particles, thermal particles, and with auroral images obtained from investigation 81-070A-03. Ultra low frequency (ULF) waves were also studied. The magnetometer incorporated its own 12-bit analog-to-digital converter, a 4-bit digital compensation register for each axis, and a system control to generate a 48-bit data word consisting of a 16-bit representation of the field measured along each of the three magnetometer axes. Track and hold modules were used to obtain simultaneous samples on all three axes. Instrument bandwidth was 25 Hz. The instrument dynamic range was plus or minus 6.2E4 nT (gammas), and the resolution was plus or minus 1.5 nT in the 6.2E4 nT range, plus or minus 0.25 nT in the 1.E3 nT range, anc plus or minus 0.02 nT in the 80 nT range. The magnetometer's digital compensation of the ambient field was nominally in 8.E3 nT increments. Further details are in W. H. Farthing et al., Space Sci. Instrum., v. 5, n. 4, p. 551, 1981.

********** DYNAMICS EXPLORER 2**********

SPACECRAFT COMMON NAME- DYNAMICS EXPLORER 2
ALTERNATE NAMES- DE-B, DE 2
DYNAMICS EXPLORER-B

NSSDC ID- 81-070B

LAUNCH DATE- 08/03/81 WEIGHT- 403. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 08/03/81
ORBIT PERIOD- 98. MIN INCLINATION- 89.9 DEG
PERIAPSIS- 309. KM ALT APOAPSIS- 1012.5 KM ALT

PERSONNEL

PM - J.P.	CORRIGAN	NASA-GSFC
PM - G.D.	HOGAN	NASA-GSFC
PS - R.A.	HOFFMAN	NASA-GSFC

BRIEF DESCRIPTION

The DE 2 spacecraft (low-altitude mission) complemented the high-altitude mission DE 1 and was placed into an orbit with a perigee sufficiently low to permit measurements of neutral composition, temperature, and wind. The apogee was high enough to permit measurements above the interaction regions of suprathermal ions, and also plasma flow measurements at the feet of the magnetospheric field lines. The general form of the spacecraft was a short polygon 137 cm in diameter and 115 cm high. The triaxial antennas were 23 m tip-to-tip. One 6-m boom was provided for remote measurements. The spacecraft weight was 403 kg. Power was supplied by a solar cell array, which charged two six ampere-hour nickel-cadmium batteries. The spacecraft was three-axis stabilized with the yaw axis aligned toward the center of the earth to within 1 deg. The spin axis was normal to the orbit plane within 1 deg with a spin rate of one revolution per orbit. A single-axis scan platform was included in order to mount the Low-Altitude Plasma Instrument (81-070B-08). The platform rotated about the spin axis. A pulse code modulation telemetry data system was used that operated in real time or in a tape-recorder mode. Data were acquired on a science-problem-oriented basis, with closely coordinated operations of the various instruments, both satellites and supportive experiments. Measurements were temporarily stored on tape recorders before transmission at an 8:1 playback-to-record ratio. Since commands were also stored in a commanc memory unit, spacecraft operations were not real time. Additional details can be found in R. A. Hoffman et al., Space Sci. Instrum., v. 5, n. 4, p. 349, 1981.

------- DYNAMICS EXPLORER 2, BRACE----------

INVESTIGATION NAME- LANGMUIR PROBE

NSSDC ID- 81-070B-09

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

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL

PI - L.H.	BRACE	NASA-GSFC
OI - W.R.	HOEGY	NASA-GSFC
OI - R.F.	THEIS	NASA-GSFC
OI - K.D.	COLE	LA TROBE U
OI - G.R.	CARIGNAN	U OF MICHIGAN

BRIEF DESCRIPTION

The Langmuir Probe Instrument (LANG) was a cylindrical electrostatic probe that obtained measurements of electron temperature, Te, and electron or ion concentration, Ne or Ni, respectively, and spacecraft potential. Data from this investigation were used to provide temperature and density measurements along magnetic field lines related to thermal energy and particle flows within the magnetosphere-ionosphere system, to provide thermal plasma conditions for wave-particle interactions, and to measure large-scale and fine-structure ionospheric effects of energy deposition in the ionosphere. The Langmuir Probe instrument was identical to that used on the AE satellites and the Pioneer Venus Orbiter. Two independent sensors were connected to individual adaptive sweep voltage circuits which continuously tracked the changing electron temperature and spacecraft potential, while autoranging electrometers adjusted their gain in response to the changing plasma density. The control signals used to achieve this automatic tracking provided a continuous monitor of the ionospheric parameters without telemetering each Volt-Ampere (V-I) curve. Furthermore, internal data storage circuits permitted high resolution, high data rate, sampling of selected V-I curves for transmission to ground to verify or correct the inflight processed data. More details are in J. P. Krehbiel et al., Space Sci. Instrum., v. 5, n. 4, p. 493, 1981.

------- DYNAMICS EXPLORER 2, CARIGNAN----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE COMPOSITION SPECTROMETER

NSSDC ID- 81-070B-03

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - G.R.	CARIGNAN	U OF MICHIGAN
OI - N.W.	SPENCER	NASA-GSFC
CI - C.A.	REBER	NASA-GSFC
OI - A.E.	HEDIN	NASA-GSFC
OI - B.P.	BLOCK	U OF MICHIGAN
OI - J.C.	MAURER	U OF MICHIGAN

BRIEF DESCRIPTION

The Neutral Atmosphere Composition Spectrometer (NACS) was designed to obtain in situ measurements of the neutral atmospheric composition and to study the variations of the neutral atmosphere in response to energy coupled into it from the magnetosphere. Because temperature enhancements, large-scale circulation cells, and wave propagation are produced by energy input (each of which posseses a specific signature in composition variation), the measurements permitted the study of the partition, flow, and deposition of energy from the magnetosphere. Specifically, the investigation objective was 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 system. The quadrupole 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. Atmospheric particles entered an antechamber through a knife-edged orifice, where they were thermalized to the instrument temperature. The ions with the selected charge-to-mass ratios had stable trajectories through the hyperbolic electric field, exited the analyzer, and entered into the detection system. An off-axis beryllium-copper dynode multiplier operating at a gain of 2.E6 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 optional measurement of the zonal and vertical components of the neutral wind. The mass select system provided for 256 mass values between 0 and 51 atomic mass units (u) or each 0.2 u. It was possible to call any one of these mass numbers into each of eight 0.016 second intervals. This sequence was repeatec each 0.128 s. More details are found in G. R. Carignan et al., Space Sci. Instrum., v. 5, n. 4, p. 429, 1981.

------- DYNAMICS EXPLORER 2, HANSON----------

INVESTIGATION NAME- RETARDING POTENTIAL ANALYZER

NSSDC ID- 81-070B-07

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL

PI - W.B.	HANSON	U OF TEXAS, DALLAS
OI - R.A.	HEELIS	U OF TEXAS, DALLAS
OI - D.R.	ZUCCARO	U OF TEXAS, DALLAS
OI - C.R.	LIPPENCOTT	U OF TEXAS, DALLAS

BRIEF DESCRIPTION

The Retarding Potential Analyzer (RPA) measured the bulk ion velocity in the direction of the spacecraft motion, the constituent ion concentrations, and the ion temperature along the satellite path. These parameters were derived from a least squares fit to the ion number flux vs. energy curve obtained by sweeping or stepping the voltage applied to the internal retarding grids of the RPA. In addition, a separate wide aperture sensor, a duct sensor, was flown to measure the spectral characteristics of irregularities in the total ion concentration. The measured parameters obtained from this investigation were important to the understanding of mechanisms that influence the plasma; i.e., to understand the coupling between the solar wind and the earth's atmosphere. The measurements were made with a multigridded planar Retarding Potential Analyzer very similar in concept and geometry to the instruments carried on the AE satellites. The retarding potential was variable in the range from approximately +32 to 0 volts. The details of this voltage trace and whether it was continuous or stepped, depended on the operating mode of the instrument. Specific parameters deduced from these measurements were ion temperature; vehicle potential; ram component of the ion drift velocity; the ion and electron concentration irregularity spectrum; and the concentration of H+, He+, O+, and Fe+, and of molecular ions near perigee. Additional details are in W. B. Hanson et al., Space Sci. Instrum., v. 5, n. 4, p. 503, 1981.

------- DYNAMICS EXPLORER 2, HAYS----------

INVESTIGATION NAME- FABRY-PEROT INTERFEROMETER

NSSDC ID- 81-070B-05

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

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - P.B.	HAYS	U OF MICHIGAN
OI - R.G.	ROBLE	NATL CTR FOR ATMOS RES
OI - G.R.	CARIGNAN	U OF MICHIGAN
OI - A.F.	NAGY	U OF MICHIGAN
OI - D.	REES	U COLLEGE LONDON
OI - 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, meridional wind, and density of the following metastable atoms-atomic oxygen (singlet S and D) and the 2P state of ionic atomic oxygen. The FPI performed a wavelength analysis on the light detected from the thermospheric emission features by spatially scanning the interference fringe plane with a multichannel array detector. The wavelength analysis characterized the Doppler line profile of the emitting species. A sequential altitude scan performed by a commandable horizon scan mirror provided a cross-sectional view of the thermodynamic and dynamic state of the thermosphere below the DE 2 orbit. The information obtained from this investigation 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 Airglow Experiment (VAE) used in the AE program. The addition of a scanning mirror, the Fabry-Perot etalon, an image plane detector, and a calibration lamp were the principal differences. Interference filters isolated lines at (in Angstroms) 5577, 6300, 7320, 5896, and 5200. The FPI had a field of view of 0.53 deg (half-cone angle). More details are found in P. B. Hays et al., Space Sci. Instrum., v. 5, n. 4, p. 395, 1981.

------- DYNAMICS EXPLORER 2, HEELIS----------

INVESTIGATION NAME- ION DRIFT METER

NSSDC ID- 81-070B-06

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - R.A.	HEELIS	U OF TEXAS, DALLAS
OI - W.B.	HANSON	U OF TEXAS, DALLAS
OI - D.R.	ZUCCARO	U OF TEXAS, DALLAS
OI - C.R.	LIPPENCOTT	U OF TEXAS, DALLAS

BRIEF DESCRIPTION

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 ion-drift 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 attitude determination. The nominal time resolution of the measurement was 1/32 s. This investigation yielded information on (1) the ion convection (electric field) pattern in the auroral and polar ionosphere; (2) the flow of plasma along magnetic field lines within the plasmasphere, which determines whether this motion was simply a breathing of the protonosphere, a refilling of this region after a storm, or an interhemispheric transport of plasma; (3) the thermal ion contribution to field-aligned electric currents; (4) velocity fields associated with small-scale phenomena that are important at both low and high latitudes; and (5) the magnitude 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 collimator 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 electrically 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, and this was done by taking the difference in the logarithms of the current. 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 both components. Here, each collector segment was permanently connected to a logarithmic amplifier and two difference amplifiers were used to determine the horizontal and vertical arrival angles simultaneously. The IDM consisted of two sensors, one providing the SDS output and the other providing the UDS output. Further details are in R. A. Heelis et al., Space Sci. Instrum., v. 5, n. 4, p. 511, 1981.

------- DYNAMICS EXPLORER 2, HOFFMAN----------

INVESTIGATION NAME- LOW ALTITUDE PLASMA INVESTIGATION HIGH ANGULAR RESOLUTION

NSSDC ID- 81-070B-13

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
AERONOMY
IONOSPHERES

PERSONNEL

PI - R.A.	HOFFMAN	NASA-GSFC
OI - J.D.	WINNINGHAM	SOUTHWEST RES INST
OI - D.M.	KLUMPAR	U OF TEXAS, DALLAS
OI - J.L.	BURCH	SOUTHWEST RES INST

BRIEF DESCRIPTION

This investigation used the suprathermal particle distribution functions measured by both the High-(81-070A-05) and Low-(81-070B-08) Altitude Plasma Instruments. The objectives were (1) to study the properties and locations of auroral acceleration mechanisms, (2) to determine the nature and distribution of electric fields parallel to the magnetic field, (3) to identify the charge carriers of the major electric current systems coupling the magnetosphere and ionosphere, and (4) to determine relations between these quantities, and the convection electric field and auroral light emission patterns.

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

INVESTIGATION NAME- ELECTRIC FIELD INVESTIGATIONS

NSSDC ID- 81-070B-02

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
PARTICLES AND FIELDS

PERSONNEL

PI - N.C.	MAYNARD	NASA-GSFC
OI - J.P.	HEPPNER	NASA-GSFC

BRIEF DESCRIPTION

The Vector Electric Field Instrument (VEFI) used flight-proven double-probe techniques with 20-m baselines to obtain measurements of dc electric fields. This electric field investigation had the following objectives: (1) to obtain accurate and comprehensive triaxial dc electric field measurements at ionospheric altitudes in order to refine the basic spatial patterns, define the large-scale time history of these patterns, and study the small-scale temporal and spatial variations within the overall patterns; (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 (4) to perform numerous correlative studies. The instrument consisted of six cylindrical elements 11 m long and 28 mm in diameter. Each antenna was insulated from the plasma except for the outer 2 m. The baseline, or distance between the midpoints of these 2-m active elements, was 20 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 ISEE 1, but modified for a three-axis measurement on a nonspinning spacecraft. At the core of the system were the high-impedance (1.E12 ohm) preamplifiers, whose outputs were accurately subtracted and digitized (14-bit a-d conversion for sensitivity to about 0.1 microvolt/m) to maintain high resolution, for subsequent removal of the cross-product of the vectors V and B in data processing. This provided the basic dc measurement. Other circuitry was used to aid in interpreting the dc data and to measure rapid variations in the signals detected by the antennas. The planned dc electric field range was plus or minus 1 V/m, the planned resolution was 0.1 mV/m, and the variational electric field was measured from 4 Hz to 1024 Hz. The dc electric field was measured at 16 samples/s. The variational electric field was measured from 1 microvolt/m to 10 mV/m rms. Additional details are found in N. C. Maynard et al., Space Sci. Instrum., v. 5, n. 4, p. 523, 1981.

------- DYNAMICS EXPLORER 2, MAYR----------

INVESTIGATION NAME- ATMOSPHERIC DYNAMICS AND ENERGETICS INVESTIGATION

NSSDC ID- 81-070B-12

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES
PARTICLES AND FIELDS

PERSONNEL

PI - H.G.	MAYR	NASA-GSFC
OI - G.P.	NEWTON	NASA HEADQUARTERS

BRIEF DESCRIPTION

The purpose of this investigation was to study the dynamic responses of the thermosphere and ionosphere to energy deposition in the form of Joule heating, particle precipitation, and momentum transfer by electric field-generated drifts. The objective was to determine the relative importance of the various phenomena and the conditions under which ordering occurs. Because the relative importance of the different processes varied with geomagnetic activity, both geomagnetically quiet and disturbed conditions were examined. Using theoretical models as tools, the principal goal was to quantitatively analyze the physical processes involved in the energy coupling between the magnetosphere and the thermosphere. In addition to data obtained from various DE satellite instruments, the investigation planned to use ground-based correlative measurements.

------- DYNAMICS EXPLORER 2, NAGY----------

INVESTIGATION NAME- MAGNETOSPHERIC ENERGY COUPLING TO THE ATMOSPHERE INVESTIGATION

NSSDC ID- 81-070B-10

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
AERONOMY
IONOSPHERES

PERSONNEL

PI - A.F.	NAGY	U OF MICHIGAN

BRIEF DESCRIPTION

This investigation used data from various spacecraft instruments to study the following: (1) global thermospheric dynamics (the effects of energy input to the thermosphere from the magnetosphere by convection, Joule heating, particle precipitation and tidal energy), (2) the convective coupling of the thermal plasma between the ionosphere and magnetosphere; and (3) the energy-loss mechanisms of ionospheric photoelectrons in the plasmasphere.

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

INVESTIGATION NAME- NEUTRAL-PLASMA INTERACTIONS INVESTIGATION

NSSDC ID- 81-070B-11

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

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL
PI - R.G. ROBLE NATL CTR FOR ATMOS RES

BRIEF DESCRIPTION
This investigation used data from several spacecraft instruments to study the large-scale neutral-plasma interactions in the thermosphere caused by magnetospheric-ionospheric and thermospheric coupling processes. Planned use of the models was to provide a theoretical framework in which certain important ionospheric and atmospheric properties needed for coupling processes (such as the Pedersen and Hall conductivities) were consistently calculated using satellite data measured at a given height. Planned examples include (1) to calculate vertical profiles of ionospheric properties that were useful for comparison with incoherent scatter radar measurements and other ground-based supporting data, (2) to identify and evaluate the neutral thermospheric heat and momentum sources, and (3) to determine the effectiveness of high-latitude dynamic processes in controlling the global thermospheric circulation and thermal structure.

------- DYNAMICS EXPLORER 2, SPENCER----------

INVESTIGATION NAME- WIND AND TEMPERATURE SPECTROMETER

NSSDC ID- 81-070B-04

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - N.W.	SPENCER	NASA-GSFC
OI - A.E.	HEDIN	NASA-GSFC
OI - H.B.	NIEMANN	NASA-GSFC
OI - G.R.	CARIGNAN	U OF MICHIGAN
OI - L.E.	WHARTON	NASA-GSFC
OI - J.C.	MAURER	U OF MICHIGAN

BRIEF DESCRIPTION
The Wind and Temperature Spectrometer (WATS) measured the in situ neutral winds, the neutral particle temperatures, and the concentrations of selected gases. The objective of this investigation was to study the interrelationships among the winds, temperatures, plasma drift, electric fields, and other properties of the thermosphere that were measured by other instruments on the spacecraft. Knowledge of how these properties are interrelatec helped contribute to an understanding of the consequences of the acceleration of neutral particles by the ions in the ionosphere, the acceleration of ions by neutrals creating electric fields, and the related energy transfer between the ionosphere and the magnetosphere. Three components of the wind, one normal to the satellite velocity vector in the horizontal plane, one vertical, and one in the satellite direction were measured. A retarding potential quadrupole mass spectrometer, coupled to the atmosphere through a precisely orificed antechamber, was used. It was operated in either of two modes, one employed the retarding capability and the other used the ion source as a conventional nonretarding source. Two scanning baffles were used in front of the mass spectrometer, one moved vertically and the other moved horizontally. The magnitudes of the horizontal and vertical components of the wind normal to the spacecraft velocity vector were computed from measurements of the angular relationship between the neutral particle stream and the sensor. The component of the total stream velocity in the satellite direction was measured directly by the spectrometer system through determination of the required retarding potential. At altitudes too high for neutral species measurements, the planned operation required the instrument to measure the thermal ion species only. A series of four sequentially occurring "slots" --each a 2-s long measurement interval-- was adapted for the basic measurement format of the instrument. Different functions were commanded into these "slots" in any combination, one per measurement interval. Further details are found in N. W. Spencer et al., Space Sci. Instrum., v. 5, n. 4, p. 417, 1981.

------- DYNAMICS EXPLORER 2, SUGIURA----------

INVESTIGATION NAME- MAGNETIC FIELD OBSERVATIONS

NSSDC ID- 81-070B-01

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
AERONOMY
MAGNETOSPHERIC PHYSICS

PERSONNEL

PI - M.	SUGIURA	NASA-GSFC
OI - B.G.	LEDLEY	NASA-GSFC
OI - W.H.	FARTHING	NASA-GSFC
OI - L.J.	CAHILL, JR.	U OF MINNESOTA

BRIEF DESCRIPTION
A triaxial fluxgate magnetometer (MAG-B) similar to one on board DE 1 (81-070A-01), was used to obtain magnetic field data needed to study the magnetosphere-ionosphere-atmosphere 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 spacecraft, and to correlate these measurements with observations of electric fields, plasma waves, suprathermal particles, thermal particles, and auroral images obtained from investigation 81-070A-03. The magnetometer had digital compensation of the ambient field in 8.E3 nT (8.E3 gamma) increments. The instrument incorporated its own 12-bit analog-to-digital converter, a 4-bit digital compensation register for each axis, and a system control that generated a 48-bit data word consisting of a 16-bit representation of the field measured along each of three magnetometer axes. Track and hold modules were used to obtain simultaneous samples on all three axes. The instrument bandwidth was 25 Hz. The analog range was plus or minus 6.2E4 nT, the accuracy was plus or minus 4 nT, and the resolution was 1.5 nT. More details can be found in W. H. Farthing et al., Space Sci. Instrum., v. 5, n. 4, p. 551, 1981.

------- DYNAMICS EXPLORER 2, WINNINGHAM----------

INVESTIGATION NAME- LOW ALTITUDE PLASMA INSTRUMENT

NSSDC ID- 81-070B-08

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
PARTICLES AND FIELDS
IONOSPHERES

PERSONNEL

PI - J.D.	WINNINGHAM	SOUTHWEST RES INST
OI - D.M.	KLUMPAR	U OF TEXAS, DALLAS
OI - R.A.	HOFFMAN	NASA-GSFC
OI - J.L.	BURCH	SOUTHWEST RES INST

BRIEF DESCRIPTION
The Low-Altitude Plasma Instrument (LAPI) provided high-resolution velocity space measurements of positive ions and electrons from 5 eV to 32 keV, and a monitor of electrons with energies above 35 keV. Pitch angle measurements covered the full 180 deg range. Data from this investigation and supporting measurements were used to study (1) the identification and intensities of Birkeland currents, (2) auroral particle source regions and acceleration mechanisms, (3) the existence and role of E parallel to B, (4) sources and effects of polar cap particle fluxes, (5) the transport of plasma within and through the magnetospheric cusp, (6) dynamic configurations of high-latitude flux tubes, (7) loss-cone effects of wave-particle interactions, (8) hot-cold plasma interactions, (9) ionospheric effects of particle precipitation, and (10) plasma convection at high altitudes. The instrument contained an array of 15 parabolic electrostatic analyzers of the ISIS 2 type, each with an electron channel and an ion channel, in order to obtain detailed pitch-angle distributions as a function of energy. Two Geiger-Mueller counters were mounted on the scan platform. The basic mode of operation provided a 32-point energy spectrum in the range 5 eV to 32 kev every second. The voltages on the electrostatic analyzers were programmable to allow for greater space/time resolution over limited portions of the energy and angular distributions. The instrument was mounted on a one-axis scan platform controlled by a magnetometer, whose purpose was to maintain the detector array, which spanned 180 deg, at nearly constant angle to the magnetic field. Additional details are found in J. D. Winningham et al., Space Sci. Instrum., v. 5, n. 4, p. 465, 1981.

********** ESRO 4**********

SPACECRAFT COMMON NAME- ESRO 4
ALTERNATE NAMES- PL-724C, 06285

NSSDC ID- 72-092A

LAUNCH DATE- 11/22/72 WEIGHT- 130. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
INTERNATIONAL ESA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 11/22/72
ORBIT PERIOD- 98.9 MIN INCLINATION- 91.1 DEG
PERIAPSIS- 252. KM ALT APOAPSIS- 1186. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
The ESRO 4 spacecraft was designed to investigate neutral particle and ion 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 -3.5 deg/day. The spacecraft was cylindrical in shape (similar in construction to ESRO 2), was spin stabilized, and used a PCM/PM telemetry mode transmitted in three forms: real-time telemetry at 64 bps, tape-recorder playback, and high-speed telemetry at 10,240 bps. The spacecraft spin rate was about 1 rps. The spin axis direction was changed periodically during the mission. The spacecraft reentered the earth's atmosphere after a successful mission on April 15, 1974.

------- ESRO 4, RAITT----------

INVESTIGATION NAME- POSITIVE ION SPECTROMETER

NSSDC ID- 72-092A-01 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - W.J. RAITT UTAH STATE U
OI - R.L.F.BOYD U COLLEGE LONDON

BRIEF DESCRIPTION
The primary objective of this experiment, designated as experiment S45 in ESRO project documents, was to measure the density and temperature of electrons and ions in the vicinity of the spacecraft, and to identify the prominent ion species present. Three spherical probes of different sizes were flown to obtain the desired measurements. The largest one, 19 cm in diameter, functioned as an ion mass spectrometer, and was surrounded by a spherical grid 20 cm in diameter which was maintained at a negative potential to repel electrons. Application of a suitable voltage sweep to the probe allowed species identifications to be made and their densities to be measured. One cycle of mass scan was made every 4.8 s. This sensor was mounted on a radial boom, approximately 130 cm from the spacecraft's skin, in order that it have a 360-deg "look angle," and that it sample the ionosphere outside the satellite's charge sheath. To keep this ion mass sensor from crossing the satellite's wake, the satellite's attitude had to be such that the velocity vector was kept inside a cone of approximately 55 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 main probe, i.e., 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 separation plane of the satellite (i.e., the rear) for approximately 35 cm, and was flown to monitor total ion density. The measurements from this sensor were also used to better interpret and eventually correct the measurements made with the main probe. This experiment required a minimum of 5.E3 sq cm of conducting area on the satellite skin, to be provided primarily by two additional spheres on the end of booms. To maintain the satellite at a reasonable potential for this experiment, the positive side of the solar cells was grounded. The experiment functioned normally until spacecraft reentry (April 15, 1974).

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

SPACECRAFT COMMON NAME- EXPLORER 1
ALTERNATE NAMES- 1958 ALPHA 1, 00004

NSSDC ID- 58-001A

LAUNCH DATE- 02/01/58 WEIGHT- 18.8 KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- JUNO

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-ARMY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 02/01/58
ORBIT PERIOD- 114.8 MIN INCLINATION- 33.24 DEG
PERIAPSIS- 358. KM ALT APOAPSIS- 2550. KM ALT

PERSONNEL
PM - J. FROELICH NASA-JPL
PS - A. HIBBS NASA-JPL

BRIEF 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-mW amplitude-modulatec transmitter and a 10-mW phase-modulated transmitter. Data were recorded only when the cylindrical spin-stabilized spacecraft was over one of 17 receiving stations. Both the high-power and low-power transmitters 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)
AERONOMY

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

BRIEF 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 deduced from sequential observations of the spacecraft position, using optical (Baker-Nunn camera network) and radio and/or radar tracking techniques. A good discussion of the general techniques used to deduce 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 Astrophysical Observatory special report n. 100, Cambridge, Mass., July 1962. This experiment resulted in the successful determination of reasonable density values until the spacecraft reentered the earth's atmosphere on March 31, 1970.

------- EXPLORER 1, MANRING----------

INVESTIGATION NAME- MICROMETEORITE DETECTOR

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

INVESTIGATION DISCIPLINE(S)
INTERPLANETARY DUST

PERSONNEL
PI - E. MANRING U OF NORTH CAROLINA
OI - M. DUBIN NASA-GSFC

BRIEF 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 rates of each size interval, the impinging velocity, the composition, and the density of the micrometeorite. The wire grid detector consisted of 12 cards (connected in parallel) mounted in a fiberglass supporting ring which in turn was mounted on the satellite's spherical surface. Each card was wound with enameled 17-micron-diameter nickel alloy 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 impact, destroy the electrical connection, and thus record the event. The acoustic detector (transducer and solid-state amplifier) was placed in acoustical contact with the middle section skin where it could respond to meteorite impacts on the spacecraft skin such that each recorded event would be a function of mass anc velocity. The effective area of this section was 0.075 sq m, and the average threshold sensitivity was 2.5E-3 gm-cm/s. During launch on February 1, 1958, one or two of the 12 grid detectors were apparently broken. The recorded grid data, valid for approximately 60 days after launch (February 1, 1958, to April 1, 1958), showed no more than one and possibly no detectors broken from meteorite impacts. Data from the acoustical sensor 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), 145 impacts were recorded (minus eight impacts that registered during the launch and injection into orbit). Due to poor signal-to-noise ratios, 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 satellite's 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 U OF IOWA
OI - G.H. LUDWIG NOAA-ERL

BRIEF DESCRIPTION
An Anton 314 omnidirectional Geiger tube detector was used to measure the flux of energetic charged particles (protons E>30 MeV and electrons E>3 MeV). The detector was saturated much of the time. The experiment performed normally until March 16, 1958, at which time the batteries powering the Geiger tube circuits became exhausted. No usable data were received after that time.

********** EXPLORER 4**********

SPACECRAFT COMMON NAME- EXPLORER 4
ALTERNATE NAMES- 1958 EPSILON 1, 00009

NSSDC ID- 58-005A

LAUNCH DATE- 07/26/58 WEIGHT- 25.5 KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- JUNO

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-ARMY
UNITED STATES NASA-JPL

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 07/26/58
ORBIT PERIOD- 110.2 MIN INCLINATION- 50.3 DEG
PERIAPSIS- 263. KM ALT APOAPSIS- 2213. KM ALT

PERSONNEL
PM - J. FROELICH NASA-JPL
PS - A. HIBBS NASA-JPL

BRIEF DESCRIPTION
Explorer 4 was a cylindrically shaped satellite instrumented to make the first detailed measurements of charged particles (protons and electrons) trapped in the terrestrial radiation belts. An unexpected tumble motion of the satellite made the interpretation of the detector data very difficult. The low-power transmitter and the plastic scintillator detector failed September 3, 1958. The two Geiger-Mueller tubes and the cesium iodide crystal detectors continued to operate normally until September 19, 1958. The high-power transmitter ceased sending signals on October 5, 1958. It is believed that exhaustion of the power batteries caused these failures. The spacecraft decayed from orbit after 454 days on October 23, 1959.

------- EXPLORER 4, VAN ALLEN----------

INVESTIGATION NAME- CHARGED PARTICLE DETECTOR

NSSDC ID- 58-005A-01 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - J.A. VAN ALLEN U OF IOWA
OI - L.A. FRANK U OF IOWA
OI - C.E. MCILWAIN U OF CALIF, SAN DIEGO
OI - G.H. LUDWIG NOAA-ERL

BRIEF DESCRIPTION
The purpose of this experiment was to extend the first measurements of the trappec radiation belt discovered with Explorers 1 and 3 and to provide measurements of artificially injected electrons from the three high-altitude Argus nuclear detonations. Four separate radiation detectors were used in the experiment: a shieldec directional plastic scintillation counter sensitive to electrons (E>700 keV) and protons (E>10 MeV), a shielded directional cesium iodide scintillation counter sensitive to electrons (E>20 keV) and protons (E>400 keV), an omnidirectional Anton type 302 GM ccunter sensitive to electrons (E>3 MeV) and protons (E>30 MeV), and a shielded omnidirectional Anton type 302 GM tube sensitive to electrons (E>5 MeV) and protons (E>40 MeV). The plastic scintillation counter and the cesium iodide scintillation counter were each viewed by a separate photomultiplier tube. These detectors were mounted orthogonally to the longitudinal axis of the satellite with apertures facing in opposite directions. The two GM counters were located side by side along the satellite longitudinal axis. The plastic scintillation counter failed about September 3, 1958, while the two GM counters and the cesium iodide detectors continued to operate normally until September 19, 1958.

********** EXPLORER 7**********

SPACECRAFT COMMON NAME- EXPLORER 7
ALTERNATE NAMES- 1959 ICTA 1, S 1A
00022

NSSDC ID- 59-009A

LAUNCH DATE- 10/13/59 WEIGHT- 41.50 KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- JUNO

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-ARMY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 10/21/59
ORBIT PERIOD- 101.38 MIN INCLINATION- 50.27 DEG
PERIAPSIS- 573. KM ALT APOAPSIS- 1073. KM ALT

PERSONNEL
PM - H.E. LAGOW(RETIRED) NASA-GSFC
PS - H.E. LAGOW(RETIRED) NASA-GSFC

BRIEF DESCRIPTION
Explorer 7 was designed to measure solar X-ray and Lyman-alpha flux, trapped energetic particles, and heavy primary cosmic rays (Z>5). Secondary objectives included collecting data on micrometeoroid penetration and molecular sputtering and studying the earth-atmosphere heat balance. The spin-stabilized satellite's external structure consisted of two truncated conical fiberglass 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 nickel-cadmium 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, 20 MHz) telemetry antennas projected outward from the center section, and a 108-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 cadmium sulfide micrometeoroid detector cells. A cylindrical ion chamber (lithium fluoride window) and a beryllium window X-ray chamber were located on opposite sides of the upper cone, and a cosmic-ray Geiger counter was located on the very top. A primary cosmic-ray ionization chamber was located within the center portion of the upper cone. Useful real-time data were transmitted from launch through February 1961 and intermittently until August 24, 1961.

------- EXPLORER 7, POMERANTZ----------

INVESTIGATION NAME- HEAVY PRIMARY COSMIC RAYS

NSSDC ID- 59-009A-03 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
COSMIC RAYS

PERSONNEL
PI - M.A. POMERANTZ U OF DELAWARE

BRIEF DESCRIPTION
This experiment was designed to measure the omnidirectional flux of heavy primary cosmic rays in the rigidity range 1 to 15.5 GV. Particles with atomic numbers Z>5, Z>8, and Z>15 were counted separately by an ionization chamber in which each incident particle yielded a pulse. Pulse amplitude was substantially independent of the energy of the incident particle but was proportional to the square of its Z value. Each of the three counting rates was determined every 15 s. The experiment performed as planned from launch until October 25, 1959, to May 31, 1960, period are useful, with most problems occurring in the lowest Z mode. Very little useful data were acquired after May 31, 1960.

------- EXPLORER 7, SUOMI----------

INVESTIGATION NAME- THERMAL RADIATION

NSSDC ID- 59-009A-01 INVESTIGATIVE PROGRAM
CODE EE-8, APPLICATIONS

INVESTIGATION DISCIPLINE(S)
METEOROLOGY

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 forces of the earth-atmosphere system. The primary instrumentation consisted of five bolometers in the form of hollow silver hemispheres that were thermally insulated from, but in close proximity to specially aluminized mirrors. The hemispheres thereby behaved very much like isolatec spheres in space. Two of the hemispheres had black coatings and responded about equally to solar and terrestrial radiation. A third hemisphere, coated white, was more sensitive to terrestrial radiation than to solar radiation. A fourth, which had a gold metal surface, 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- 59-009A-04 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - J.A. VAN ALLEN U OF IOWA
OI - G.H. LUDWIG NOAA-ERL
OI - L.A. FRANK U OF IOWA

BRIEF DESCRIPTION
Two omnidirectional Geiger counters (Anton 302 and 112) were used to conduct a comprehensive spatial and temporal monitoring of total cosmic-ray intensity, geomagnetically trapped corpuscular radiation, and solar protons. The detector was sensitive to protons (E>20 MeV) and electrons (E>30 keV). The experiment operated satisfactorily from launch until February 28, 1961, except for a brief period in September and October 1960.

********** EXPLORER 8**********

SPACECRAFT COMMON NAME- EXPLORER 8
ALTERNATE NAMES- 1960 XI 1, 00060
S 30

NSSDC ID- 60-014A

LAUNCH DATE- 11/03/60 WEIGHT- 41. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- JUNO

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 11/03/60
ORBIT PERIOD- 112.7 MIN INCLINATION- 50.0 DEG
PERIAPSIS- 417. KM ALT APOAPSIS- 2288. KM ALT

PERSONNEL
PM - R.E. BOURDEAU(RETIRED) NASA-GSFC
PS - R.E. BOURDEAU(RETIRED) NASA-GSFC

BRIEF DESCRIPTION
Explorer 8 was a 41-kg mercury-battery-powered, earth-orbiting satellite designed to obtain measurements in the ionosphere at altitudes between 400 and 1600 km, of the electron density, the electron temperature, the ion concentration, the ion mass, the micrometeorite distribution, and the micrometeorite mass. It was intendec to stucy 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 aluminum and had a diameter of 76 cm and a height of 76 cm. The 108.00-MHz transmitter had 100 mW 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 on solar cell surfaces, solar cells were not used. Experiment instrumentation included an RF impedance probe, an ion current monitor, a retarding potential probe, a two-element and a three-element electron temperature probe, an electron current monitor, a photomultiplier-type and a microphone-type micrometeorite detector, an electric field meter, a solar horizon sensor, and thermistor temperature probes. Simultaneous measurements of electron and ion concentration were used to resolve the question of neutrality of the medium. Battery power failed on December 27, 1960. Considerable difficulty was encountered with decommutating the telemetered data to make 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 8, JACCHIA----------

INVESTIGATION NAME- SATELLITE DRAG ATMOSPHERIC DENSITY

NSSDC ID- 60-014A-07 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

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

BRIEF DESCRIPTION
Because of its symmetrical shape, Explorer 8 was selected for use in determining upper atmospheric densities as a function of altitude, latitude, season, 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-Nunn camera network) and radio and/or radar tracking techniques. A good discussion of the general techniques used to deduce 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 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 8 has an expected orbital lifetime of 80 yr.

********** EXPLORER 9**********

SPACECRAFT COMMON NAME- EXPLORER 9
ALTERNATE NAMES- 1961 DELTA 1, S 56A
00081

NSSDC ID- 61-004A

LAUNCH DATE- 02/16/61 WEIGHT- 36.0 KG
LAUNCH SITE- WALLOPS FLIGHT CENTER, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 02/16/61
ORBIT PERIOD- 118.6 MIN INCLINATION- 38.91 DEG
PERIAPSIS- 545. KM ALT APOAPSIS- 2225. KM ALT

PERSONNEL
PM - C.W. COFFEE, JR. NASA-LARC
PS - R.F. FELLOWS(RETIRED) NASA HEADQUARTERS

BRIEF DESCRIPTION
Explorer 9 was the first in a series of 3.66-m inflatable spheres placed into orbit solely for the determination of atmospheric densities. The spacecraft consisted of alternating layers of aluminum foil and plastic film. Uniformly distributed over the aluminum surface were 5.1-cm dots of 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 SAO Baker-Nunn camera network had to be relied upon for tracking. The spacecraft reentered the earth's atmosphere on April 9, 1964.

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

INVESTIGATION NAME- SATELLITE DRAG ATMOSPHERIC DENSITY

NSSDC ID- 61-004A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - W.J. O'SULLIVAN, JR. NASA-LARC
OI - C.W. COFFEE, JR. NASA-LARC
OI - G.M. KEATING NASA-LARC
OI - L.G. JACCHIA SAO

BRIEF DESCRIPTION
Because of its symmetrical shape, Explorer 9 was selected for use in determining 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 position, using optical (Baker-Nunn 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. G. Jacchia and J. Slowey, "Accurate drag determination for eight artificial satellites of atmospheric densities and temperatures," Smithsonian Astrophysical Observatory special report n. 100, Cambridge, Mass., July 1962. This experiment resulted in the successful determination of reasonable density values until the satellite reentered the earth's atmosphere on April 9, 1964.

********** FR 1**********

SPACECRAFT COMMON NAME- FR 1
ALTERNATE NAMES- 01814, FRANCE-1

NSSDC ID- 65-101A

LAUNCH DATE- 12/06/65 WEIGHT- 60. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
FRANCE CNES
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/09/65
ORBIT PERIOD- 99.94 MIN INCLINATION- 75.87 DEG
PERIAPSIS- 746. KM ALT APOAPSIS- 762. KM ALT

PERSONNEL
PM - X. NAMY CNES
PM - S.R. STEVENS(NLA) NASA-GSFC
PS - L.R. STOREY CNET
PS - R.W. ROCHELLE(RETIRED) NASA-GSFC

BRIEF DESCRIPTION
The FR-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 pyramics, joined at their bases by an octagonal prism measuring 68.6 cm across from corner to corner. This basic structure was covered with solar cells and measured about 71.2 cm high. Extending 48.3 cm downward from the base of this structure was the electron density probe. 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 artennas. Four 198-cm-long electric field antenna booms extended outward from the base of the prismatic portion of the basic structure. The spacecraft was spin-stabilized, with attitude anc spin determination made from observations by a sur sensor and a three-axis fluxgate magnetometer. This satellite was used to study VLF propagation in the magnetosphere and irregularities in the topside ionosphere. There was no tape recorder onboard, so real-time data were obtained as scheduled, over designated telemetry stations. The spacecraft operated successfully until August 1968.

------- FR 1, STOREY----------

INVESTIGATION NAME- VLF RECEIVER

NSSDC ID- 65-101A-01 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - L.R.O.STOREY IONOSPHERIC RES GROUP
OI - C. RENARD U OF BOURGES
CI - M.P. AUBREY CNET

BRIEF DESCRIPTION
This 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 loop 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 far exceeded the 3-month planned lifetime. These five wide-dynamic-range (52dB), narrowband (160 Hz), VLF receivers received at frequencies of 16.8 kHz (St. Assise, France -FUB), or at 24.0 kHz (Balboa, Panama -NBA). For a more extensive experiment description see L. R. O. Storey, "Preliminary results on VLF propagation in the lower magnetosphere obtained by the FR 1 satellite," Space Research, n. 7, pp. 588-603, North Holland Pub. Co., Amsterdam, 1967.

********** GRS-A**********

SPACECRAFT COMMON NAME- GRS-A
ALTERNATE NAMES- PL-6940, AZUR,GERMAN RESEARCH SAT
GRS-A1, 04221

NSSDC ID- 69-097A

LAUNCH DATE- 11/08/69 WEIGHT- 70.7 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
FED REP OF GERMANY DFVLR
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 11/10/69
ORBIT PERIOD- 122.00 MIN INCLINATION- 102.96 DEG
PERIAPSIS- 387. KM ALT APOAPSIS- 3150. KM ALT

PERSONNEL
PM - A. KUTZER GES FUR WELTRAUMFORSCH
PM - A.L. FRANTA(RETIRED) NASA-GSFC
PS - E. KEPPLER MPI-AERONOMY
PS - G.F. PIEPER NASA-GSFC

BRIEF DESCRIPTION
The magnetically aligned spacecraft GRS-A, launched into a near-polar orbit in November of 1969, was a product of a joint effort by NASA-GSFC and the German Bundesministerium fur Wissenschaftliche Forschung (BMWF) and had as its primary purpose the acquisition of terrestrial radiation belt data. Specifically, the scientific mission of the spacecraft was as follows: (1) to scan the energy spectra of inner zone protons and electrons, (2) to measure the fluxes of electrons of energy greater than 40 keV that are parallel, antiparallel, and perpendicular to the magnetic lines of force over the auroral zone and to measure associated optical emission, and (3) to record solar protons on alert. After about 24 hours in orbit, a commanc system instability developed and persisted intermittently throughout the flight. The tape recorder failed on December 8, 1969. Prior to this failure, the German project office estimated that 85-90% of the expected data had been obtained. All experiments were operating normally until the spacecraft telemetry system malfunctioned in early July 1970.

------- GRS-A, HOVESTADT----------

INVESTIGATION NAME- PROTON-ALPHA TELESCOPE

NSSDC ID- 69-097A-02 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - D.K. HOVESTADT MPI-EXTRATERR PHYS

BRIEF DESCRIPTION
This experiment consisted of two identical proton-alpha particle telescopes, one oriented perpendicular and one oriented at 45 deg with respect to the local magnetic field vector. In the northern hemisphere, the 45-deg telescope pointed upwards. The telescopes were to detect protons and alpha particles in the earth's trapping region. The experiment was also used in conjunction with experiment 69-097A-04 (proton-electron detectors) to provide pitch angle distributions for protons above 20 MeV. Each telescope was composed of seven fully depleted silicon surface barrier detectors (D1 through D7) surrounded by a plastic anticoincidence scintillator (D8) and a heavy shielding (proton threshold energy of 75 MeV). The seven energy channels for which data were obtained are as follows: protons 1.5 to 2.7, 2.7 to 5.2, 5.2 to 10.4, 10.4 to 22, 22 to 49, and 49 to 104 MeV, and alpha particles 6 to 19 MeV. The telescopes had geometric factors of about 0.0580 sq cm sr. The acceptance cone of both telescopes was 31-deg full angle. The experiment performed normally throughout the mission.

------- GRS-A, HOVESTADT----------

INVESTIGATION NAME- PROTON-ELECTRON DETECTOR

NSSDC ID- 69-097A-04 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS
PARTICLES AND FIELDS

PERSONNEL
PI - D.K. HOVESTADT MPI-EXTRATERR PHYS

BRIEF DESCRIPTION
This experiment consisted of two omnidirectional proton/electron detectors composed of cubical lithium-drifted silicon elements, heavily shielded on one side and covered by a hemispherical shield over a 2-pi sr solid angle on the other side. The detectors were used to measure trapped and solar protons and electrons, and the experiment was also used in conjunction with experiment 69-097A-02 (proton/alpha particle telescopes) to provide pitch angle distributions for protons above 20 MeV. One of the detectors was sensitive to electrons with E>1.5 MeV and protons with E>20 MeV in one electrical threshold moce and sensitive only to protons from 20 to 45 MeV in the other mode. Similarly, the other detector was sensitive to electrons with E>4 MeV and protons with E>40 MeV in one electrical threshold mode and sensitive only to protons from 40 to 72 MeV in the other mode. The experiment performed normally throughout the mission.

------- GRS-A, MORITZ----------

INVESTIGATION NAME- PROTON TELESCOPE

NSSDC ID- 69-097A-03

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

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS
PARTICLES AND FIELDS

PERSONNEL
PI - J. MORITZ 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 channels: protons from 0.25 to 1.65, 0.25 to 12.5, 0.5 to 1.65, 1.0 to 1.65, and 1.65 to 13.5 MeV, and alpha particles from 2.0 to 6.4 MeV. Electrons were eliminated from the incident beam by using a broom magnet. The acceptance cone was 20.4 deg full angle. The experiment worked normally until the spacecraft telemetry system malfunctioned in early July 1970.

------- GRS-A, MUSMANN----------

INVESTIGATION NAME- FLUXGATE MAGNETOMETER

NSSDC ID- 69-097A-01

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

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - G. MUSMANN BRAUNSCHWEIG TECH U

BRIEF DESCRIPTION
A two-component fluxgate magnetometer with two identical electrically independent measuring units was used as an attitude sensor and as an experiment for detecting transverse hydromagnetic waves. 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.E4 nT, with 4.8-nT digitization resolution. Each sensor was sampled for 125 ms once every 5 s. The experiment worked normally until the spacecraft telemetry system malfunctioned in early July 1970. For further details, see B. Theile and H. M. 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**********

SPACECRAFT COMMON NAME- IE-A
ALTERNATE NAMES- EXPLORER 20, S 48
TOPSI, 00870

NSSDC ID- 64-051A

LAUNCH DATE- 08/25/64 WEIGHT- 44. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/12/65
ORBIT PERIOD- 104. MIN INCLINATION- 79.9 DEG
PERIAPSIS- 864. KM ALT APOAPSIS- 1025. KM ALT

PERSONNEL
PM - J.E. JACKSON NASA-GSFC
PS - J.E. JACKSON NASA-GSFC

BRIEF DESCRIPTION
Explorer 20 was designed to measure electron distribution, ion density and temperature, and to estimate cosmic noise levels between 2 and 7 MHz. The satellite was a small ionospheric observatory instrumented with a six-frequency ionospheric sounder and an ion probe. A cosmic noise experiment used the noise signal from the sounder receivers. The satellite consisted of a short cylinder terminated on either end by truncated cones. The ion probe, mounted on a short boom, extended from the upper cone. The six sounding antennas (3 dipoles) extended from the satellite equator. One pair of 18.28 m antennas formed the dipole used for the low frequencies, and the other two dipoles consisted of four 9.14 m antennas. The satellite was spin stabilized at 1.53 rpm just after antenna extension, with the spin axis initially very close to the orbit plane. At the end of 1 year, the spin had slowed to 0.45 rpm. Since there was no tape recorder, data were received only in the vicinity of telemetry stations. Telemetry stations were located to provide primary data coverage near 80 deg W plus areas near Hawaii, Singapore, England, Australia, and Africa. Data were recorded for periods of 1/2 h to over 4 h per day depending upon available power. Even though there were problems with telemetry and interference, the experiments operated satisfactorily for about 16 months. A large spacecraft plasma sheath prevented the ion probe data from being useful in spite of attempts to compensate. For this spacecraft, the 1-yr automatic satellite turnoff was disconnected just prior to launch. The satellite responses to command signals were not dependable after December 20, 1965, and the satellite transmitter, which was often spuriously turned on, did not respond to a turnoff command.

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

INVESTIGATION NAME- SPHERICAL ION-MASS SPECTROMETER

NSSDC ID- 64-051A-02

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - R.L.F.BOYD(RETIRED) U COLLEGE LONDON
OI - A.P. WILLMORE U OF BIRMINGHAM

BRIEF DESCRIPTION
The ion probe on Explorer 20 was a spherical retarding potential instrument from which ion mass spectra and ion temperatures could be determined. It consisted of a spherical inner electrode, 9 cm in diam, surrounded by a spherical, gridded (0.5 mm holes), nickel foil covering, 10 cm in diam and 0.1 mm thick. A negative charge was maintained in the grid to remove electron effects. The more massive ions passed through the grid to form an ion current dependent upon the voltage condition of the inner electrode. A slow-sweeping sawtooth potential from about -2 to +10 volts (with two low-voltage, 0.5- and 3.2-kHz sinewave forms impressed upon it) provided a profile of voltage versus ion current. The change in slope of the voltage versus ion current profile, gives the energy distribution profile, which, for thermal ions, is a function of ion mass and satellite velocity. Thermal ion velocities broaden the mass peaks somewhat and thereby degrade mass resolution slightly, but this broadening effect was used to determine the ion temperature. Analysis of current variations resulting from the two sinewave forms on the sweep voltage, provided the required slope change data for analysis of the profiles. The probe was mounted at the positive end of the spin (Z) axis on a short tubular support. With the nominal spin axis, perpendicular to the orbit plane, this arrangement eliminated spin modulation of the observations. Although this experiment functioned properly, the occurrence of a large plasma sheath about the spacecraft, prevented acquisition of scientifically useful data.

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

INVESTIGATION NAME- FIXED-FREQUENCY IONOSONDE

NSSDC ID- 64-051A-01

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - R.W. KNECHT NATL BUREAU OF STD
OI - W. CALVERT U OF IOWA
OI - T.E. VAN ZANDT NOAA-ERL
OI - R.B. NORTON NOAA-ERL
OI - J.M. WARNOCK NOAA

BRIEF DESCRIPTION
The purpose of the fixed-frequency ionosonde was to investigate ionospheric 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 once every 0.105 second. Several delay times were often observed for each frequency due to plasma resonances, birefringence of the ionosphere, nonvertical propagation, etc. 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 1450 h of data was acquired. Most of these data were of adequate quality to prepare ionograms. Since only time is noted on each ionogram, satellite position 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 EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS
ASTRONOMY

PERSONNEL
PI - R.G. STONE NASA-GSFC

BRIEF DESCRIPTION
The cosmic noise experiment utilized the noise signal from the sounder receiver to investigate cosmic noise in the 1.5- to 7.2-MHz frequency range. The measurements were in rough agreement with previous observations of cosmic noise. The receiver calibration, however, was not sufficiently accurate to yield new scientific results.

********** INJUN 1**********

SPACECRAFT COMMON NAME- INJUN 1
ALTERNATE NAMES- 1961 OMICRON 2, INJUN-SR-3
00117, GREBE 3
SOLRAD 3

NSSDC ID- 61-015B

LAUNCH DATE- 06/29/61 WEIGHT- 16. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES U OF IOWA
UNITED STATES DOD-NAVY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 06/29/61
ORBIT PERIOD- 103.9 MIN INCLINATION- 66.82 DEG
PERIAPSIS- 882. KM ALT APOAPSIS- 999. KM ALT

PERSONNEL
PM - J.A. VAN ALLEN U OF IOWA
PS - B.J. O'BRIEN(NLA) U OF IOWA

BRIEF DESCRIPTION
The satellite Injun 1 was the first of a series of spacecraft designed and built by the University of Iowa to study the natural and artificial trapped radiation belts, auroras and airglow, and other geophysical phenomena. Injun 1 was launched simultaneously with Transit 4A and Grebe 3. Transit 4A successfully separated from Injun 1, but Grebe 3 did not. Injun 1 was designed to be magnetically aligned. However, due to the presence of Grebe 3 (which blocked the view of the photometer), it was impossible to keep the satellite constantly oriented on the terrestrial magnetic field throughout an orbit. A single axis fluxgate magnetometer was used to monitor the orientation of the spacecraft with respect to the local magnetic field. Injun 1 had a complex spin-and-tumble motion with an ill-defined and variable period of several minutes. The satellite sent back radiation data until March 6, 1963, and is expected to be in orbit for about 900 yr.

------- INJUN 1, BOSTROM----------

INVESTIGATION NAME- SOLID-STATE PROTON DETECTOR

NSSDC ID- 61-015B-06 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - C.O. BOSTROM APPLIED PHYSICS LAB
OI - A.J. ZMUDA(DECEASED) APPLIED PHYSICS LAB
OI - G.F. PIEPER NASA-GSFC

BRIEF DESCRIPTION
This experiment consisted of four silicon p-n junction detectors. Two detectors mounted perpendicular with respect to each other measured directional fluxes of protons in the energy ranges 1.4 to 17 MeV and 1.6 to 11 MeV, respectively. The remaining two detectors served as background detectors. The detectors were insensitive to naturally occurring electrons. Counts in each detector were accumulated for almost a full second and were telemetered every second. The detectors worked well until July 9, 1962, after which Starfish electrons contaminated the data. Loss of the intended magnetic alignment rendered the data useless for detailed pitch angle studies.

------- INJUN 1, FRANK----------

INVESTIGATION NAME- GM COUNTER

NSSDC ID- 61-015B-01 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - L.A. FRANK U OF IOWA
OI - J.A. VAN ALLEN U OF IOWA

BRIEF DESCRIPTION
An Anton type 213 directional Geiger tube detector was used to detect solar X rays in the 2 to 12-A range, electrons (E>40 keV), and protons (E>0.5 MeV). The detector was sampled every second, and the accumulation time for the detector was 61/64 s. The spacecraft had a complex spin-and-tumble motion with a poorly defined period of several minutes. The soft X-ray observations were made at sporadic intervals from June 29, 1961, through August 12, 1962 (about 74 min of data). The experiment performed nominally throughout the life of the spacecraft.

------- INJUN 1, FREEMAN----------

INVESTIGATION NAME- CADMIUM SULFIDE DETECTOR

NSSDC ID- 61-015B-02 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - J.W. FREEMAN RICE U
OI - B.J. O'BRIEN DEPT OF ENVIRON PROT

BRIEF DESCRIPTION
A set of five directional cadmium sulfide (CdS) crystal energy flux detectors was used to study the flux of low-energy protons and ions trapped in the inner radiation belt. Two of the detectors (CdS total energy detectors oriented at 90 and 180 deg with respect to the satellite symmetry axis) had no physical obstruction between space and the crystal and were sensitive to electrons (200 eV to 500 keV) and protons (1 keV to 10 MeV). The second two CdS detectors (CdS proton energy detectors oriented at 90 and 180 deg with respect to the satellite symmetry axis) were identical to the total energy detectors but included small broom magnets that swept electrons with E<500 keV from the beam incident on the crystal. The magnets provided a field of 5.E-2 T and subtended a solid angle of 0.5 sr at the crystal. The fifth CdS detector (optical monitor oriented at 90 deg with respect to the satellite symmetry axis) was geometrically identical to the other four but was, in addition, fitted with a 0.5 gm/sq cm transparent quartz window and hence served as a light and X-ray detector. All five detectors had direct current outputs proportional to the incident charged corpuscular energy flux. The detectors were sampled at least once every second, and the detector accumulation times ranged from 9/64 to 61/64 s. (The spacecraft had a complex spin-and-tumble motion with an ill-defined and variable period of several minutes). The experiment performed nominally throughout the lifetime of the spacecraft.

------- INJUN 1, KREPLIN----------

INVESTIGATION NAME- 2- TO 8-A AND 8- TO 20-A X-RAY DETECTORS

NSSDC ID- 61-015B-07 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS

PERSONNEL
PI - R.W. KREPLIN US NAVAL RESEARCH LAB

BRIEF DESCRIPTION
This experiment consisted of two ionization chambers mounted 60 deg apart on the equator of the GREB 3 satellite along with a sun aspect sensor and telemetry antennas. These detectors were designed to measure solar X rays in the 2 to 8-A and 8 to 20-A bands and were mounted behind permanent magnets to shield them from penetration by energetic protons (less than 1 MeV) and electrons (less than 1 MeV) in the Van Allen radiation belts. Each magnet and its aluminum retaining cover effectively limited the detector look cone to an angular diameter of approximately 60 deg. The spectral sensitivity of the X-ray detectors was determined by their aluminum windows and nitrogen gas filler. The solar aspect sensor was a vacuum photocell behind a specially designed aperture and was designed to measure the angle between the sun and the satellite's equatorial plane. Data handling was essentially the same as that used for the GREB 1 X-ray experiment. Current from the ionization chambers was measured by a feedback-stabilized electrometer amplifier. Data were then telemetered to the ground using real-time FM/AM telemetry and were recorded by NASA minitrack stations on magnetic tape. The failure of the GREB 3 satellite to separate from Injun 1 resulted in a complicated tumbling motion of the composite satellite, which made it generally impossible to identify unambiguously an X-ray response from one or the other ion chamber. Therefore, no data from the 2 to 8-A detector were obtained. Data from the 8 to 20-A detector, however, were obtained from favorable ion chamber-aspect sensor geometry configurations (69 observations) and from close coincidences between the 8 to 20-A detector and solar aspect sensor responses (32 observations). The ion chambers also suffered from three types of energetic particle interference: (1) inner-zone protons with E>1 MeV, (2) high-energy solar protons associated with solar proton events, and (3) high-energy outer-zone electrons (the strongest source of particle contamination). Data were obtained for the period June 29 to November 26, 1961.

------- INJUN 1, LAUGHLIN----------

INVESTIGATION NAME- ELECTRON DIFFERENTIAL ENERGY SPECTROMETER

NSSDC ID- 61-015B-03

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
AERONOMY

PERSONNEL
PI - C.D. LAUGHLIN MCDONALD OBS

BRIEF DESCRIPTION
This experiment was designed to study auroral and radiation zone phenomena using three end-window type 213 directional Geiger-Mueller (GM) counters. Small magnets were used to focus electrons with energies between 40 and 50 keV into one of the GM counters anc electrons with energies between 90 and 100 keV into another counter. The third GM counter served as a monitor of penetrating X rays and energetic protons. The detector accumulators were sampled once per second, and the accumulation time for each detector was 61/64 s. (The spacecraft had a complex spin-and-tumble motion with an ill-defined and variable period of several minutes). The experiment performed nominally throughout the lifetime of the spacecraft.

------- INJUN 1, O'BRIEN----------

INVESTIGATION NAME- AURORAL AND AIRGLOW PHOTOMETER

NSSDC ID- 61-015B-04

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
AERONOMY

PERSONNEL
PI - B.J. O'BRIEN DEPT OF ENVIRON PROT

BRIEF DESCRIPTION
A photometer was included in the payload cf Injun 1 for the purpose of measuring the auroral and airglow intensities of the atomic oxygen green line at 5577 A. A malfunction prevented the separation of Injun 1 from the Naval Research Laboratory satellite, GREB 3 (also known as Solrad 3). Greb 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.

------- INJUN 1, VAN ALLEN----------

INVESTIGATION NAME- FLUXGATE MAGNETOMETER

NSSDC ID- 61-015B-05

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

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 look directions of the various detectors. The magnetometer, mounted in a pointing direction normal to the magnetic field vector, hac a range of 0 to 5.E-5 T. Measurements were made at the rate of one per second, with each fourth measurement being used as a calibration check. The magnetometer performed normally throughout the lifetime of Injun 1.

********** INJUN 3**********

SPACECRAFT COMMON NAME- INJUN 3
ALTERNATE NAMES- 1962 BETA TAU 2, INJUN 2B
00504

NSSDC ID- 62-067B

LAUNCH DATE- 12/13/62 WEIGHT- 52. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-NAVY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/13/62
ORBIT PERIOD- 116. MIN INCLINATION- 70.38 DEG
PERIAPSIS- 235. KM ALT APOAPSIS- 2785. KM ALT

PERSONNEL
PM - J.A. VAN ALLEN U OF IOWA
PS - B.J. O'BRIEN(NLA) U OF IOWA

BRIEF DESCRIPTION
Injun 3 was a magnetic field-aligned-spacecraft instrumentec for a study of geophysical phenomena, particularly high-latitude and auroral, using an integrated system of several particle detectors, a VLF detector, and three auroral photometers. A fluxgate magnetometer was used to monitor the orientation of the spacecraft with respect to the local magnetic field. Injun 3 had two separate telemetry and encoding systems: mode 1 (PCM/FSK/PM) and mode 5 (PCM/FSK/AM). These systems were powered by a common-battery solarcell power supply. The spacecraft was launched simultaneously with and successfully separated from the U.S. Air Force spacecraft 1962 Beta Tau. Injun 3 performed normally until late October 1963 when the satellite power supply (chemical batteries) failed. The satellite command system was partially impaired after some time in March 1963. The satellite decayed from orbit August 25, 1968. For further details about Injun 3 and its complement of experiments see B. J. O'Brien et al., J. Geophys. Res., v. 69, n. 1, p. 1, 1964.

------- INJUN 3, GURNETT----------

INVESTIGATION NAME- VLF ELECTROMAGNETIC RADIATION

NSSDC ID- 62-067B-09

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - D.A. GURNETT U OF IOWA
OI - S.D. SHAWHAN U OF IOWA
OI - B.J. O'BRIEN DEPT OF ENVIRON PROT

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 man-made signals from the ground or satellites, spherics, ionospheric or magnetospheric noise, and noise from other extraterrestrial sources. The receiver system used a 30.5-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 5.E-11 sq nT (sq gammas) per Hz. This experiment had three data outputs: (1) wideband (0.5 to 7.0 kHz) spectral information in analog form, (2) wideband (0.5 to 7.0 kHz) signal strength in digital form, and (3) 6 channels (0.7, 2.7, 4.3, 5.5, 7.0, and 8.8 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 1.E-3 to 1.E-1 nT. 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, ranging from 1.E-11 to 1.E-7 sq nT per Hz, with an additional two satellite-controlled attenuation steps of 20 dB each. Digital resolution was 2.5 dB. Both digital and analog data were recorded almost continuously from launch to spacecraft failure on October 28, 1963. More details about the VLF experiment construction, calibration, and operation are in D. A. Gurnett anc B. J. O'Brien, J. Geophys. Res., v. 69, n. 1, p. 65, 1964.

------- INJUN 3, JACCHIA----------

INVESTIGATION NAME- SATELLITE DRAG ATMOSPHERIC DENSITY

NSSDC ID- 62-067B-13

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
AERONOMY

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

BRIEF DESCRIPTION
Because of its symmetrical shape, Injun 3 was selected by the experimerters for use in determining upper atmospheric densities as a function of altitude, latitude, season, 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-Nunn camera network) and radio and/or radar tracking techniques. Reasonable density values were obtained until the spacecraft reentered the earth's atmosphere on August 25, 1968.

------- INJUN 3, O'BRIEN----------

INVESTIGATION NAME- GEIGER TUBE DETECTORS

NSSDC ID- 62-067B-01

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - B.J.	O'BRIEN	DEPT OF ENVIRON PROT
OI - L.A.	FRANK	U OF IOWA

BRIEF DESCRIPTION
A set of four Geiger-Mueller (GM) counters was used to detect electrons and protons in the radiation belts. Three Type 213 detectors pointed directionally at 90, 130, or 180 deg with respect to the local magnetic field, and had full-width viewing angles of 26, 26, and 86 deg, respectively. The fourth detector was a Type 302 omnidirectional GM tube. Orientation of the detectors was defined so that 0 deg corresponded to a detector looking downward toward the earth in the northern hemisphere. The 90 deg GM tube had threshold energies of 4 MeV for protons and 250 keV for electrons. The other two 213 GM tubes had 0.5 MeV (protons) and 40 keV (electrons) thresholds, while the 302 tube had 20 MeV (protons) and 1.5 MeV (electrons) thresholds. The detector accumulators were sampled every 0.25 s in mode 1 and every second in mode 5. The experiment operated nominally from launch until late October 1963 when the satellite power supply failed. For further details see B. J. O'Brien, J. Geophys. Res., v. 69, n. 1, p. 13, 1964.

------- INJUN 3, O'BRIEN----------

INVESTIGATION NAME- PULSE SCINTILLATOR

NSSDC ID- 62-067B-02

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - B.J.	O'BRIEN	DEPT OF ENVIRON PROT
OI - C.E.	MCILWAIN	U OF CALIF, SAN DIEGO

BRIEF DESCRIPTION
An omnidirectional pulse scintillator composed of a spherical plastic scintillator and photomultiplier tube was used to detect protons with E>40 MeV in the natural and artificial radiation belts, as a function of location and time. The detector, which protruded beyond the satellite shell, was oriented at 180 deg to the local magnetic field direction and had an unobstructed view over almost 2 pi sr. The detector accumulators were sampled every 0.25 s in telemetry mode 1 and every second in telemetry mode 5. The experiment operated nominally from launch until late October 1963 when the satellite power supply failed.

------- INJUN 3, O'BRIEN----------

INVESTIGATION NAME- MAGNETIC DIFFERENTIAL ELECTRON SPECTROMETER

NSSDC ID- 62-067B-03

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - B.J.	O'BRIEN	DEPT OF ENVIRON PROT
OI - C.D.	LAUGHLIN	MCDONALD OBS

BRIEF DESCRIPTION
A magnetic differential spectrometer, composed of two directional Anton 213 Geiger-Mueller (GM) counters, one omnidirectional Anton 213 GM counter, and two magnets, was used to detect locally mirroring electrons in the energy ranges 42 to 53 keV and 83 to 98 keV. The directional counters had a 6-deg diameter field of view. The omnidirectional GM tube monitored the background due to electrons above 5 MeV and protons above 40 MeV. The detector accumulators were sampled every 0.25 s in telemetry mode 1 and every second in telemetry mode 5. The 83 to 98 keV detector malfunctioned after May 15, 1963. The rest of the instrumentation performed normally until late October 1963 when the satellite power supply failed.

------- INJUN 3, O'BRIEN----------

INVESTIGATION NAME- INTEGRAL MAGNETIC ELECTRON SPECTROMETER

NSSDC ID- 62-067B-04

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - B.J.	O'BRIEN	DEPT OF ENVIRON PROT
OI - C.D.	LAUGHLIN	MCDONALD OBS

BRIEF DESCRIPTION
An integral magnetic spectrometer, composed of three directional Anton 213 Geiger-Mueller (GM) counters and two broom magnets, was used to study locally mirroring high-energy fission electrons with E>1.5 MeV, injected into the geomagnetic field by the Starfish high-altitude nuclear explosion. The detector accumulators were sampled every 0.25 s in telemetry mode 1. The experiment operated nominally from launch until late October 1963 when the satellite power supply failed. However, since the spectrometer was designed and built just before the Injun 3 launch, proper orientation of the broom magnets was not achieved. As a result, neither of the corresponding GM counters responded solely to particles which traveled at 90 deg to the local magnetic field. The actual pitch angles (about 70 deg) observed were somewhat dependent on electron energy.

------- INJUN 3, O'BRIEN----------

INVESTIGATION NAME- DC SCINTILLATOR

NSSDC ID- 62-067B-05

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - B.J.	O'BRIEN	DEPT OF ENVIRON PROT
OI - R.	HALE(NLA)	U OF IOWA

BRIEF DESCRIPTION
A directional cesium iodide scintillator, oriented at 130 deg with respect to the local magnetic field, was used to study outflux and auroral phenomena, i.e., to detect low-energy electrons with E>5 keV and protons with E>50 keV. The scintillator looked away from the earth in the northern hemisphere, and its accumulators were sampled every 0.25 s in telemetry mode 1 and every second in telemetry mode 5. The experiment performed nominally from launch until late October 1963 when the satellite power supply failed.

------- INJUN 3, O'BRIEN----------

INVESTIGATION NAME- ELECTRON MULTIPLIER

NSSDC ID- 62-067B-06

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - B.J.	O'BRIEN	DEPT OF ENVIRON PROT
OI - D.E.	STILWELL	NASA-GSFC

BRIEF DESCRIPTION
The experiment used a directional electron multiplier detector similar to the Ascop 541A photomultiplier, except that it lacked a photocathode. The detector was oriented at 130 deg with respect to the local magnetic field line, to obtain total number fluxes of electrons with energy above 10 keV, and looked away from the earth in the northern hemisphere. The detector accumulator was sampled every 0.25 s in telemetry mode 1. The experiment operated nominally from launch until late October 1963 when the satellite power supply failed.

------- INJUN 3, O'BRIEN----------

INVESTIGATION NAME- PROTON SPECTROMETER

NSSDC ID- 62-067B-07

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - B.J.	O'BRIEN	DEPT OF ENVIRON PROT
OI - C.D.	BOSTROM	APPLIED PHYSICS LAB
OI - G.F.	PIEPER	NASA-GSFC

BRIEF DESCRIPTION
A set of four p-n junction detectors, each one having its own amplifier, was used in applying coincidence techniques to study the proton spectrum. The following ranges were measured: 1.2 to 2.2, 2.2 to 8, 8 to 24, and 24 to 100 MeV. Two of the detectors were oriented at 90 deg and two at 180 deg with respect to the local magnetic field lines. Each detector pair measured protons in the four indicated energy ranges. The detector accumulators were sampled every 8.1 s in telemetry mode 1. The experiment operated nominally from launch until late October 1963 when the satellite power supply failed.

------- INJUN 3, O'BRIEN----------

INVESTIGATION NAME- AURORAL AND AIRGLOW PHOTOMETERS

NSSDC ID- 62-067B-08

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
IONOSPHERES
AERONOMY

PERSONNEL
PI - B.J. O'BRIEN — DEPT OF ENVIRON PROT

BRIEF DESCRIPTION
Three photometers were flown to measure auroral and airglow intensities. Two were sensitive to the atomic oxygen green line at 5577 A and one to the molecular nitrogen band near 3914 A. The 3914-A photometer and one of the 5577-A photometers were situated adjacent to each other on the spacecraft and had a viewing direction down toward the earth in the Arctic region. These same two photometers, because of the magnetic orientation of the spacecraft, were facing out toward space in the Antarctic region. The other 5577-A photometer was located on the opposite side of the spherical spacecraft and consequently had a viewing direction that was different from the others by 180 deg at all times. The satellite transmitted only upon command from the ground, for a fixed period of 17 min. During this time, the two 5577-A photometers were usually sampled four times per second, and the 3914-A photometer once every 2 s. Useful data were obtained from the experiment from launch until October 28, 1963. The operation of the experiment was essentially normal, except for the intermittent performance of one of the 5577-A photometers. A more complete description of the experiment, the instrumentation, and the calibration procedures can be found in B. J. O'Brien and H. Taylor, J. Geophys. Res., v. 69, n. 1, p. 45, 1964.

********** INJUN 4**********

SPACECRAFT COMMON NAME- INJUN 4
ALTERNATE NAMES- EXPLORER 25, 00932

NSSDC ID- 64-076B

LAUNCH DATE- 11/21/64 — WEIGHT- 40. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES — NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC — EPOCH DATE- 11/21/64
ORBIT PERIOD- 116.3 MIN — INCLINATION- 81.4 DEG
PERIAPSIS- 522. KM ALT — APOAPSIS- 2494. KM ALT

PERSONNEL
PM - J.A. VAN ALLEN — U OF IOWA
PS - J.A. VAN ALLEN — U OF IOWA

BRIEF DESCRIPTION
Explorer 25 was a magnetically aligned satellite launched simultaneously with Explorer 24 (air 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 and to study atmospheric heating and the increase in scale height which have been correlated with geomagnetic activity. Studies of the natural and artificial trapped radiation belts were also conducted. A biaxial fluxgate magnetometer was used to monitor the orientation of the spacecraft with respect to the local magnetic field. Explorer 25 was equipped with a tape recorder and analog-to-digital converters. The satellite power was derived from rechargeable batteries and solar cells. A transmitter operating in an AM mode at carrier frequency 136.29 MHz was used to transmit real-time data, and one operating in a PM mode at 136.86 MHz was used to transmit tape recorder data. Stable magnetic alignment was not achieved until late February 1965. The satellite sent radiation data until December 1966 and is expected to be in orbit for about 200 yr.

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

INVESTIGATION NAME- GEIGER-MUELLER COUNTER

NSSDC ID- 64-076B-03

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

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

BRIEF DESCRIPTION
This experiment was designed to measure the net down-flux of particles from the trapping region and the intensities of geomagnetically trapped particles at low altitudes, over a wide range of latitudes and longitudes and a long period of time, 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>40 keV) and protons (E>600 keV). The detectors were arranged to detect particles with pitch angles from 0 to 180 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 downward 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 mid-March 1965. Periods of intermittent operation commenced at that time due to continuous discharge of the GM counter, and the counter failed completely in June 1965. The fourth counter, at 125 deg, malfunctioned shortly after launch and yielded no useful data. One heavily shielded omnicirectional Eon 6213 type counter was used for the stucy of the Starfish radiation. This counter was sensitive to protons (E>70 MeV) but insensitive to electrons except via bremsstrahlung (E>1 MeV). One omnidirectional 5112 type GM counter of the kind flown on the Explorer 7 satellite and one omnidirectional 7302 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>1 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- 64-076B-04

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - J.A. VAN ALLEN — U OF IOWA
OI - S.M. KRIMIGIS — 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 circular disk. The detector was located inside a conical collimator with full vertex angle of 40 deg and was oriented at 90 deg to the satellite symmetry axis. Separate determinations of proton and alpha particle fluxes were made in the energy ranges 0.52 to 4 MeV/nucleon and 0.9 to 1.8 MeV/nucleon, respectively. The detector was insensitive to electron fluxes in the radiation zones. The detector accumulators were sampled sequentially every 4 s, and the detector performed normally through July 19, 1966.

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

INVESTIGATION NAME- CADMIUM SULFIDE DETECTORS

NSSDC ID- 64-076B-05

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

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, anc two 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 such that 0 deg corresponded to a detector looking downward towards the earth in the northern hemisphere. The detector accumulators were sampled sequentially every 8 s. The detectors were flown to yield total flux measurements for electrons (E>100 eV) and protons (E>100 eV). 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- 64-076B-06

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

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

BRIEF DESCRIPTION
This experiment was cesigned to measure the directional fluxes of electrons (E>5 keV) mirroring at satellite altitudes and being precipitated into the earth's upper atmosphere. Two plastic scintillator particle detectors were used. One detector, which measured electrons with pitch angles abcut 90 deg plus or minus 15 deg, operated normally until late January 1965. An apparent intermittent failure in the detector power supply decreased further observations to only brief periods throughout the active life of the satellite. The other detector, which measured electrons with pitch angles of about 40 deg 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 samplec sequentially every 8 s.

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

SPACECRAFT COMMON NAME- INJUN 5
ALTERNATE NAMES- EXPLORER 40, INJUN-C
INJUN IE-C, 03338

NSSDC ID- 68-066B

LAUNCH DATE- 08/08/68 WEIGHT- 71.4 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA
UNITED STATES DOD-NAVY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/13/68
ORBIT PERIOD- 118.3 MIN INCLINATION- 80.7 DEG
PERIAPSIS- 665. KM ALT APOAPSIS- 2525. KM ALT

PERSONNEL
PM - 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-kg magnetically oriented spacecraft and was launched by a Scout rocket, together with a 3.65-m inflatable 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 flux, (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 electrons and positive ions of thermal and near thermal energy. The spacecraft systems performed normally except for the malfunction of the solar cell power dump device (shortly after launch) which caused the solar cells to deliver a lower power level to the experiments and reduced the time during which the onboard tape recorder coulc be run. The passive magnetic alignment became effective in mid-December 1968. The spacecraft was turned off from May 31, 1970, to February 18, 1971, after this period it was turned on again. The spacecraft was put in an operational off-mode in early June 1971, and became inoperable shortly thereafter.

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

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

NSSDC ID- 68-066B-01
INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

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, separately, over the range 50 eV tc 50 keV. The energy spectra of these particles were studied separately as a function of pitch angle, latitude, local time, altitude, and magnetic activity. The detector usec was composec of three Low-Energy Proton and Electron Differential Energy Analyzer (LEPEDEA) devices, each made up of cylindrical curved plate electrostatic analyzers and continuous channel multipliers (channeltrons). Each LEPEDEA was accompanied by one EON Type 6213 Geiger-Mueller tube for measurements of electron (E>40 keV) and proton (E>500 keV) intensities and to provide background measurements for the LEPEDEA. The detector performed normally from launch until the spacecraft was put in an operational off-mode, except for a temporary failure of the LEPEDEA-C power supply on September 21, 1968, and the failure of a second LEPEDEA sometime during the summer of 1970.

------- INJUN 5, GURNETT----------

INVESTIGATION NAME- VLF RECEIVER

NSSDC ID- 68-066B-02
INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - D.A. GURNETT U OF IOWA
OI - L.A. FRANK U OF IOWA

BRIEF DESCRIPTION
This very low frequency (VLF) receiver was designed to study both electric and magnetic components (both phase and amplitude) of VLF signals. The direction of signal propagation could be determined and used to assist in identifying the origins of various VLF signals. The observations of antenna impedance for the electric antenna (ECA) were needed to study characteristics of such an antenna operating in a plasma. There were two antennas, one driving a magnetic-field component receiver (MCR), and the other driving two electric-field component receivers (ECR). The MCR operated from a 55.9-cm-diameter loop antenna (MCA), and the ECRs operated from an antenna consisting of two 20.3-cm-diameter aluminum spheres mounted 2.85 m apart on opposite sides of the spacecraft (S/C). Both the MCA and ECA were mounted on booms to reduce interference from the S/C. Within a few weeks after launch, the S/C was despun and magnetically stabilized so that nominally, the antenna axes and the magnetic field line through the S/C were orthogonal. In the northern hemisphere, the MCA supporting boom was inclined earthward. Both the MCR and ECR operated from 10 to 30.E3 Hz. Also operating from the ECA was a narrow-banc step frequency receiver (ECR 2) which operated through filters with center frequencies at 7.5, 10.5, 22, 52.5, 70, and 105 (plus or minus 7.5 %) kHz. Supplementary to these three receivers and two antennas were (1) a special circuit that could measure phase and amplitude of the impedance on the ECA between 20 and 2.E3 Hz and (2) an electron gun used to bias the ECA. The MCR and ECR 1 observed and telemetered (on a 0.8-W, 400-MHz channel) analog, broadband data in real time, when the S/C was in telemetry range of a ground station. When observing with the impedance circuit on, impedance measurements required 8 of each 30 s of wideband observing time. The signal strength values from the ECR 2, and separately from both the low (0.03 to 0.65 kHz) and high (0.3 to 10 kHz) ranges of the ECR 1 and MCR, were recorded on the S/C tape recorder and comprised the digital data for this experiment. In this experiment, the digital data were observed and recorded over a 30-s cycle within which the signal amplitudes from the two low-frequency steps of the ECR 2 were observed every 4 s (1-second duration) and the other frequencies observed every 8 s. When the impedance circuit was on, eight samples of the step receiver data were not observed during each 30-s cycle. Experiment performance was nominal. Failure of the S/C power regulator early in the mission limited operation to some extent, but nominal data were obtained until May 29, 1970. Principal telemetry sites for the data through May 1970 were in Iowa and Alaska. Further experiment details may be found in D. A. Gurnett et al., J. Geophys. Res., v. 74, n. 19, p. 4631, 1969.

------- INJUN 5, SAGALYN----------

INVESTIGATION NAME- SPHERICAL RETARDING POTENTIAL ANALYZER

NSSDC ID- 68-066B-04
INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
PARTICLES AND FIELDS
IONOSPHERES

PERSONNEL
PI - R.C. SAGALYN USAF GEOPHYS LAB
OI - D.A. GURNETT U OF IOWA

BRIEF DESCRIPTION
Two four-grid spherical retarding potential analyzers were used to measure thermal and nonthermal ions and electrons in the energy range 0 to 2 keV. The objective was to study the spatial and temporal variations in the concentration and energy distribution of low energy charged particles between 500 and 4000 km.

------- INJUN 5, VAN ALLEN----------

INVESTIGATION NAME- SOLID-STATE PARTICLE DETECTOR

NSSDC ID- 68-066B-03
INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - J.A.	VAN ALLEN	U OF IOWA
OI - T.P.	ARMSTRONG	U OF KANSAS
OI - S.M.	KRIMIGIS	APPLIED PHYSICS LAB

BRIEF DESCRIPTION

This experiment was designed to conduct an investigation of the spatial and temporal distributions and energy spectra of low-energy alpha particles, protons, and electrons. A set of solid-state detectors (totally depleted silicon surface barrier type) was used to form a proton-telescope capable of detecting protons from 0.304 to 74 MeV using 10 energy channels and electrons with energies greater than 262, 264, 267, 269, 405, 407, 427, 428, 616, 646, 800, and 833 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 8.0, 1.65 to 4.5, and 2.03 to 3.35 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.

********** ISIS 1**********

SPACECRAFT COMMON NAME- ISIS 1
ALTERNATE NAMES- ISIS-A, 03669

NSSDC ID- 69-009A

LAUNCH DATE- 01/30/69 WEIGHT- 241. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY

CANADA	DRB-DRTE
UNITED STATES	NASA-OSSA

INITIAL ORBIT PARAMETERS

ORBIT TYPE- GEOCENTRIC	EPOCH DATE- 02/04/69
ORBIT PERIOD- 128.42 MIN	INCLINATION- 88.42 DEG
PERIAPSIS- 578. KM ALT	APOAPSIS- 3526. KM ALT

PERSONNEL

PM - L.H.	BRACE	NASA-GSFC
PM - C.D.	FLORIDA(DECEASED)	DRB-DRTE
PM - E.D.	NELSEN(NLA)	NASA-GSFC
PS - L.H.	BRACE	NASA-GSFC
PS - I.	PAGHIS(RETIRED)	DRB-DRTE
PS - J.E.	JACKSON	NASA-GSFC

BRIEF DESCRIPTION

ISIS 1 was an ionospheric observatory instrumented with sweep- and fixed-frequency ionosondes, a VLF receiver, energetic and soft particle detectors, an ion mass spectrometer, an electrostatic probe, an electrostatic analyzer, a beacon transmitter, and a cosmic noise experiment. The sounder used two dipole antennas (73 and 18.7 m long, respectively). The satellite was spin-stabilized at about 2.9 rpm after antenna deployment. Some control was exercised over the spin rate and attitude by using magnetically induced torques to change the spin rate and to precess the spin axis. A tape recorder with 1-h capacity was included on the satellite. The satellite could be programmed to take recorded observations for four different time periods for each full recording period. The recorder data were dumped only at Ottawa. For non-tape-recorded observations, data for the satellite and subsatellite regions could be acquired and telemetered when the spacecraft was in the line of sight of telemetry stations. The selected telemetry stations were in areas that provided primary data coverage near the 80 deg W meridian and in areas near Hawaii, Singapore, Australia, England, Norway, India, Japan, Antarctica, New Zealand, and Central Africa. NASA support of the ISIS project was terminated on October 1, 1979. A significant amount of experimental data, however, was acquired after this date by the Canadian project team.

------- ISIS 1, BARRINGTON----------

INVESTIGATION NAME- VLF RECEIVER

NSSDC ID- 69-009A-03

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - R.E.	BARRINGTON	DOC-CRC
OI - F.H.	PALMER	DEFENCE RESEARCH ESTAB
OI - H.G.	JAMES	DOC-CRC

BRIEF DESCRIPTION

The purpose of this experiment was to study natural and manmade VLF signals. Specific objectives included the investigation of VLF propagation phenomena, ion and hybrid plasma resonances, and correlations between VLF emissions and intense fluxes of energetic particles. In this experiment an attempt was made to stimulate the ion resonances of the ambient plasma by using signals from a VLF swept-frequency exciter, contained within the spacecraft. The instrumentation consisted of a low-frequency, broadband receiver that sensed signals received by the 73-m dipole (split monopole) antenna, between 0.05 and 30 kHz. This same antenna was used for receiving frequencies below 5 MHz on the ionosonde. The receiver had a wide dynamic range (80 dB) that was achieved by use of an automatic gain control system. This VLF experiment included an optional-use onboard exciter that operated over a frequency cycle from 0 to 0.3 to 0 to 11 to 0 kHz over a 3.5-s "frame" period. The frames sequenced through four steps where the transmissions were attenuated by 0, 20, 20, then 40 dB, thus requiring 14 s for one complete cycle of exciter operation. The exciter transmitted on the short antennas and the receiver sensed the signals coupled between the two antennas by the ambient plasma, plus any noise signals which were excited in the plasma. This VLF experiment also permitted antenna impedance measurements, with or without a dc bias on the antenna. The real-time data were transmitted on 136.08-MHz telemetry. The VLF data could be recorded on one of the four tape-recorder channels during the time the tape recorder operated. Tape-recorded and backup real-time data were transmitted on 400-MHz telemetry.

------- ISIS 1, BRACE----------

INVESTIGATION NAME- CYLINDRICAL ELECTROSTATIC PROBES

NSSDC ID- 69-009A-07

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - L.H.	BRACE	NASA-GSFC
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 maximum, and to study characteristics of the S/C ion sheath. The measurements were made with two cylindrical probes, operating as Langmuir probes. There were a boom probe and an axial probe. The axial probe extended 48.3 cm from the S/C, along the spin axis, and was centered among the four telemetry antennas on the underside of the S/C. This probe was capable of measurements undisturbed by the satellite motion only when the probe preceded the S/C in its motion through the plasma. The boom probe extended horizontally and outward (in S/C frame of reference) from a boom 1 m long, which in turn extended from an upper surface of the satellite at an angle of about 45 deg to the spin axis. This probe provided some observations during each S/C spin cycle that were free of S/C wake effects. The probes consisted of three concentric, electrically isolated, stainless steel tubes. The outer (0.24-cm diam and 23-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 (0.165-cm diam) extending 23 cm outward from the outer tube acted as an electrical guard for the collector. Its electrical potential was controlled. The collector (0.058-cm diam) extended 23 cm outward from the driven guard. During each 2-min sequence, a volt-ampere curve was obtained from the sawtooth voltage (-2 to +10 V) applied to the collector. This was interpreted in electron densities over a range from 1.E2 to 1.5E6 electrons per cc, and temperatures from about 400 to 5.E4 deg K. NSSDC has all the useful data that exist from this investigation.

------- ISIS 1, CALVERT----------

INVESTIGATION NAME- FIXED-FREQUENCY SOUNDER

NSSDC ID- 69-009A-02

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - W.	CALVERT	U OF IOWA
CI - R.B.	NORTON	NOAA-ERL
OI - J.M.	WARNOCK	NOAA
OI - J.H.	WHITTEKER	DOC-CRC

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 (a function of propagation time of the reflected pulse) and time. These data were normally observed only when the spacecraft was in range of a telemetry station. The fixed-frequency sounder operated from the same antenna, transmitter, and receiver used for the sweep-frequency experiment. It normally operated for 5 s during the frequency flyback period of the sweep-frequency operation that was every 19 or 29 s. One of six frequencies (0.25, 0.48, 1.00, 1.95, 4.00, or 9.303 MHz) was chosen for use by the experimenter as desired. Other modes of operation were available, including continuous observation at a selected frequency, and a special mixed mode with transmission at the fixed frequency of 0.82 MHz and sweep reception.

------- ISIS 1, HARTZ----------

INVESTIGATION NAME- COSMIC RADIO NOISE

NSSDC ID- 69-009A-10

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

INVESTIGATION DISCIPLINE(S)
ASTRONOMY
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - T.R.	HARTZ(RETIRED)	DOC-CRC
PI - H.G.	JAMES	DOC-CRC

BRIEF DESCRIPTION

This experiment used the sweep-frequency ionosonde receiver automatic gain control voltage to measure galactic and solar radio noise levels. The receiver swept from 0.1 to 20 MHz. The dynamic range was 50 dB, and the bandwidth was 55 kHz. The antennas used were 18.7-m and 73-m dipoles.

------- ISIS 1, HEIKKILA----------

INVESTIGATION NAME- SOFT-PARTICLE SPECTROMETER

NSSDC ID- 69-009A-05

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
PARTICLES AND FIELDS
AERONOMY

PERSONNEL

PI - W.J.	HEIKKILA	U OF TEXAS, DALLAS
OI - D.M.	KLUMPAR	U OF TEXAS, DALLAS

BRIEF DESCRIPTION

The purpose of this experiment was to stucy auroral and ionospheric phenomena by stucying 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 axis and one perpendicular to it. A programmed power supply provided swept and stepped modes of operation selected either by internal programming or by ground command. The energy range was from 10 eV to 10 keV per unit charge. The swept mode of energy selection provided a 22-point spectrum in 0.5 s, while the steppec mode provided a 20-point (geometrically spaced) spectrum in 40 s. The experiment worked well. NSSDC has all the useful data that exist from this investigation.

------- ISIS 1, MCDIARMID----------

INVESTIGATION NAME- ENERGETIC PARTICLE DETECTORS

NSSDC ID- 69-009A-04

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

INVESTIGATION DISCIPLINE(S)
MAGNETOSPHERIC PHYSICS
PARTICLES AND FIELDS

PERSONNEL

PI - I.B.	MCDIARMID	NATL RES COUNC OF CAN
OI - J.R.	BURROWS	NATL RES COUNC OF CAN
OI - R.C.	RCSE(RETIRED)	NATL RES COUNC OF CAN

BRIEF DESCRIPTION

The purpose of this experiment was to provide data that would aid in understanding (1) the mechanisms responsible for the production and control of the outer radiation zone, (2) the related problems of particle entry into the earth's magnetic field, and (3) interactions between the earth's magnetosphere and the solar wind. This experiment consisted of four sets of detectors. The first set, comprising four Geiger counters, measured electrons greater than 20 and 40 keV and protons greater than 300 and 500 keV parallel and perpencicular to the satellite spin axis. All remaining detectors measured particles perpendicular to the spin axis. The second set consisted of solid-state silicon junction detectors. These responced to electrons greater than 25 and 140 keV, electrons in the range 200 to 770 keV, and protons greater than 200 and 400 keV. The third set consisted of five silicon junction detectors that responded to protons between 0.15 and 30 MeV. The fourth set consisted of cesium iodide scintillation photomultiplier systems. Each system operated in two modes and responded to electrons greater than 8, 40, and 60 keV and protons greater than 50 keV and in the range 50 to 70 keV.

------- ISIS 1, NARCISI----------

INVESTIGATION NAME- POSITIVE ION MASS SPECTROMETER (1-20 AMU)

NSSDC ID- 69-009A-06

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - R.S.	NARCISI	USAF GEOPHYS LAB

BRIEF DESCRIPTION

The ISIS 1 ion mass spectrometer (IMS) experiment was planned to provide in situ measurements of the exospheric ion concentrations, for species having mass-to-charge ratios from 1 to 20, as a function of latitude, longitude, time of day, season, and special events such as solar flares and magnetic storms. Ion concentrations from five ions to 5.E5 ions/cc could be measured. The instrumentation consisted of two mass analyzer assemblies plus a power supply and control unit that generated sweep voltages, bias potentials, and supply voltages. Each analyzer assembly contained a quadrupole mass filter, an electron multiplier, and excitation and detection electronics. The quadrupole rods were 7.62 cm long and 0.38 cm in diameter. The electron multiplier brought ion currents to values greater than 1.E-12 A, and an electrometer amplifier converted output currents to voltages suitable for telemetry. The mass filter was operated at 7 MHz, with the peak radio frequency voltage across the rocs at 365 V. The IMS experiment failed during the period of February 2 and 3, 1969.

------- ISIS 1, NELMS----------

INVESTIGATION NAME- SWEEP-FREQUENCY SOUNDER

NSSDC ID- 69-009A-01

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - G.L.	NELMS	DOC-CRC
PI - D.B.	MULDREW	DOC-CRC
OI - J.E.	JACKSON	NASA-GSFC
OI - J.H.	WHITTEKER	DOC-CRC
OI - J.	TURNER	IONOSPHERIC PRED SERV
OI - M.	SYLVAIN	LGE
OI - O.	HOLT	AURORAL OBS
OI - Y.	OGATA	RADIO RESEARCH LAB
OI - R.	RAGHAVARAO	PHYSICAL RESEARCH LAB
OI - R.B.	NORTON	NOAA-ERL
OI - K.L.	CHAN	NASA-ARC
OI - R.S.	UNWIN	DEPT OF SCI+INDUST RES

BRIEF DESCRIPTION

The purpose of this experiment was to investigate the ionospheric electron density in the altitude range 300 to 3500 km for a full solar cycle (by combining the ISIS 1 measurements with the Alcuette 2 data). Another important function of the sounder was to provide correlative data for the other ISIS 1 experiments, particularly those measuring ionospheric parameters. The ISIS 1 ionosonde was basically a radio transmitter/receiver that recorded the time delay between a transmitted and a returned radio frequency pulse. A continuum of frequencies between 0.1 and 20 MHz was sampled once every 19 or 29 s, anc one of six selected frequencies was also used for a period of 3 to 5 s during this 19- or 29-s period. In addition to the sweep-and fixed-frequency modes of operation, a mixed mode was possible where the transmitter frequency was fixed at 0.82 MHz while the receiver swept. Several virtual height (delay time) traces were normally observed due to ground reflections, plasma resonances, birefringence of the ionosphere, nonvertical propagation, etc. Virtual height at a given frequency was primarily a function of distance traversed by the signal, electron density along the propagation path, and mode of propagation. The standard data format was an ionogram showing virtual height as a function of frequency.

------- ISIS 1, SAGALYN----------

INVESTIGATION NAME- SPHERICAL ELECTROSTATIC ANALYZER

NSSDC ID- 69-009A-08

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - R.C.	SAGALYN	USAF GEOPHYS LAB
OI - M.	SMIDDY	USAF GEOPHYS LAB

BRIEF DESCRIPTION

The objective of the spherical electrostatic analyzer experiment was to measure the temporal and spatial variations in the concentration and energy distribution of the charged particles throughout the orbit. Specifically, the objectives were to measure the following parameters: (1) the density of positive ions having thermal energy in the concentration range from 1.E1 to 1.E6 ions per cc, (2) the kinetic temperature of the thermal ions in the range from 700 to 4000 deg K, (3) the flux and energy spectrum of protons in the range from 0 to 2 keV, and (4) the satellite potential with respect to the

undisturbed plasma. Two units made up the experiment package: a 96-cm boom that supportec the sensor and made possible omnidirectional measurements, and an electronics package (considered to include the sensor) to perform the measurements and tc process the data into a suitable form for telemetry. The sensor was made up of three concentric spherical meshed 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 90%. To measure the parameters listed above, suitable sweep and step voltages were applied to the grids. This instrument was operated in several modes. The ion densities were sampled 60 times a second, corresponding to a spatial resolution of 150 m. Once per minute the ratio of mass to temperature was sampled, and the energy distribution was sampled once every 2 min. NSSDC has all the useful data that exist from this investigation.

********** ISIS 2**********

SPACECRAFT COMMON NAME- ISIS 2
ALTERNATE NAMES- ISIS-B, PL-701F
05104

NSSDC ID- 71-024A

LAUNCH DATE- 04/01/71 WEIGHT- 256. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
CANADA DOC-CRC
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 04/02/71
ORBIT PERIOD- 113.6 MIN INCLINATION- 88.1 DEG
PERIAPSIS- 1358. KM ALT APOAPSIS- 1428. KM ALT

PERSONNEL
PM - L.H. BRACE NASA-GSFC
PM - C.A. FRANKLIN DOC-CRC
PM - E.D. NELSEN(NLA) NASA-GSFC
PS - L.H. BRACE NASA-GSFC
PS - T.R. HARTZ(RETIRED) DOC-CRC
PS - J.E. JACKSON NASA-GSFC

BRIEF DESCRIPTION
ISIS 2 was an ionospheric observatory instrumented with a sweep-and a fixed-frequency ionosonde, a VLF receiver, energetic and soft particle detectors, an ion mass spectrometer, an electrostatic probe, a retarding potential analyzer, a beacon transmitter, a cosmic noise experiment, and two photometers. Two long crossed-dipole antennas (73 and 18.7 m) were used for the sounding, VLF, and cosmic noise experiments. The spacecraft was spin-stabilized to about 2 rpm after antenna deployment. There were two basic orientation modes for the spacecraft, cartwheel and orbit-aligned. The spacecraft operated approximately the same length of time in each mode, remaining in one mode typically 3 to 5 months. The cartwheel mode with the axis perpendicular to the orbit plane was made available to provide ram and wake data for some experiments for each spin period, rather than for each orbit period. Attitude and spin information was obtained from a three-axis magnetometer and a sun sensor. Control of attitude and spin was possible by means of magnetic torquing. The experiment package also included a programmable tape recorder with a 1-h capacity. For nonrecorded observations, data from satellite and subsatellite locations were telemetered when the spacecraft was in the line of sight of a telemetry station. Telemetry stations were located so that primary data coverage was near the 80-deg-W meridian and near Hawaii, Singapore, Australia, England, France, Norway, India, Japan, Antarctica, New Zealand, and Central Africa. NASA support of the ISIS project was terminated on October 1, 1979. A significant amount of experimental data, however, was acquired after this date by the Canadian project team.

------- ISIS 2, ANGER-------

INVESTIGATION NAME- 3914- AND 5577-A PHOTOMETER

NSSDC ID- 71-024A-11
INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
PARTICLES AND FIELDS
AERONOMY

PERSONNEL
PI - C.D. ANGER U OF CALGARY

BRIEF DESCRIPTION
This dual-wavelength scanning auroral photometer was designed to map the distribution of auroral emissions at 5577 and 3914 A over the portion of the dark earth visible to the spacecraft. A combination of internal electronic scanning performed by an image dissector and of the natural orbital and rotational motions of the spacecraft permitted the sensor to systematically scan across the earth. The detector system 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. Only one of the two optical systems pointed at the earth at any one time, while the other faced into space. When the spacecraft spin axis was oriented to lie in the orbital plane, each rotation of the spacecraft resulted in an earth scan 5 deg wide. This width size was chosen to ensure overlap with the previous scan. The image dissector repetitively scanned at a high speed across the narrow dimension of each 5-deg band and civided it into separately resolved regions 0.4 deg by 0.4 deg. Similar strips were scanned at each of the two wavelengths, but at times that differed by half the rotation period of about 10 s. A calibration light source for each wavelength was built into the optical assembly, and a calibrate cycle was initiated automatically whenever a "power on" command was given. To minimize the problems arising from solar illumination of the optics and the direct viewing of the sunlit earth, a sunlight protection system was included. Complete details about the experiment can be found in C. D. Anger et al., "The ISIS-II scanning auroral photometer," Applied Optics, v. 12, n. 8, pp. 1753-1766, August 1973.

------- ISIS 2, BARRINGTON-------

INVESTIGATION NAME- VLF RECEIVER

NSSDC ID- 71-024A-03
INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - R.E. BARRINGTON DOC-CRC
OI - F.H. PALMER DEFENCE RESEARCH ESTAB
OI - H.G. JAMES DOC-CRC

BRIEF DESCRIPTION
The purpose of this experiment was to study natural and manmade VLF signals. Specific objectives included the investigation of VLF propagation phenomena, ion and hybrid plasma resonances, and correlations between VLF emissions and intense fluxes of energetic particles. In this experiment a swept-frequency exciter, covering the range 15 to 0.05 kHz in 1.0 s, was used to stimulate ion resonances in the plasma. The instrumentation consisted of a low-frequency broadband receiver that observed signals from the 73-m long dipole (split monopole) antenna between 0.05 and 30 kHz. This same antenna was used for receiving signals below 5 MHz on the ionosonde. 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 or without a dc bias on the antenna. The real-time data were transmitted on 136.08-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.

------- ISIS 2, BRACE-------

INVESTIGATION NAME- CYLINDRICAL ELECTROSTATIC PROBES

NSSDC ID- 71-024A-07
INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - L.H. BRACE NASA-GSFC
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 altitudes during the waning 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) greater sensitivity allowing a more complete coverage of low-density regions such as over the polar cap, (2) very high resolution of plasma structure (down to 10 m in extent), and (3) onboard signal processing with backup to provide data in the format that had been used for the ISIS 1 experiment. NSSDC has all the useful data that exist from this investigation.

------- ISIS 2, CALVERT-------

INVESTIGATION NAME- FIXED-FREQUENCY SOUNDER

NSSDC ID- 71-024A-02
INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - W. CALVERT		U OF IOWA
OI - R.B. NORTON		NOAA-ERL
OI - J.H. WHITTEKER		DOC-CRC
OI - J.M. WARNOCK		NOAA

BRIEF DESCRIPTION

This experiment was designed to study ionospheric features of a smaller scale than could be detectec by the sweep sounder and to study plasma resonances. Parameters measured were virtual range (a function of propagation time of the pulse) and time. These data were normally observed only when the spacecraft was in range of a telemetry station. The fixed-frequency sounder operated from the same antenna, transmitter, and receiver used for the sweep-frequency experiment. It normally operated for 3 to 5 s during the frequency flyback period of the sweep-frequency operation which was every 14 or 21 s. One of six frequencies (0.12, 0.48, 1.00, 1.95, 4.00, or 9.303 MHz) was chosen for use by the experimenter, as desired. Other modes of operation were available, including continuous observation at a selected frequency and a special mixed mode with transmission at a selected one of the six fixed frequencies and sweep reception.

------- ISIS 2, HARTZ----------

INVESTIGATION NAME- COSMIC RADIO NOISE

NSSDC ID- 71-024A-10

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

INVESTIGATION DISCIPLINE(S)
ASTRONOMY
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - T.R. HARTZ(RETIRED)		DOC-CRC
PI - H.G. JAMES		DOC-CRC

BRIEF DESCRIPTION

This experiment used the sweep-frequency ionosonde receiver automatic gain control voltages to measure galactic and solar radio-noise levels. The receiver swept from 0.1 to 20 MHz. The dynamic range was 50 dB, and the bandwidth was 55 kHz. The antennas used were 18.7-m and 73-m dipoles.

------- ISIS 2, HEIKKILA----------

INVESTIGATION NAME- SOFT-PARTICLE SPECTROMETER

NSSDC ID- 71-024A-05

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
PARTICLES AND FIELDS
AERONOMY

PERSONNEL

PI - W.J. HEIKKILA		U OF TEXAS, DALLAS
OI - D.M. KLUMPAR		U OF TEXAS, DALLAS

BRIEF DESCRIPTION

The soft-particle spectrometer (basically an electrostatic analyzer) was used to study the directional intensity and differential energy spectra 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 15 keV with a 20% energy resolution. The voltage sweep program of the analyzer was flexible. The experiment worked well from launch until October 1969, when the ion part of the experiment failed. Subsequently, only electron data were acquired. NSSDC has all the useful data that exist from this investigation.

------- ISIS 2, HOFFMAN----------

INVESTIGATION NAME- ION-MASS SPECTROMETER

NSSDC ID- 71-024A-06

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - J.H. HOFFMAN		U OF TEXAS, DALLAS

BRIEF DESCRIPTION

The magnetic ion-mass spectrometer experiment was flown to measure the distribution of the concentrations of the positive ion species as a function of time and position, with particular interest focused on the polar wind particles. The instrument had two ion detector 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 log electrometer amplifiers. A circuit following each amplifier detected the peak amplitude of the ion current. This peak value, rather than the entire mass spectrum, was transmitted in order to reduce the required telemetry bandwidth. In this mode of operation, the complete mass range was scanned in 1 s. A backup mode was provided that produced an analog output with a sweep period of 8 s. This experiment operated nominally after launch with most of the data obtained in the peak mode and while the satellite operated in the cartwheel mode. For about 2 min per pass over Ottawa, Canada, the experiment operated in the analog mode. Inflight calibration was achieved by comparing ion concentration measurements at appropriate altitudes, i.e., where a single ion species predominated, with electron density data from the sounder on board. Other comparisons were made between the spectrometer output and measurements obtained from other related experiments on board. NSSDC has all the useful data that exist from this investigation.

------- ISIS 2, MAIER----------

INVESTIGATION NAME- RETARDING POTENTIAL ANALYZER

NSSDC ID- 71-024A-08

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - E.J. MAIER		NASA-GSFC
CI - B.E. TROY, JR.		US NAVAL RESEARCH LAB
OI - J.L. DONLEY		NASA-GSFC

BRIEF DESCRIPTION

The primary objective of this experiment was to measure the positive ion density, composition, and temperature in the vicinity of the spacecraft. A secondary objective was to measure the thermal electron density and temperature, and the flux of suprathermal electrons. This retarding potential analyzer consisted of three grids (aperture grid, retarding grid, and suppressor grid) that provided a volt-ampere curve relating sweep voltage on the retarding grid to current flow to the collector. Analysis of the volt-ampere curves provided ion/electron temperatures and densities. This experiment was designed to operate only with the satellite in a cartwheel mode of operation. In this mode, the spin axis was perpendicular to the orbit plane. This allowed the analyzer aperture to face the direction of satellite motion once each spin period. NSSDC has all the useful data that exist from this investigation.

------- ISIS 2, MCDIARMID----------

INVESTIGATION NAME- ENERGETIC PARTICLE DETECTORS

NSSDC ID- 71-024A-04

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

INVESTIGATION DISCIPLINE(S)
MAGNETOSPHERIC PHYSICS
PARTICLES AND FIELDS

PERSONNEL

PI - I.B. MCDIARMID		NATL RES COUNC OF CAN
OI - J.R. BURROWS		NATL RES COUNC OF CAN

BRIEF DESCRIPTION

The objectives of the energetic particle experiment were 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 related problem of solar-flare particle entry into the earth's magnetic field; and (3) interactions between the earth's magnetosphere and the solar wind. This experiment consisted of four sets of detectors. The first set consisted of three Geiger counters (of which one failed after launch) and measured electrons greater than 20 and 40 keV perpendicular and parallel to the spin axis. These Geiger counters were also sensitive to protons with energies greater than 240 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 mode, while one could additionally be switched to another discrimination level. They measured electrons with energies greater than 40, 60, 90, 120, 150, and 200 keV. They were also sensitive to protons with energies greater than 150, 200, and 750 keV. The switchable detector experienced continuous saturation. The third set consisted of three silicon-junction detectors that measured protons in the energy ranges 0.8 to 4.0, 3.2 to 12.7, and 12.9 to 28.0 MeV, alpha particles in the energy range 2.5 to 16.0 MeV, and electrons in the energy range 1.0 to 2.0 MeV. The fourth set was composed of two cesium iodide scintillation-photomultiplier systems (channeltrons with cylindrical electrostatic analyzers) stepped through eight energies in 64/60 of a second. These differential spectrometers measured electrons at 9.6, 7.8, 6.0, 4.1, 3.0, 2.2, 1.3, and 0.15 keV, and measured protons at 26.2, 21.6, 17.0, 12.4, 9.4, 7.6, 5.2, and 2.2 keV.

------- ISIS 2, SHEPHERD----------

INVESTIGATION NAME- 6300-A PHOTOMETER

NSSDC ID- 71-024A-12

INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, 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 day, twilight, and night airglow and aurora. Each channel had its own optical input, and the two inputs were mounted at the same end of the spacecraft, separated by 180 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.E11 photons per sq m per s (10 rayleighs) to more than 1.E16 photons per sq m per s. Sunlight could enter the optical systems directly in addition to earth-reflected light. The instrument baffle 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 earth beneath it was dark. An external light source "saw" the filter only when it was 7.5 deg or less off axis. In the range 7.5 to 47 deg, good data were still obtained when the sunlit earth was the origin of the contamination. To perform the data analysis, it was necessary, among other operations, to evaluate different geometrical situations, and to locate the on-earth limb crossing of the 12-A bandpass photometer so that the data could be organized into spin maps. For more details see G. G. Shepherd et al. "ISIS-II atomic oxygen red line photometer," Applied Optics, v. 12, n. 8, pp. 1767-1774, August 1973.

------- ISIS 2, WHITTEKER----------

INVESTIGATION NAME- SWEEP-FREQUENCY SOUNDER

NSSDC ID- 71-024A-01

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - J.H.	WHITTEKER	DOC-CRC
PI - D.B.	MULDREW	DOC-CRC
OI - J.	TURNER	IONOSPHERIC PRED SERV
OI - M.	SYLVAIN	LGE
OI - O.	HOLT	AURORAL OBS
OI - Y.	OGATA	RADIO RESEARCH LAB
OI - R.	RAGHAVARAO	PHYSICAL RESEARCH LAB
OI - J.E.	JACKSON	NASA-GSFC
OI - R.B.	NORTON	NOAA-ERL
OI - K.L.	CHAN	NASA-ARC
OI - R.S.	UNWIN	DEPT OF SCI+INDUST RES

BRIEF DESCRIPTION
The purpose of this experiment was to measure the ionospheric electron density in the altitude range 300 to 1400 km. Another important function of the sounder was to provide correlative data for the other ISIS 2 experiments, particularly those measuring ionospheric parameters. the ISIS 2 ionosonde 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 14 or 21 s, and one of six selected frequencies was also used for sounding for a few seconds during each 14- or 21-s period. In addition to the sweep-and fixed-frequency modes of operation, a mixed mode was available in which the transmitter frequency was fixed at one of six possible frequencies while the receiver swept. Several virtual-range (delay-time) traces resulting from ground reflections, plasma resonances, birefringence of the ionosphere, nonvertical propagation, etc., were normally observed. Virtual range at a given frequency was primarily a function of distance traversed by the signal, electron density along the propagation path, and mode of propagation. The standard data format was an ionogram (graph) showing virtual range as a function of radio frequency.

********** ISS-B**********

SPACECRAFT COMMON NAME- ISS-B
ALTERNATE NAMES- IONOSP SOUNDING SAT 2, 10674
UME 2, ISS-2

NSSDC ID- 78-018A

LAUNCH DATE- 02/16/78 WEIGHT- 135. KG
LAUNCH SITE- TANEGASHIMA, JAPAN
LAUNCH VEHICLE- NU

SPONSORING COUNTRY/AGENCY
JAPAN RRL

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 02/17/78
ORBIT PERIOD- 107. MIN INCLINATION- 69.4 DEG
PERIAPSIS- 972. KM ALT APOAPSIS- 1225. KM ALT

PERSONNEL

PM - Y.	HAKURA	RADIO RESEARCH LAB
PS - N.	MATUURA	RADIO RESEARCH LAB

BRIEF DESCRIPTION
The Ionosphere 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 ionosphere 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 spin stabilized at about 13 rpm 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 perpendicular to the spin axis. These antennas, 36.8 and 11.4 m long, were unfurled in orbit and were shared by ionospheric sounding and radio noise experiments. A spherical retarding-potential trap sensor was mounted on a boom perpendicular to the spin axis. A magnetic attitude sensor was mounted on a similar boom on the opposite side of the spacecraft. The remaining experiment involved a Bennett-type mass spectrometer with two sensors flush-mounted on opposite ends of the spacecraft. Spacecraft attitude was determined by means of a magnetometer, a solar sensor, and an earth horizon sensor. Small telemetry and command antennas extended from the spacecraft. The spacecraft was powered from a battery solar-cell system with solar cells covering most of the cylindrical surface. One recorder on board permitted spacecraft operation in either a recorded (for up to 112 min) or real-time mode. Readout and real-time operation were done from Kashima, Japan, and Ottawa, Canada.

------- ISS-B, AIKYO----------

INVESTIGATION NAME- SWEEP FREQUENCY TOPSIDE IONOSPHERIC SOUNDER (TOP)

NSSDC ID- 78-018A-01

INVESTIGATIVE PROGRAM
SCIENTIFIC SATELLITE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - K. AIKYO RADIO RESEARCH LAB

BRIEF DESCRIPTION
The Ionosphere Sounding Satellite (ISS) ionosonde was a pulsed radio transmitter and receiver that recorded the time delay between a transmitted pulse and its return. Frequencies between 0.5 and 14.8 MHz were sampled in 0.1-MHz steps to provide virtual range (delay time) of signal reflections. More than one virtual range-vs-frequency trace was often observed. These resulted from ground reflections, plasma resonances, birefringence of the ionosphere, nonvertical propagation, etc. Virtual range at a given frequency was primarily a function of distance traversed by the signal, electron density along the propagation path, and mode of propagation. The standard data form, an ionogram (graph) showing virtual range as a function of radio pulse frequency, was used to display these observations. Two other forms of data were prepared from these ionograms. They were digital (virtual range vs frequency) values of characteristic ionospheric features read directly from the ionogram, and computed profiles of electron density. This sounding mode of operation, called TOP-B, required 16 s to sample all frequencies (one ionogram). A TOP-A 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 supporting data. Unfortunately, the TOP-A mode failed to function due to internal spurious noise. With data from the TOP-B mode, world-wide maps of critical frequency were prepared. For both the TOP-A and TOP-B modes, the complete cycle time between successive ionograms or successive critical frequency observations was 64 s.

------- ISS-B, IWAMOTO----------

INVESTIGATION NAME- ION MASS SPECTROMETER

NSSDC ID- 78-018A-04

INVESTIGATIVE PROGRAM
SCIENTIFIC SATELLITE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

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 ends 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.E4 ions per cc.

------- ISS-B, KOTAKI----------

INVESTIGATION NAME- RADIO NOISE NEAR 2.5, 5, 10, AND 25 MHZ

NSSDC ID- 78-018A-02
INVESTIGATIVE PROGRAM
SCIENTIFIC SATELLITE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES 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, 4.997, 9.997, 10.003, 24.996, and 25.006 MHz. Characteristics observed at each frequency were noise intensity (resolution of 1/12.8 s) and occurrence frequency of impulsive noise (>15 dB above resolved intensity).

------- ISS-B, MIYAZAKI----------

INVESTIGATION NAME- RETARDING POTENTIAL TRAP

NSSDC ID- 78-018A-03
INVESTIGATIVE PROGRAM
SCIENTIFIC SATELLITE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
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.E3 to 1.E6 per cc. 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 measurement with a given voltage sequence applied to the collector and screen grids. The sensor was mounted on a boom extending perpendicular to the spacecraft spin axis. It consisted of a 2-cm diameter collector, concentrically enveloped by 6- and 10-cm diameter spherical wire grids. The current-voltage analog data were telemetered and subsequently analyzed by the experimenter.

********** KYOKKO**********

SPACECRAFT COMMON NAME- KYOKKO
ALTERNATE NAMES- EXOSPHERIC SAT. A, EXOS A
10664

NSSDC ID- 78-014A

LAUNCH DATE- 02/04/78 WEIGHT- 126. KG
LAUNCH SITE- KAGOSHIMA, JAPAN
LAUNCH VEHICLE- M-3H

SPONSORING COUNTRY/AGENCY
JAPAN ISAS

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 02/06/78
ORBIT PERIOD- 134. MIN INCLINATION- 65.4 DEG
PERIAPSIS- 642. KM ALT APOAPSIS- 3978. KM ALT

PERSONNEL
PM - K. HIRAO U OF TOKYO
PS - T. ITOH 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 0.946 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 1.9 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 UHF (400 MHz) and another for VHF, extended from opposite ends of the spacecraft. The VHF antenna was diplexed 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 160 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
IONOSPHERES

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

BRIEF DESCRIPTION
The instrument measured upper-atmosphere positive ions in the ranges 1 to 4 and 14 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
PARTICLES AND FIELDS

PERSONNEL
PI - E. KANEDA ISAS
OI - N. NIWA ISAS
OI - M. TAKAGI ISAS

BRIEF DESCRIPTION
The instrument was a TV camera that consisted of an image-memory tube with a slow-scan readout. The photoelectric 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 photoelectric 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 178x198 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)
PARTICLES AND FIELDS
AERONOMY

PERSONNEL
PI - T. MUKAI ISAS

BRIEF DESCRIPTION
The instrument consisted of two spherical electrostatic analyzers, one 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 GLOW SPECTROPHOTOMETER

NSSDC ID- 78-014A-05
INVESTIGATIVE PROGRAM
SCIENTIFIC SATELLITE

INVESTIGATION DISCIPLINE(S)
ASTRONOMY
AERONOMY

PERSONNEL
PI - M. NAKAMURA TSUKUBA U
OI - T. WATANABE TSUKUBA U

BRIEF DESCRIPTION
The instrument consisted of a grating spectrograph 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 (He+), 584 A (He), 833 A (O+), 1216 A (H, Lyman-alpha) and 1304 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.

------- KYOKKO, OYAMA----------

INVESTIGATION NAME- ELECTRON PROBES

NSSDC ID- 78-014A-01

INVESTIGATIVE PROGRAM
SCIENTIFIC SATELLITE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - K. OYAMA ISAS
OI - K. HIRAO ISAS

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

------- KYOKKO, YOSHINO----------

INVESTIGATION NAME- ELECTROSTATIC PLASMA WAVE MEASUREMENT

NSSDC ID- 78-014A-04

INVESTIGATIVE PROGRAM
SCIENTIFIC SATELLITE

INVESTIGATION DISCIPLINE(S)
MAGNETOSPHERIC PHYSICS
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - T. YOSHINO U OF ELECTRO-COMMUN
OI - R. NAKAMURA ISAS
OI - T. ITOH ISAS

BRIEF DESCRIPTION
This investigation involved electrostatic waves in the magnetosphere in the frequency range 0.4 to 30 kHz 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 1.9 m long and was attached along the extendable stabilization booms. One Faraday cup was mounted to look parallel to the spin axis, and the other, perpendicular to the spin axis. Waves in the 0.4 to 30 kHz range were received by wideband receivers 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- AEM-C, GLOBAL MAGNETIC SURV MSN
MAGSAT-A, 11604

NSSDC ID- 79-094A

LAUNCH DATE- 10/30/79 WEIGHT- 158. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 10/31/79
ORBIT PERIOD- 93.9 MIN INCLINATION- 96.8 DEG
PERIAPSIS- 351.9 KM ALT APOAPSIS- 578.4 KM ALT

PERSONNEL
PM - G.W. OUSLEY NASA-GSFC
PS - R.A. LANGEL NASA-GSFC

BRIEF DESCRIPTION
The Magsat project was a joint NASA/United States Geological 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, compilation of a global crustal magnetic anomaly map, and interpretation of that map in terms of geologic/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 data-handling, power, communications, command, and attitude-control subsystems to support the instrument module. The base module complete with its subsystems 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 from the instrument and base module (chiefly from the star cameras) was less than 1 nT.

------- MAGSAT, LANGEL----------

INVESTIGATION NAME- SCALAR MAGNETOMETER

NSSDC ID- 79-094A-01

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

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
GEODYNAMICS

PERSONNEL
PI - R.A. LANGEL NASA-GSFC
OI - W.H. FARTHING NASA-GSFC

BRIEF DESCRIPTION
The scalar magnetometer had two dual-cell, cesium-vapor sensor heads whose output frequency was proportional to the total magnetic field. With this sensor configuration, only two small diamond-shaped dead zones existed. These lay along the orbit normal (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 1.5E4 to 6.4E4 nT. Most of the time, noise on the spacecraft resulted in operation of only one sensor at a time.

------- MAGSAT, LANGEL----------

INVESTIGATION NAME- VECTOR MAGNETOMETER

NSSDC ID- 79-094A-02

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

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
GEODYNAMICS

PERSONNEL
PI - R.A. LANGEL NASA-GSFC
OI - M.H. ACUNA NASA-GSFC

BRIEF DESCRIPTION
The vector magnetometer consisted of three fluxgate sensing elements aligned along orthogonal axes. The output of each vector sensor was converted to a digital word by an analog-to-digital converter. The outputs of all these axes were sampled essentially at the same time. Each vector measurement had a resolution of better than 1 nT and an absolute accuracy of better than 6 nT rms when referenced to a geocentric coordinate system. The measurement range was plus or minus 6.4E4 nT.

********** MIDAS 2**********

SPACECRAFT COMMON NAME- MIDAS 2
ALTERNATE NAMES- 1960 ZETA 1, 00043

NSSDC ID- 60-006A

LAUNCH DATE- 05/24/60 WEIGHT- 2300. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 05/24/60
ORBIT PERIOD- 94.44 MIN INCLINATION- 33.0 DEG
PERIAPSIS- 484. KM ALT APOAPSIS- 511. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
Midas 2 was an earth-orbiting satellite designed to measure IR background and define IR sources. In addition, the satellite carried experiments to measure cosmic radiation, atmospheric density, thermal emission and reflected solar radiation from the earth, and micrometeorites. A plasma probe was included too. The spacecraft weighed 2268 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, MCISAAC----------

INVESTIGATION NAME- ATMOSPHERIC NEUTRAL DENSITY

NSSDC ID- 60-006A-02

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - J.P. MCISAAC USAF GEOPHYS LAB

BRIEF DESCRIPTION
This density experiment was designed to yield atmospheric pressure and densities from an earth orbit of several hundred km. The experiment consisted of a single manometer gauge and associated telemetry. The instrumentation performed satisfactorily until the telemetry failed 2 days after launch. However, the quality of the data produced was questionable due to instability in the spacecraft attitude while measurements were being taken.

********** OGO 2**********

SPACECRAFT COMMON NAME- OGO 2
ALTERNATE NAMES- OGO-C, POGO 1
S 50, 01620

NSSDC ID- 65-081A

LAUNCH DATE- 10/14/65 WEIGHT- 520. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 10/15/65
ORBIT PERIOD- 104. MIN INCLINATION- 87.4 DEG
PERIAPSIS- 414. KM ALT APOAPSIS- 1510. KM ALT

PERSONNEL
PM - W.E. SCULL(NLA) NASA-GSFC
PS - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
OGO 2 was a large observatory instrumented with 20 experiments designed to make simultaneous, correlative observations of aurora and airglow emissions, energetic particles, magnetic field variations, ionospheric properties, etc., especially over the polar areas. OGO 2 consisted of a main body, generally parallelepipedal in form, two rectangular solar panels, each with a solar-oriented experiment package (SOEP), and two orbital plane experiment packages (OPEP). It also included six experiment packages (EP-1,-2,-3,-4,-5,and -6) mounted on booms extending generally fore and aft of the spacecraft along the 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 earth (Z axis). The axis connecting the two solar panels (X axis) was designed to oscillate in order to remain perpendicular to the earth-sun-spacecraft plane. The solar panels activated by sun sensors could rotate about this X axis in order to obtain maximum radiation for the solar cells and concurrently orient the SOEP properly. The OPEPs were reoriented on either end of an axis that was parallel to the Z axis and attached to the forward end of the main body. These OPEP sensors normally were maintained looking forward in the orbital plane of the satellite. To maintain this orientation, the OPEP axis could rotate over 90 deg. In addition, an angular difference of over 90 deg was possible between the orientation of the upper and lower OPEP packages. The SOEP contained four experiments, and the OPEP contained five experiments. Soon after achieving orbit, difficulties in maintaining earth lock with horizon scanners caused exhaustion of attitude control gas by October 23, 1965, 10 days after launch. At this time, the spacecraft entered a spin mode (about 0.11 rpm) with a large coning angle about the previously vertical axis. Five 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 batteries had failed, so subsequent observations were limited to sunlit portions of the orbit. By December 1966, only eight experiments were operational, five of which were not degraded by the spin mode operation. 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 scheduling conflicts created six large data gaps so that data were observed on a total of about 306 days of the 2-yr, 18-day total span of observed satellite data to November 1, 1967. The data gaps were (a) October 24, 1965, to November 5, 1965, (b) December 6, 1965, to January 7, 1966, (c) April 9, 1966, to June 21, 1966, (d) September 2, 1966, to November 18, 1966, (e) December 27, 1966 , 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 still operational. It was reactivated for 2 weeks in February 1968 to operate experiment 65-081A-05. For additional information see J. E. Jackson and J. I. Vette, OGO Program Summary, NASA SP-7601, December 1975.

------- OGO 2, ANDERSON----------

INVESTIGATION NAME- COSMIC-RAY IONIZATION

NSSDC ID- 65-081A-06 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
COSMIC RAYS

PERSONNEL
PI - H.R. ANDERSON SCIENCE APPL, INC
OI - V.H. NEHER(RETIRED) CALIF INST OF TECH

BRIEF DESCRIPTION
This experiment was designed to measure cosmic-ray and solar flare particle intensities (protons above 10 MeV, electrons above 1.0 MeV) 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. Because the ion chamber had omnidirectional sensitivity, except for negligible shadowing by the spacecraft, the unintended slow rolling of the spacecraft did not adversely affect the instrument. The experiment operated normally from October 14, 1965, to April 2, 1966. A detailed description of the instrumentation appears in H. R. Anderson et al., "Observations of POGO ion chamber experiment in the outer radiation zone," J. Geophys. Res., v. 73, n. 19, pp. 6285-6297, October 1968.

------- OGO 2, CAIN----------

INVESTIGATION NAME- RUBIDIUM VAPOR MAGNETOMETER

NSSDC ID- 65-081A-05 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - J.C. CAIN US GEOLOGICAL SURVEY
OI - R.A. LANGEL NASA-GSFC

BRIEF DESCRIPTION
The primary objectives of this experiment were to refine the analytical description of the main geomagnetic field (as part of the U.S. contribution to the world magnetic survey) and to measure the secular change in the main field. The detector system consisted of two dual-cell, optically pumped, self-oscillating, rubidium (85) vapor magnetometers. The oscillation frequency (proportional to the ambient field magnitude) was counted by two electronic scalers for alternate half-seconds. Each scaler was read out once in each main frame. Since the spacecraft operated at 4 kbs, 16 kbs, or 64 kbs, the main frame was read out in 0.288, 0.072, or 0.018 s. Because of the rate difference between the half-second sampling times and the times between readouts, the same data point was often read out more than once. The oscillation frequency of the magnetometer was also transmitted in real time on one channel of the spacecraft's special purpose telemeter to provide information on field fluctuations. This magnetometer system made scalar measurements over a range of 1.5E4 to 6.4E4 nT and had precision of 0.5 to 1.5 nT over this range. In spite of the spacecraft attitude control system problems, the magnetometer functioned well. The instrument operation was nominal for the first 6 months of the satellite lifetime, after which a failure of one scaler power supply caused the loss of the special-purpose telemetry signal and half of the digital data. The reduction in the scientific usefulness of the data received from the remaining scaler was minor, however, because of the redundancies built into the system. The rest of the data from the magnetometer were obtained with the remaining scaler until May 1967 and then in the interval from September 19 to October 2, 1967, during which time data collection was very intermittent.

------- OGO 2, DONLEY----------

INVESTIGATION NAME- POSITIVE ION STUDY

NSSDC ID- 65-081A-19 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - J.L. DONLEY NASA-GSFC
OI - R.E. BOURDEAU(RETIRED) NASA-GSFC

BRIEF DESCRIPTION
This instrument was a planar retarding potential analyzer designed to measure ion composition and density and temperature of electrons and ions. The sensor consisted of three grids and a collector. With controlled voltages and voltage sweeps on the grids, voltage versus current profiles could be obtained. From these profiles, density, temperature, and composition data could be calculated. The instrument was designed so that the aperture grid faced in the direction of spacecraft motion. Due to the failure (10 days after launch) of the three-axis stabilization system, the instrument could not be oriented properly. The subsequent data obtained were not scientifically useful.

------- OGO 2, HELLIWELL----------

INVESTIGATION NAME- VLF NOISE AND PROPAGATION

NSSDC ID- 65-081A-02

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - R.A.	HELLIWELL	STANFORD U
OI - L.H.	RORDEN	DEVLCO INC
OI - J.J.	ANGERAMI	STANFORD U

BRIEF DESCRIPTION

This experiment consisted of five VLF radio receivers that studied natural and man-made VLF noise occurrences at orbital altitudes. The receiver systems consisted of an inflatable 2.9-m diameter loop antenna, a preamplifier stage at the end of a long boom, and a receiver electronics package in the main body of the satellite. Three step-frequency receivers, covering frequency ranges of 0.2 to 1.6, 1.6 to 12.5, and 12.5 to 100 kHz, each observed a complete spectrum of 256 signal strength values once every 4.6, 18.4, or 73.7 s, depending upon the selected mode of operation. Observations from these three receivers were tape recorded at 1 kbs or observed in real time at 4, 16, or 64 kbs. The tape was read out at 64 kbs upon command. The fourth receiver operated between 14.4 and 26.3 kHz and was tuned by command to receive signals from any VLF station transmitting in this range. Signal phase and amplitude were observed twice in each main commutator frame, making available 512 observations of phase and amplitude every 4.6, 18.4, or 73.7 s depending on the mode of operation. These data were recorded and transmitted in the same way as the data from the three step-frequency receivers. The fifth receiver was a broadband receiver operating between 0.3 and 12.5 kHz. These data were not tape recorded, but were observed only in real time on the special purpose telemetry channel. Data from the first four receivers were obtained intermittently for about one-third of the time over approximately 2 years of spacecraft operation. The data from the fifth receiver covered only a very small portion of the satellite lifetime due to the limitation of real-time operation only and difficulties experienced with the spacecraft power. This experiment operated for seven 1- to 2-month periods, beginning respectively on October 17, 1965; January 17, 1966; March 15, 1966; June 21, 1966; November 18, 1966; April 11, 1967; and September 2, 1967.

------- OGO 2, HINTEREGGER----------

INVESTIGATION NAME- SOLAR UV SPECTROMETER

NSSDC ID- 65-081A-17

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY
SOLAR PHYSICS

PERSONNEL

PI - H.E.	HINTEREGGER	USAF GEOPHYS LAB
OI - D.E.	BEDO	USAF GEOPHYS LAB

BRIEF DESCRIPTION

This experiment was designed to measure solar photon flux as a function of wavelength between 170 and 1700 A. The experiment was located on a solar-oriented panel 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 then illuminated a stack of six small gratings and was diffracted onto six photocathodes. By electronic discrimination, only one photocathode was used at any given time in each photomultiplier. The gratings were all illuminated at the same angle of incidence, and were stepped through the spectral range in 512 intervals every 7 minutes during normal operation. An alternative mode provided for a short scan of 32 steps beginning at any of 16 different points in the 512-step scan. This experiment failed to yield any useful scientific data due to the failure of the spacecraft to orient properly. It provided useful engineering data .

------- OGO 2, HOFFMAN----------

INVESTIGATION NAME- SCINTILLATION DETECTOR

NSSDC ID- 65-081A-09

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - R.A.	HOFFMAN	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. One scintillator/photomultiplier tube was intended to point radially away from the earth. The other scintillator was to have looked at 90 deg to this. One of the two photomultiplier tubes lost three orders of magnitude gain when turned on after launch. This, coupled with the failure of the attitude control system, made the data from the remaining detector worthless. This detector failed on October 14, 1965. No useful data were obtained from this experiment.

------- OGO 2, KREPLIN----------

INVESTIGATION NAME- SOLAR X-RAYS

NSSDC ID- 65-081A-16

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

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS

PERSONNEL

PI - R.W.	KREPLIN	US NAVAL RESEARCH LAB
OI - T.A.	CHUBB(RETIRED)	US NAVAL RESEARCH LAB
OI - H.	FRIEDMAN(RETIRED)	US NAVAL RESEARCH LAB

BRIEF DESCRIPTION

This experiment utilized four ion chambers to observe broadband solar emissions in the wavelength ranges 0.5-3 A, 2-8 A, 8-16 A, and 44-60 A. To minimize contamination from charged particles, the field of view of each ion chamber was limited to 0.1 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 deg. The instrument cycled each detector through a zero-current calibration check once each 640 s. Each detector, except the 44-60-A, 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.

------- OGO 2, MANGE----------

INVESTIGATION NAME- LYMAN-ALPHA AND UV AIRGLOW

NSSDC ID- 65-081A-11

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

INVESTIGATION DISCIPLINE(S)
ASTRONOMY
IONOSPHERES
AERONOMY

PERSONNEL

PI - P.W.	MANGE	US NAVAL RESEARCH LAB

BRIEF DESCRIPTION

There were two parts to this experiment: a far-UV experiment (1230-1350 A) and a Lyman-alpha experiment (1050-1350 A). The sensors were UV ion chambers. The far-UV experiment yielded information about the rate at which energy is absorbed. The Lyman-alpha glow 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.

------- OGO 2, NEWTON----------

INVESTIGATION NAME- NEUTRAL PARTICLE STUDY

NSSDC ID- 65-081A-20

INVESTIGATIVE PROGRAM
CODE EE-8, 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 OGO 2 orbit. The instrumentation contained a Bayard-Alpert ionization gauge, which consisted of a gridded tube open to the neutral atmosphere. The experiment failed immediately after launch, when the breakaway device, which should have opened the sensor to the space 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.

------- OGO 2, NILSSON----------

INVESTIGATION NAME- INTERPLANETARY DUST PARTICLES

NSSDC ID- 65-081A-14

INVESTIGATIVE PROGRAM
CODE EL-4/CO-OP

INVESTIGATION DISCIPLINE(S)
INTERPLANETARY DUST

PERSONNEL
PI - C.S. NILSSON — FLINDERS U OF S AUST
OI - D. WILSON — SAO

BRIEF DESCRIPTION
Four thin-film capacitor micrometeorite detectors were carried aboard the polar-orbiting OGO 2 spacecraft to obtain measurements of the velocities, masses, and orbits of dust particles in the earth's dust cloud. The detectors were circular tubes, 2.5 cm in diameter and 10 cm long, each containing three sensors, two twin thin-film capacitors, and a microphone crystal. The front sensor consisted of two 500-A layers of K aluminum oxide, each coated front and back with 500 A of aluminum. The rear sensor was a 1-micron silicon oxide layer, coated front and back with 1000 A of aluminum and deposited on a glass disk. The third sensor was a lead zirconate crystal transducer that was bonded to the rear of each glass disk. A particle that passed through the front sensor would give rise to a small plasma pulse, which was detected by an amplifier and then used to start an oscillator that measured the time of flight down the tube. After traversing the length of the tube, the particle would impact destructively on the rear capacitor sensor, producing another plasma pulse which was used to stop the time-of-flight oscillator and provide some measure of the particle's energy. The impulse imparted to the glass disk by the particle impact was detected and measured by the microphone crystal and provided information on the momentum of the particle. A reasonable mass threshold for both thin-film capacitor sensors was estimated to be 1.E-12 g. Three of the four tubes were pointed in mutually orthogonal directions. One of the detectors was shielded from particle impacts to serve as a control against electrical interference. The only sensor to fail was the rear capacitor on the shielded detector. The experiment heater failed after 1 week of operation, introducing numerous false counts into the transducer data output due to the transducer-noise temperature dependence. Electrical interference arising from commands sent to the spacecraft caused the rear capacitor sensor data to contain many false counts. In 1370 h of data, only two possible micrometeoroid impacts were found. However, the flux rate determined from these data compares favorably with flux rates obtained from experiments on earlier spacecraft.

------- OGO 2, REED----------

INVESTIGATION NAME- AIRGLOW STUDY

NSSDC ID- 65-081A-10

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - E.I. REED — NASA-GSFC
OI - J.E. BLAMONT — CNRS-SA

BRIEF DESCRIPTION
Two photometers were used to measure the airglow in several spectral regions. One sensor was located in the orbital plane experiment package (OPEP), which was mounted on a boom below the satellite. The other instrument was located in the main body. The main body instrument measured airglow radiation through six different filters while viewing the earth (i.e., viewing in the nadir direction), and measured the zenith airglow at one wavelength. Through the use of a mirror-switching arrangement, the nadir radiations were directed sequentially through six filters at the following wavelengths (Angstroms): 2630, 3914, 5577, 5890, 6225, and 6300. The seventh position of the mirrors directed incoming zenith light through a 6300-A filter into the photocathode. In the eighth mirror position the filter was blanked off and no light was directed into the cathode. In normal operation, the different wavelengths were measured in a fixed sequence, each one being measured for 1 s every 8 s. The fields-of-view, i.e., half-cone angles, of the upward-looking and nadir-looking optics were 4 deg and 5 deg respectively. The optics of the OPEP photometer focused the incoming radiation onto a slit near an interference filter peaked at 6219 A with a bandwidth of 40 A. Light passing through the slit reached the cathode of a slide-window photometer. The field of view defined by the slit was 1/2 deg in height, and 6 deg in width. By moving the entrance mirror, the center of the field-of-view was moved from horizontal to 30 deg below horizontal in 1/2-deg steps. The time required to scan across these 30 degs was 34.7 s, a time interval in which the spacecraft moved approximately 250 km. When one scan was completed the motion reversed direction and a new scan started at the same rate. Every 200 s, there was an 8-s calibration cycle. Because the spacecraft lost attitude control very early in its life, no useful data were obtained from this investigation.

------- OGO 2, SIMPSON----------

INVESTIGATION NAME- LOW-ENERGY PROTON, ALPHA PARTICLE MEASUREMENT

NSSDC ID- 65-081A-07

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
COSMIC RAYS

PERSONNEL
PI - J.A. SIMPSON — U OF CHICAGO
OI - E.C. STONE — CALIF INST OF TECH
OI - C.Y. FAN — U OF ARIZONA

BRIEF DESCRIPTION
Two solid-state particle telescopes were used to study low-energy cosmic-ray protons and alpha particles. One of these detectors was a three-element range telescope ("vertical") that was capable of identifying protons and alpha particles (1.22 to 39.2 MeV/nucleon) and electrons (E>400 keV). The other detector was a one-element telescope ("horizontal") sensitive to protons and alpha particles in the energy range from 0.72 to about 11 MeV/nucleon. The vertical telescope axis of symmetry was parallel to the spacecraft Z axis, which later unintentionally became the spin axis. The horizontal telescope symmetry axis was nearly parallel to the spacecraft Y axis (perpendicular to the Z axis). Pulse-height information was sent back from the vertical telescope allowing pulse-height analyses of protons, alpha particles, and electrons using a 256-channel pulse-height analyzer. Count rate information was sent back from both telescopes. The time resolution ranged from about one measurement per 0.02 s to about one measurement per 0.3 s depending on the counting mode and the telemetry bit rate. The unintended spin period of the spacecraft 10 days after launch was about 10 min. The experiment was performing normally at the time the spacecraft systems were deactivated (November 1, 1967). However, the spinning of the spacecraft caused difficulty in interpreting the data after October 23, 1965.

------- OGO 2, SMITH----------

INVESTIGATION NAME- TRIAXIAL SEARCH-COIL MAGNETOMETER

NSSDC ID- 65-081A-04

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - E.J. SMITH — NASA-JPL
OI - R.E. HOLZER — U OF CALIF, LA

BRIEF DESCRIPTION
This experiment was used to study the ELF frequency range of magnetic fluctuations of 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 main electronic assembly further amplified the signal and performed 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 their associated preamplifiers were mounted at the end of a 6-m boom to reduce interference from spacecraft-generated fields. Magnetic field 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, and 64 kbs, with the time intervals between sucessive samples of the spectrum analyzer measuring 36.9, 9.22, and 2.31 s. Difficulties immediately after launch caused OGO 2 to spin, thus 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.

------- OGO 2, TAYLOR, JR.----------

INVESTIGATION NAME- IONOSPHERIC COMPOSITION

NSSDC ID- 65-081A-15

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - H.A. TAYLOR, JR. — NASA-GSFC
OI - N.W. SPENCER — NASA-GSFC

BRIEF DESCRIPTION
A ceramic Bennett radio-frequency ion mass spectrometer tube with its associated electronics was used to measure thermal atmospheric ions having mass-to-charge values from 1 to 45 atomic mass units (u), with a mass resolution of approximately 1 in 20 u. Concentrations from 1.E1 to 1.E6 ions per cc were measured. The time between consecutive samples of each ion detected, i.e., the spectral sweep rate, was 25.6 s. This time interval corresponded to a spatial resolution of from

175 to 200 km along the orbit path, or to 1.5 deg in latitude. Mean ion mass and total ion concentration were also calculated. The instrumentation is described in H. A. Taylor et al., "Thermal ions in the exosphere, evidence of solar and geomagnetic control," J. Geophys. Res., v. 73, n. 17, pp. 5521-5533, September 1968. Data sets are no longer available from this investigation.

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

INVESTIGATION NAME- GALACTIC AND SOLAR COSMIC RAY

NSSDC ID- 65-081A-08

INVESTIGATIVE PROGRAM
CODE EE-8, 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 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 2000 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 (PM) tube, and a scintillator and a Cerenkov element sandwich with both elements optically coupled to the same PM tube. A 70-ns coincidence circuit ccupled the two detectors to form the telescope. Pulses from each detector were pulse-height analyzed. Sample pulse heights, the coincicence count rate, and the count rate of the first detector were telemetered. The noise levels of the spacecraft increased to sufficient amplitude to render the first detector count rate data unusable except during eclipse periods. All the useful data from this experiment were obtained between October 15 and October 24, 1965, and about 17% of the data obtained during this period contain useful information. NSSDC has all the useful data that exist from this investigation.

********** OGO 4**********

SPACECRAFT COMMON NAME- OGO 4
ALTERNATE NAMES- OGO-D, POGO 2
02895, S 50A

NSSDC ID- 67-073A

LAUNCH DATE- 07/28/67 — WEIGHT- 562.0 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- TAT-AGEN D

SPONSORING COUNTRY/AGENCY
UNITED STATES — NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC — EPOCH DATE- 07/28/67
ORBIT PERIOD- 98. MIN — INCLINATION- 86. DEG
PERIAPSIS- 412. KM ALT — APOAPSIS- 908. KM ALT

PERSONNEL
PM - W.E. SCULL(NLA) — NASA-GSFC
PS - N.W. SPENCER — NASA-GSFC

BRIEF DESCRIPTION
OGO 4 was a large observatory instrumented with experiments designed to study the interrelationships between the aurora and airglow emissions, energetic particle activity, geomagnetic field variation, ionospheric ionization and recombination, and atmospheric heating which take place during a period of increased solar activity. OGO 4 consisted of a main body, generally parallelepipedal in form, two rectangular solar panels each including a solar-oriented experiment package (SOEP), and two orbital plane experiment packages (OPEP). The main body was attitude controlled by use of horizon scanners and gas jets and was designed to be pointed toward the earth (Z axis). The axis connecting the two solar panels (X axis) was designed to oscillate so as to remain perpendicular to the earth-sun-spacecraft plane. The solar panels, activated by sun sensors, could rotate about this X axis to obtain maximum radiation for the solar cells and, concurrently, orient the SOEP properly. The OPEPs were mounted on either end of an axis which was parallel to the Z axis and attached to the forward end of the main body. The OPEP sensors normally were maintained looking forward in the orbital plane of the satellite. To maintain this orientation, the OPEP axis could rotate over 90 deg, and, in addition, an angular difference of over 90 deg was possible between the orientation of the upper and lower OPEP packages. The SOEP contained four experiments, and the OPEP contained five experiments. After the spacecraft achieved orbit and the experiments were deployed into an operating mode, an attitude control problem occurred. This condition was corrected by ground control procedures until complete failure of the tape recording systems in mid-January 1969. At that time, due to the difficulty of maintaining attitude control without the tape recorders, the attitude control system was commanded off, and the spacecraft was placed into a spin-stabilized mode about the axis which was previously maintained vertically. Initial spin period was 202 s with the mean spin axis approximately perpendicular to the orbit plane (spin period as of March 12, 1969, was 217 s). The precession period of the mean spin axis was about 5 days. In this mode, seven of the remaining experiments were turned off since no meaningful data could be observed by them. On October 23, 1969, the satellite was turned off. It was reactivated again in January 1970 for 2 months to obtain VLF observations. For additional information see J. E. Jackson and J. I. Vette, OGO Program Summary, NASA SP-7601, December 1975.

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

INVESTIGATION NAME- COSMIC-RAY IONIZATION

NSSDC ID- 67-073A-07

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
SOLAR PHYSICS
COSMIC RAYS

PERSONNEL
PI - H.R. ANDERSON — SCIENCE APPL, INC
OI - V.H. NEHER(RETIRED) — CALIF INST OF TECH

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

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

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

NSSDC ID- 67-073A-14

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - C.A. BARTH — U OF COLORADO
OI - L.J. WALLACE — KITT PEAK NATL OBS
OI - E.F. MACKEY — PACKARD-BELL CORP

BRIEF DESCRIPTION
An Ebert-Fastie scanning spectrometer was used to measure the ultraviolet (UV) spectrum of the earth in the wavelength range from 1100 to 3400 A, with a 20-A resolution. The cbjectives 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 1304-A day and twilight glow, and (c) the atomic oxygen 1356-A line, the atomic nitrogen 1493-A line, and the molecular nitrogen Lyman-Birge-Hopfield bands of the photoelectron excited dayglow. Another objective was the determination of the vertical distribution of ozone from the measurement of the back-scatterec UV daylight in the 2000-to 3400-A range. The focal length of the Ebert mirror was 250 mm, and the grating used had 2160 lines per millimeter. The spectral scan period was essentially 74.5 s. However, during about 7% of the time, this scan period was reduced to 18.6 s. The instrument was mounted looking to nadir. The F channel was the output of a photomultiplier tube (PMT) with a sapphire window and a cesium telluride cathode. The wavelength interval measured here extended from 1750 to 3400 A, with a dynamic range of intensities of 1.E6. The G data channel was the output of a PMT with a lithium fluoride window and a cesium iodide cathode. On this charnel the wavelength ranges scanned extended from 1100 to 1750 A, and the measured intensity could vary over a range from 1 to 1000. The exponential voltage gain characteristics of the PMT resulted in a near-logarithmic scaling between flux and high-voltage level. Appropriate circuitry translated the output to 1-to-5-V analog, an output signal consistent with the spacecraft data system. Prefocused light sources, some operated by command, provided in-orbit calibrations. A complete description of this experiment can be found in C. A. Barth and E. F. Mackey,"OGO-IV ultraviolet airglow spectrometer," IEEE Transactions on Geoscience Electronics, v. GE-7, n. 2, pp. 114-119, April 1969.

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

INVESTIGATION NAME- MAGNETIC SURVEY, RUBIDIUM VAPOR MAGNETOMETER

NSSDC ID- 67-073A-06

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - J.C. CAIN — US GEOLOGICAL SURVEY
OI - R.A. LANGEL — NASA-GSFC

BRIEF DESCRIPTION
A continuation of the only complete pole-to-pole survey (started by OGO 2) of the earth's magnetic field was conducted with the optically pumped, self-oscillating rubidium magnetometer aboard OGO 4. Magnetic fields were monitored with a time resolution of 0.5 s from launch until January 19, 1969, when the instrument failed. The instrument produced scalar magnetic field measurements with an absolute accuracy of better than 2.5 nT throughout its operational lifetime. Data from this instrument may be used to study changes in field magnitude of greater than that amount. The dynamic range of the instruments extends to 6.4E4 nT.

------- OGO 4, CHANDRA----------

INVESTIGATION NAME- POSITIVE ION STUDY

NSSDC ID- 67-073A-19

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - S.S. CHANDRA — NASA-GSFC
OI - J.L. DONLEY — NASA-GSFC
OI - R.E. BOURDEAU(RETIRED) — NASA-GSFC

BRIEF DESCRIPTION
This instrument was a planar retarding potential analyzer (RPA) which was designed to measure ion composition and density and temperature of ions and electrons. The sensor unit in the OPEP was oriented to face the spacecraft velocity vector. It consisted of three circular gold-plated wire mesh grids mounted in front of a circular gold-plated collector. All elements were separated by 0.4 cm. The outer grid was 2.5 cm in diameter, and the remaining elements were 6.4 cm in diameter. This outer grid was mounted on a 7-cm guard ring, flush with, but electrically isolated from, the OPEP. A sweep of stepping voltages (128 steps) was applied in alternating ion (middle grid swept from 12.6 to -0.1 V) and electron (outer two grids swept from -3.2 to 7.0 V) modes. Raw data consisted of plots of retarding potential values versus current flowing to the collector. These were analyzed to obtain temperature, density, and composition data. The 128 voltage steps required for each curve took 36.6 s to sweep, during which time the spacecraft moved a distance of 1.5 to 2.5 deg latitude. The densities observable ranged from about 100 to 1.E5 particles/cc. The composition determinations could not satisfactorily distinguish N^+ from O^+, but He^+ and H^+ were consistently identifiable. This experiment operated satisfactorily. Data collected after the spacecraft stabilization was lost were not usable.

------- OGO 4, HELLIWELL----------

INVESTIGATION NAME- VLF NOISE AND PROPAGATION

NSSDC ID- 67-073A-02

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - R.A. HELLIWELL — STANFORD U
OI - L.H. RORDEN — DEVLCO INC

BRIEF DESCRIPTION
This experiment consistec of six VLF radio receivers that studied natural and man-made VLF noise occurrences at orbital altitudes. The receiver systems consisted of an inflatable 2.9-m loop antenna, a preamplifier stage at the end of a long boom, and a receiver electronics package in the main body of the satellite. Three step-frequency receivers covering frequency ranges from 0.2 to 1.6, 1.6 to 12.5, and 12.5 to 100 kHz each observed a complete spectrum of 256 signal strength values once every 4.6, 18.4, or 73.7 s, depending on the selected mode of operation. Observations from these receivers were tape recorded at 1 kbs or observed in real time at 4, 16, or 64 kbs. The tape was read out at 64 kbs upon command. These three sweeping receivers could be tuned, on command, to any fixed frequency in their range. The fourth (phase-tracking) receiver operated between 14.4 and 26.3 kHz and was tuned on command to receive signals from any VLF station transmitting in this range. Signal phase and amplitude were observed twice in each commutator frame, making available 512 observations of phase and amplitude every 4.6, 18.4, or 73.7 s, depending on the mode of operation. These data were recorded and transmitted in the same way as the step-frequency receiver data. The fifth and sixth receivers were broadband, operating from 0.015 to 0.30 kHz (ELF) and from 0.30 to 12.5 kHz (VLF). These data were not tape recorded, but were observed only in real time on the special purpose telemetry channel. A matching transformer connected on command to the antenna allowed either electric field or magnetic field observations. This experiment was the same as that for OGO 2, except for the addition of the ELF receiver and the ability to make electric field observations. The experiment operated nominally through February 1968, when the electric field observing mode failed. Subsequent operation continued until spacecraft shutdown in November 1969. The experiment was reactivated in 1970 (February 1 to March 9), and twice in 1971 (January 27 to February 2 , and August 17 to September 27). It was turned on once in 1971 for Apollo support, and once to obtain correlative data for USAF Cannonball (71-067C) observations.

------- OGO 4, HINTEREGGER----------

INVESTIGATION NAME- SOLAR UV EMISSIONS

NSSDC ID- 67-073A-20

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY
SOLAR PHYSICS

PERSONNEL
PI - H.E. HINTEREGGER — USAF GEOPHYS LAB
OI - D.E. BEDO — USAF GEOPHYS LAB

BRIEF DESCRIPTION
This experiment was designed to measure solar photon flux as a function of wavelength between 170 and 1700 A. The experiment was located on a solar-oriented panel on the spacecraft. Solar radiation entered the experiment package through an aperture equipped with a set of electrically charged grids to reject charged particles. Then the radiation illuminated a stack of six small gratings and was diffracted onto six photocathodes. By electronic discrimination, only one photocathode was used at any given time in each photomultiplier. The gratings were all illuminated at the same angle of incidence, and were stepped through the spectral range in 512 intervals every 7 minutes during normal operation. An alternative mode provided for a short scan of 32 steps, beginning at any of 16 different points in the 512-step scan. The experiment failed after 2 weeks in orbit (August 12, 1967). The 2-week period was used to check out the instrument rather than to collect data, so no data resulted.

------- OGO 4, HOFFMAN----------

INVESTIGATION NAME- LOW-ENERGY AURORAL PARTICLE DETECTOR

NSSDC ID- 67-073A-11

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
IONOSPHERES
AERONOMY

PERSONNEL
PI - R.A. HOFFMAN — NASA-GSFC
OI - D.S. EVANS — NOAA-ERL

BRIEF DESCRIPTION
The auroral particles experiment contained eight detectors, each comprised of a cylindrical electrostatic analyzer with a channel electron multiplier. Seven of these detectors were capable of measuring ions or electrons as selected by ground command, and the eighth detector measured background. Five of the detectors looked along a vector pointing radially away from the earth, while three others looked out at 30 deg, 60 deg, and 90 deg to the radius vector pointing away from the earth. The look directions of all the detectors lay in a single plane. Four of the detectors that looked directly away from the earth measured electrons or ions at either 0.7, 2.3, 7.4, or 23.8 keV, and the fifth measured the background. Those detectors at other angles measured electrons or ions at 2.3 keV. Most of the data were taken over the north and south auroral zones and polar caps, but a small amount of lower latitude data was taken. The data taken over the south auroral zone amounted to less than 5% of the data. Since the earth's magnetic field is nearly vertical in the auroral zone, the detectors that pointed away from the earth measured precipitating particles, and the angled detectors measured particles having pitch angles nearly comparable to their respective spacecraft angles. The outputs of four of the detectors that pointed directly away from the earth were accumulated simultaneously into four logarithmic accumulators over precisely the same time interval, one half of a telemetry main frame. This was followed by the storage of the outputs of the four 2.3-keV angle detectors for precisely the same duration, one half of a telemetry main frame. This resulted in sampling rates for each detector including the background detector of 55.56 samples per s at 64 kbs, 13.89 samples per s at 16 kbs, and 3.47 samples per s at 4 kbs. All detectors, except for the 6-keV and the 90-deg, 2-keV, developed some noise problems preventing the measurement of small fluxes. Other than this, the detectors functioned normally. The experiment was operated in the electron mode continuously for about 6 days out of every 7. NSSDC has all the useful data that exist from this investigation.

------- OGO 4, KREPLIN----------

INVESTIGATION NAME- SOLAR X-RAY EMISSIONS

NSSDC ID- 67-073A-21

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

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS

PERSONNEL

PI - R.W.	KREPLIN	US NAVAL RESEARCH LAB
OI - T.A.	CHUBB(RETIRED)	US NAVAL RESEARCH LAB
OI - H.	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 8-20 A), and 44-60 A passbands. The detectors were mounted in the solar-oriented experiment package (SOEP) of the spacecraft and were pointed continuously at the sun. The currents generated in the ionization chambers were amplified by linear electrometers, three of which changed ranges automatically 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 time resolution, obtained with the spacecraft multiplexer operating at 4 kbs, was 4.6 s for the 8-16 A and 44-60 A detectors. The time resolution was considerably better for the 0.5-8 A detectors. The 44-60 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. 121-130, North Holland Publ. Co., Amsterdam, The Netherlands, 1969. NSSDC has all the useful data that exist from this investigation.

------- OGO 4, MANGE----------

INVESTIGATION NAME- LYMAN-ALPHA AND UV AIRGLOW STUDY

NSSDC ID- 67-073A-13

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
ASTRONOMY
AERONOMY

PERSONNEL

PI - P.W.	MANGE	US NAVAL RESEARCH LAB
OI - R.R.	MEIER	US NAVAL RESEARCH LAB

BRIEF DESCRIPTION

This experiment was designed to measure the Lyman-alpha nightglow radiation from earth (1050 to 1350 A), the Lyman-alpha background radiation from space (1050 to 1350 A), and the far UV airglow radiation from earth (1230 to 1350 A and 1350 to 1550 A) 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 1050- to 1350-A detectors had lithium fluoride windows and nitric oxide gas filler, the 1230- to 1350-A detectors had calcium fluoride windows and nitric oxide gas filler, and the 1350- to 1550-A detectors had barium fluoride windows and unsymmetrical dimethyl hydrazine gas filler. These detectors observed zenith and nadir intensities in the night sky at altitudes of 400 to 900 km. The output consisted of intensities taken at 2-min intervals covering the period July 29, 1967, to January 20, 1969. The satellite tape recorder failed on January 20, 1969, limiting 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 1230- to 1350-A detectors which, for no known reason, steadily decreased in sensitivity and became useless after 6 weeks of operation. In general, the operation of the instrumentation was nominal.

------- OGO 4, NEWTON----------

INVESTIGATION NAME- NEUTRAL PARTICLE MEASUREMENTS

NSSDC ID- 67-073A-17

INVESTIGATIVE PROGRAM
CODE EE-8, 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 spatial and temporal changes. In addition, correlations between changes in the atmospheric parameters and variations of solar and magnetic activity were to be studied. A Bayard-Albert pressure gauge was used as the sensor. This hot filament detector had a helical grid around an axial cylindrical collector. Electrons emitted from one of the three redundant filaments, mounted outside the grid, ionized the neutral particles by collision. The positively charged grid not only accelerated the electrons, but it also repelled the positive ions toward the collector and produced a measurable collector current, which was proportional to the number density of particles inside the gauge. Located in the OPEP, the sensor was scanned about the velocity vector. It was planned that the variation of gauge density during the scanning operation would yield the neutral particle velocity distribution from which atmospheric temperature could be deduced. The data base from this investigation no longer exists.

------- OGO 4, NILSSON----------

INVESTIGATION NAME- INTERPLANETARY DUST PARTICLES

NSSDC ID- 67-073A-18

INVESTIGATIVE PROGRAM
CODE EL-4/CO-OP

INVESTIGATION DISCIPLINE(S)
INTERPLANETARY DUST

PERSONNEL

PI - C.S.	NILSSON	FLINDERS U OF S AUST

BRIEF DESCRIPTION

The objective of this experiment was to measure over a long period of time the velocity and mass distribution of interplanetary dust particles in the mass range of one nanogram to less than one picogram. The experiment extended the mass distribution curve out to the radiation pressure limit and measured the fluctuations in the velocity distribution, mass distribution, and spatial densities of the dust particles. The experiment also attempted to determine the importance of geomagnetic control on the dynamics of dust particles by correlating the various measurements with geophysical, geomagnetic, and solar phenomena. The instrumentation was very similar to that used for micrometeoroid experiments flown on previous OGO flights. The dust particles were detected by four tubular detectors mounted on a short boom and aligned along the body axes of OGO 4. The tubular detectors were a combination of acoustical and ionization sensors. An incoming dust particle first penetrated a thin film sensor. The ionization caused by this collision formed a plasma cloud which, in turn, triggered a 4-MHz clock. If the particle had sufficient energy, it impacted on the second sensor, a metallic disk with a transducer bonded to it. The signal from the transducer gave a measure of the momentum of the particle. The ionization caused by this second collision produced a plasma cloud, which was detected by a metallic grid and stopped the clock. This allowed the velocity of the particle to be determined. The micrometeoroic detectors were oriented correctly for a good deal of the experiment life. However, some unknown noise in the rear sensor system limited the amount of useful data concerning rear-sensor events. The microphone system emitted noise in a manner similar to that on OGO 2, and microphone-only events were deleted from the data analysis.

------- OGO 4, REED----------

INVESTIGATION NAME- AIRGLOW PHOTOMETER

NSSDC ID- 67-073A-12

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

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - E.I.	REED	NASA-GSFC
OI - J.E.	BLAMONT	CNRS-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 EMR 541E photomultiplier (trialkali cathode and sapphire window) was used with seven interference filters. With the two exceptions noted below, all the emissions in the visible and UV wavelengths were viewed in the nadir direction, i.e., directly below the spacecraft. Eight channels or modes of operation were used and were essentially generated by rotating mirrors. For each position of the mirrors, the light intensity for a particular light path through a different filter was recorded. The mirrors switched at 1-s intervals. In the 8-s interval needed to complete a measurement cycle, the satellite moved 0.5 deg latitude. In the first mirror position, the field of view was blanked, and the noise level of the sensor was measured. The next mirror position presented the nadir emission intensity through an interference filter centered at 2630 A. The third position measured zenith emission intensity through the 6300-A filter. This was the only upward-looking measurement taken. The next mirror position also passed the radiation through a 6300-A filter, except here the incoming light was from below. The fifth mirror position enabled radiation from the nadir at 6225 A to be measured. Subsequent mirror positions permitted measurement of nadir intensities at the following wavelengths: 5892, 5577, and 3914 A. The field of view was 10 deg across in the downward direction and 7 deg across looking upward. An assessment of the stability of the experiment's response was obtained by comparing measured moonlit earth radiance over oceans on repeated passes. Absolute "responsivity" was

determined from the overhead transit of Saturn anc Jupiter. In addition to the main body photometer, there was a photometer mounted in the OPEP that scanned the earth's limb. It projected the light thrcugh a 6300-A filter. NSSDC has all the useful data that exist from this investigation.

------- OGO 4, SIMPSON----------

INVESTIGATION NAME- LOW-ENERGY PROTON, ALPHA PARTICLE MEASUREMENT

NSSDC ID- 67-073A-08

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
COSMIC RAYS

PERSONNEL

PI - J.A.	SIMPSON	U OF CHICAGO
OI - C.Y.	FAN	U OF ARIZONA
OI - 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" telescope) that was capable of identifying protons and alpha particles (1.22 to 39.2 MeV/nucleon) and electrons (E>400 keV). The other detector was a one-element telescope ("horizontal" telescope) sensitive to protons and alpha particles in the energy range E>720 keV/nucleon. The vertical telescope axis of symmetry was parallel to the spacecraft Z axis which later became the spin axis. The horizontal telescope symmetry axis was nearly parallel to the spacecraft Y axis (perpendicular to the Z axis). Pulse-height information was sent back from the vertical telescope allowing pulse-height analyses of protons, alpha particles, and electrons (E>400 keV) using a 256-channel pulse-height analyzer. Count rate information was sent back from both telescopes. The time resolution ranged from about one measurement per 0.02 s to about one measurement per 0.3 s depending on the counting mode and the telemetry bit rate. The spin period of the spacecraft on January 23, 1969, was about 3 min. The experiment performed normally from launch until the satellite was put in an operational off mode cn October 23, 1969. However, the spinning of the spacecraft made it difficult to interpret data after mid-January 1969.

------- OGO 4, SMITH----------

INVESTIGATION NAME- TRIAXIAL SEARCH-COIL MAGNETOMETER

NSSDC ID- 67-073A-05

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - E.J.	SMITH	NASA-JPL
OI - R.E.	HOLZER	U OF CALIF, LA

BRIEF DESCRIPTION

The OGO 4 triaxial search-coil magnetometer was designed to measure the alternating component of the magnetic field from a low-altitude polar orbit. Measurements were taken in the frequency range from 0.01 Hz to 1000 Hz. The signals were divided into a high-frequency channel and a low-frequency channel which overlapped near the center of the five-decade frequency band. The low-frequency measurements were from 2.3 to 5 or 10 Hz for the 4-kbs data, 2.3 to 21 or 42 Hz for the 16-kbs data, and 75 to 83 or 166 Hz for the 64-kbs data. Since there was only one telemetry channel for these data, it was slowly commutated among the three search-coil sensors, and simultaneous triaxial waveform data were therefore not available. The high-frequency information was obtained in five narrow-band windows with center frequencies at 10, 32, 100, 320, and 800 Hz. The Z axis of the 800-Hz data was eliminated in favor of an instrument gain status word. The time required for a triaxial 5-channel spectrum sweep was 36.9, 9.22, cr 2.31 s, depending on the telemetry bit rate. Data were of good quality for the operational life of the spacecraft, including the 2 months of special operation from January to March of 1970. The data base from this investigation no longer exists.

------- OGO 4, TAYLOR, JR.----------

INVESTIGATION NAME- POSITIVE ION COMPOSITION

NSSDC ID- 67-073A-16

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - H.A.	TAYLOR, JR.	NASA-GSFC
OI - N.W.	SPENCER	NASA-GSFC

BRIEF DESCRIPTION

The specific objectives of this experiment included (1) a study of the ion composition as a function of magnetic coordinates (latitude, longitude, time, and McIlwain's L parameter) to investigate the means and degree of magnetic control of the ion distribution, (2) a comparison of measurements obtained from the same experiment on both the POGO and EOGO spacecraft, with special attention given to ionic diffusion along L shells, and (3) a study of the temporal, solar, and geomagnetic effects on the ion distribution and transition levels. A ceramic Bennett radio-frequency ion mass spectrometer tube with its associated electronics was used to measure thermal atmospheric ions having mass-to-charge ratio values from 1 to 45, with a mass resolution of about 1 in 20 u. Concentrations from 10 to 1.E6 ions/cc could be measured. The time between consecutive samples of each ion detected, i.e., the spectral sweep rate, was 25.6 s, a time interval corresponding to a spatial resolution of from 175 to 200 km along orbit path, or to 1.5 deg in latitude. The instrument was mounted in the orbital plane experiment package.

------- OGO 4, VAN ALLEN----------

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

NSSDC ID- 67-073A-10

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

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

BRIEF DESCRIPTION

The objectives of this experiment were to conduct a comprehensive latitude and temporal study of the intensities and energy spectra of electrons and protons precipitating into the earth's upper atmosphere and to provide information on the spatial, angular, and temporal distribution of geomagnetically trapped proton and alpha particles. The instrumentation used for the study of precipitating particles was a Low Energy Proton and Electron Differential Energy Analyzer (LEPEDEA) with 16 energy bands in the range 5 to 5.E4 eV. A single thin-window Geiger tube was provided for an integral measurement of electron flux above 40 keV and of proton flux above 500 keV. Two solid-state detectors were used for the trapped particles study. One was an alpha particle experiment with four energy bands in the range 1.05 MeV to 7.8 MeV. The other was a proton experiment with four energy bands in the range 0.37 MeV to 9.9 MeV. The experiment package was mounted on the short boom EP-4 and yielded data from launch until October 1969, at which time the spacecraft was placed in a standby status. The data, however, were of very limited value because of a severe temperature problem in the instrument package.

------- OGO 4, WEBBER----------

INVESTIGATION NAME- GALACTIC AND SOLAR COSMIC RAYS

NSSDC ID- 67-073A-09

INVESTIGATIVE PROGRAM
CODE EE-8, 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 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 50 to 2000 MeV/nucleon and at a maximum sampling rate of once per 288 ms. The telescope consisted of two detectors, a scintillator with its associated photomultiplier (PM) tube and a scintillator and a Cerenkov element sandwich with both elements cptically coupled to the same PM tube. A 70-ns coincidence circuit coupled the two detectors to form the telescope. Pulses from each PM tube were pulse-height analyzed. Sampled pulse heights, the coincidence count rate, and the ccurt rate of the first detector were telemetered. The resolution of the OGO 4 detector deteriorated at launch, probably due to partial separation of an optical interface in cne element of the telescope. This resulted in a reduced efficiency for detecting protons greater than about 200 MeV, with the worst resolution near the Cerenkov threshold of 320 MeV. Otherwise, the experiment functioned as planned until October 23, 1969. NSSDC has all the useful data that exist from this investigation.

********** OGO 6**********

SPACECRAFT COMMON NAME- OGO 6
ALTERNATE NAMES- PL-691D, OGO-F
S 60, POGO 3
03986

NSSDC ID- 69-051A

LAUNCH DATE- 06/05/69 WEIGHT- 632.0 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 06/05/69
ORBIT PERIOD- 99.7 MIN INCLINATION- 82. DEG
PERIAPSIS- 413. KM ALT APOAPSIS- 1077. KM ALT

PERSONNEL
PM - W.E. SCULL(NLA) NASA-GSFC
PS - N.W. SPENCER NASA-GSFC

BRIEF DESCRIPTION
OGO 6 was a large observatory instrumented with 26 experiments designed to study the 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 experiments were mounted on the solar panels (the SOEP package). An additional axis, oriented vertically across the front of the main body, carried seven experiments (the OPEP package). Nominally, these sensors observed in a forward direction in the orbital plane of the satellite. The sensors could be rotated more than 90 deg relative to the nominal observing position and more than 90 deg between the upper and lower OPEP groups mounted on either end of this axis. On June 22, 1969, the spacecraft potential dropped significantly during sunlight operation and remained so during subsequent sunlight operation. This unexplained shift affected seven experiments which made measurements dependent upon knowledge of the spacecraft plasma sheath. During October 1969, a string of solar cells failed, but the only effect of the decreased power was to cause two experiments to change their mode of operation. Also during October 1969, a combination of manual and automatic attitude control was initiated, which extended the control gas lifetime 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 off. 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 "on" experiments decreased from 13 to 7, and on June 28, 1971, the spacecraft was placed in a spin-stabilized mode about the yaw (Z) axis and turned off due to difficulties with spacecraft power. OGO 6 was turned on again from October 10, 1971, through March 1972, for operation of experiment 25 by The Radio Research Laboratory, Japan. For additional information see J. E. Jackson and J. I. Vette, OGO Program Summary, NASA SP-7601, Dec. 1975.

------- OGO 6, AGGSON----------

INVESTIGATION NAME- ELECTRIC FIELD MEASUREMENTS

NSSDC ID- 69-051A-23 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - T.L. AGGSON NASA-GSFC
OI - N.C. MAYNARD NASA-GSFC
OI - J.P. HEPPNER NASA-GSFC

BRIEF DESCRIPTION
Ambient dc electric fields were to be measured by determining the potential difference between two oppositely directed, 30-ft antennas with a high-input impedance voltmeter. The antennas were always parallel to the earth's surface, being north-south in the dawn-dusk plane and east-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 floating potential required by this experiment was lost due to a spacecraft electrical failure. After this time, the only good electric field data obtained during the spacecraft's operational life were taken during eclipse time, which was estimated to be 10% of the total time.

------- OGO 6, BARTH----------

INVESTIGATION NAME- UV PHOTOMETER

NSSDC ID- 69-051A-13 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL
PI - C.A. BARTH U OF COLORADO
OI - J.B. PEARCE SCIENCE APPL, INC
OI - E.F. MACKEY PACKARD-BELL CORP

BRIEF DESCRIPTION
The scientific objectives of this experiment were to measure (1) the intensity of the hydrogen Lyman-alpha emission at 1216 A and of the atomic oxygen emission at 1304 A in the airglow, (2) the columnar densities of the neutral atomic hydrogen and oxygen species above the orbit, and (3) the spatial distribution (in local time and latitude) and the temporal changes (with solar and geophysical activity) of the above densities and emission intensities. Three-axis earth stabilization of the main spacecraft body during normal operation permitted the photometer to view the airglow in the local zenith. The field of view was 3 deg at half-maximum. The photometer used two channels to cover the wavelength interval from 1050 to 1800 A. Channel B data, in the wavelength interval from 1250 to 1800 A, were used to remove the contribution of the non-Lyman-alpha radiation from the channel A data, which ranged from 1050 to 1800 A. Thus, the intensity of the airglow emissions at 1216 and 1304 A could be inferred directly from the quantities channel A output minus channel B, and channel B output, respectively. The photomultiplier tube anode current was detected with a dc-coupled stabilized electrometer. Both channels had a dynamic range from 10 rayleighs to 100 kilorayleighs. A commandable shutter was included to allow measurements of background. Since scattered sunlight affected the measurements when the sun was within 34 deg of the Z axis, suitable shielding was provided. The radiation belt above 1000 km (or in the anomaly above 600 km) caused spurious signals that were present in both channels. The telemetered data were approximately proportional to the logarithm of the UV source intensity. Inflight calibration checks and automatic drift corrections were incorporated in the experiment. Reduced data included experiment outputs of both photomultiplier channels at 1-s intervals. NSSDC has all the useful data that exist from this investigation.

------- OGO 6, BEDO----------

INVESTIGATION NAME- SOLAR UV EMISSIONS

NSSDC ID- 69-051A-09 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS
IONOSPHERES
AERONOMY

PERSONNEL
PI - D.E. BEDO USAF GEOPHYS LAB
OI - H.E. HINTEREGGER USAF GEOPHYS LAB

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 86 deg from the grating normal. The six gratings had different grating constants. The diffracted radiation was observed with a photomultiplier detector. Normal operation consisted of scanning the entire spectrum in 512 steps with an accumulation time of 283.5 ms/grating/step. In another mode, 15 overlapping short scans of about 65 steps each were available for more continuous coverage of a shorter spectral range. The experiment worked well, but data were not taken after about March 1, 1970, due to degradation of the channel electron multipliers. The data are no longer of any value for current or future research.

------- OGO 6, CAIN----------

INVESTIGATION NAME- MAGNETIC SURVEY, RUBIDIUM VAPOR MAGNETOMETER

NSSDC ID- 69-051A-21 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - J.C. CAIN US GEOLOGICAL SURVEY
OI - R.A. LANGEL NASA-GSFC

BRIEF DESCRIPTION
The OGO 6 rubidium vapor magnetometer was an optically pumped, self-oscillating dual-cell instrument used to measure the scalar magnetic field in polar orbit. The instrument was sampled every 0.288 s, and operated almost continuously from launch until June 28, 1971. The precision of the measurements was plus or minus 0.6 nT (gamma) with an absolute accuracy of approximately 2 nT. The accuracy of the measurements was limited by spacecraft fields.

------- OGO 6, CLARK----------

INVESTIGATION NAME- LYMAN-ALPHA PHOTOMETER

NSSDC ID- 69-051A-12

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

INVESTIGATION DISCIPLINE(S)
ASTRONOMY

PERSONNEL

PI - M.A.	CLARK	AEROSPACE CORP
OI - D.D.	ELLIOTT	SRI INTERNATIONAL
OI - P.H.	METZGER	AEROSPACE CORP

BRIEF DESCRIPTION

This experiment was designed to observe from within the geocorona weak external enhancements of celestial Lyman-alpha sky. The instrumentation consisted of a sky-scanning hydrogen Lyman-alpha photometer with a 3-A bandwidth. The instrument was equipped with (1) an insertable SRF2 scattered light testing filter, (2) a hydrogen-filled type 304 stainless steel cell resonance filter (which suppressed the strong Lyman-alpha airglow), (3) an oxygen bandwidth determining filter, (4) an EMR type 543-T photomultiplier with an NaCl cathode, (5) a rotating plane mirror optimized for reflection at 1216 A, and (6) a platinum-foil secondary standard inflight calibrator. The photometer was mounted external to the spacecraft above the Z-axis door, allowing a clear view of both horizons. The scanner plane was canted 20 deg from the spacecraft axis to avoid direct observation of the sun, and therefore the instrument scanned most of the celestial sphere exclusive 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 photometer, 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 32 turns of the scanner, which turned once every 40 s, and the SRF2 filter was inserted for 2 of every 16 turns. The photometer sensitivity was about 1 rayleigh during early operations but decayed to approximately 10 rayleighs after a few days. Count rate data were obtained during the period June 6 to 18, 1969, and were of excellent quality.

------- OGO 6, EVANS----------

INVESTIGATION NAME- AURORAL PARTICLE MEASUREMENT

NSSDC ID- 69-051A-15

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
IONOSPHERES
AERONOMY

PERSONNEL

PI - D.S.	EVANS	NOAA-ERL
OI - D.E.	STILWELL	NASA-GSFC

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 electrostatic analyzer with 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 experiment to 3 of the 6 days of the special purpose 6-day cycle of operation. In June 1972, the instrument was turned off together with the spacecraft.

------- OGO 6, FARLEY----------

INVESTIGATION NAME- TRAPPED AND PRECIPITATING ELECTRONS UCLA

NSSDC ID- 69-051A-16

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - T.A.	FARLEY(NLA)	U OF CALIF, LA
OI - M.C.	CHAPMAN	TRW SYSTEMS GROUP

BRIEF DESCRIPTION

Six plastic scintillator detectors measured the unidirectional electron fluxes in eight energy intervals between 50 keV and 1.2 MeV. A seventh plastic scintillator measured omnidirectional electron fluxes in the same energy intervals. Hours after launch one unidirectional detector experienced a large gain loss. Other detectors functioned normally from launch until June 28, 1971, when the experiment was turned off. Unfortunately, these data are contaminated by protons whenever they are present.

------- OGO 6, HANSON----------

INVESTIGATION NAME- PLANAR ION AND ELECTRON TRAP

NSSDC ID- 69-051A-03

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - W.B.	HANSON	U OF TEXAS, DALLAS
OI - T.W.	FLOWERDAY(NLA)	U OF TEXAS, DALLAS

BRIEF DESCRIPTION

This experiment was used to determine the following characteristics of the ionosphere: the ion concentration, the ion composition, the ion temperature, the fast electron flux with energy greater than 9.1 eV, and the horizontal irregularities in the ion concentration. The retarding potential analyzer consisted of a sensor head and an electronics box. The sensor head contained an 8-cm-cylinder with a concentric 2-cm aperture. Charged particles passed through this aperture before striking a solid collector. The path between the aperture and collector was segmented by four grids, whose potentials were controlled by the electronics box. The sensor head was flush-mounted with the front face of the orbital plane experimental package (OPEP). A grounded, gold-plated screen encircled the sensor head. Its purpose was to minimize electric fields parallel to the sensor face. During normal operation, the sensor face was perpendicular to the vehicle velocity vector. The electronics box contained the following: a power supply with several fixed output voltages, an automatic range-changing linear electrometer, a differential amplifier, a linear voltage sweep circuit, and several logic and timing networks. There were two basic modes of operation --an ion-analysis mode and a duct mode. These modes were alternately employed. During both modes, the first two grids were always grounded. The third grid (the retarding grid) was linearly swept from +19.5 to -1.8 V during the ion-analysis mode. This yielded a profile of ion current as a function of voltage, which was used in determining ion temperature and composition. During the duct mode, when small horizontal gradients in ion concentration were examined, the retarding grid was maintained at -1.8 V. The fourth grid (the suppressor grid) was always maintained at -9.1 V. This grid was used to suppress photoemission from the collector. (All voltages given are with respect to vehicle ground.) A complete cycle time of either 40 or 10 s could be selected for both modes by ground command. In a 10-s cycle time, for example, the first 5 s were used for the ion-analysis mode, and the second 5 s were used for the duct mode. During real-time readout, the 10-s cycle period was automatically invoked, since higher data rates were employed. The spatial resolution was from 40 to 160 m, depending on the cycle time selected. The experiment was first turned on during orbit 20. Three weeks after launch (June 22, 1969), a failure occurred in the solar paddle array. This gave the vehicle a negative potential of more than 20 V when the paddles were exposed to sunlight. Under this condition, reliable ion temperature, ion composition, and photoelectron flux data could not be obtained except upon spacecraft entry into eclipse, when the vehicle potential recovered quite rapidly. However, ion concentration and duct mode were still valid during sunlight. In October 1969, a change occurred in the solar paddle array. This caused the vehicle potential to diminish to the extent that ion temperature and dominant component ions could be determined even in sunlight. During each eclipse, the vehicle potential returned to normal, and complete data were obtained during approximately 30% of each orbit. The performance of the instrument was excellent from turn-on, and the experiment yielded excellent data. It was normally operated 100% of the time. The experiment was turned off during June 1971. A good description of the experiment is given in W. B. Hanson et al., "Plasma measurements with the retarding potential analyzer on OGO 6," J. Geophys. Res., v. 75, pp. 5483-5501, Oct. 1970. NSSDC has all the useful data that exist from this investigation.

------- OGO 6, HANSON----------

INVESTIGATION NAME- ION MASS SPECTROMETER

NSSDC ID- 69-051A-06

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - W.B.	HANSON	U OF TEXAS, DALLAS
OI - T.W.	FLOWERDAY(NLA)	U OF TEXAS, DALLAS

BRIEF DESCRIPTION

An ion 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 entrance aperture, a 90-deg sector magnetic analyzer with constant magnetic field strength, an electron multiplier detector, and a linear automatic-ranging electrometer. The different ion species 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 -94 V. The time for each sweep depended on the data telemetry rate (21.5 s at 64 kbs, 43 s at 16 kbs, and 86 s at 8 kbs). In the step mode the voltage could be stepped through a sequence of 11 values (corresponding to mass peaks at 1, 2, 4, 7, 8, 14, 16, 18, 28, 30, and 32 u) or four values (corresponding to mass peaks at 1, 4, 14, and 16 u). The duration of each step was 1.1 s. The experiment could operate in both a real-time and a tape recorder mode. There were no scientific data from this experiment because the instrument was irreparably damaged at turn-on by high voltage arcing.

------- OGO 6, HELLIWELL----------

INVESTIGATION NAME- VLF NOISE AND PROPAGATION

NSSDC ID- 69-051A-24

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - R.A.	HELLIWELL	STANFORD U
OI - L.H.	RORDEN	DEVLCO 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 30 kHz. The experiment provided information such as the polarization, wave-normal direction, and E/H ratio of signals in the frequency range of interest. Also, it measured the antenna impedance and current both with and without bias and the phase and amplitude of VLF transmitter signals. On July 25, 1969, the antenna extension was completed. On August 22, 1969, failure of a mode logic component limited observations to only the electric field spectrum. Subsequently, the special purpose data was limited to the narrow-band mode (0 to 30 kHz) and the spectrum mode (30 to 100 kHz).

------- OGO 6, KREPLIN----------

INVESTIGATION NAME- SOLAR X-RAY EMISSIONS

NSSDC ID- 69-051A-08

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS

PERSONNEL

PI - R.W.	KREPLIN	US NAVAL RESEARCH LAB
OI - T.A.	CHUBB(RETIRED)	US NAVAL RESEARCH LAB
OI - H.	FRIEDMAN(RETIRED)	US NAVAL RESEARCH LAB
OI - C.S.	BOWYER	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 6.2 A (83 to 2 keV). Each detector was coupled to an eight-channel pulse-height analyzer. Although the detectors worked well, the data were virtually useless due to contamination from trapped particles. The experiment was turned off when the spacecraft was turned off.

------- OGO 6, LAASPERE----------

INVESTIGATION NAME- WHISTLER AND LOW-FREQUENCY ELECTRIC FIELD STUDY

NSSDC ID- 69-051A-25

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL

PI - T.	LAASPERE	DARTMOUTH COLLEGE
OI - M.G.	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 frequencies. Four 15-kHz broad bands (0.02 to 15 kHz, 15 to 30 kHz, 92.5 to 107.5 kHz, and 280 to 295 kHz) could be received in real time, two 0.2-kHz narrow bands (at 200 and 540 kHz) could be tape recorded, and a 0.02-to 1000-kHz broadband signal could be recorded. The tape-recorded data consisted of digital values of signal intensities. The real-time data were normally cycled through each of the four bands at a given gain, recycled at a second overlapping gain, and finally cycled at a third overlapping gain. This whole 12-cycle step was then repeated. Each of the steps in the cycle required 18.4 s, which means all bands were observed in 1.26 min, and all bands at all gains were observed in 3.7 min. The automatic cycling could be interrupted for manual control. These real-time data were transmitted on special purpose telemetry to, and observed near, eight locations: Quito, Rosman or OGO control center, Fairbanks, Madagascar, Winkfield, Johannesburg, Orroral or Acton, and Santiago. Every 0.144 s, the narrow-band receivers recorded signal intensities of 200-kHz signals from BBC England, and of 540-kHz signals from New Mexico, or from other emitters at those frequencies. The tape-recorded broadband detector recorded signal intensity every 18.9 s, i.e., once for each 126 narrowband observations at a given frequency. Digital tape recorded data were observed almost continuously from launch until spacecraft turnoff on June 28, 1971. Real-time data were obtained from telemetry stations on all scheduled days (2 days out of 6 since this was one of three different experiments sharing the same special purpose telemetry system) over the same time period. A special operation of the real-time broadband receivers was made by the Radio Research Laboratories, Japan, with observations near Siple Station, Antarctica, and Kashima, Japan, from October 1, 1971, to March 1972.

------- OGO 6, LOCKWOOD----------

INVESTIGATION NAME- NEUTRON MONITOR

NSSDC ID- 69-051A-18

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
COSMIC RAYS

PERSONNEL

PI - J.A.	LOCKWOOD	U OF NEW HAMPSHIRE
OI - E.L.	CHUPP	U OF NEW HAMPSHIRE

BRIEF DESCRIPTION

A boom-mounted, moderated helium 3 proportional counter was used to measure the total neutron flux in the energy interval from 1 keV to 10 MeV. Four sets of charged particle counters, placed on two pairs of opposing sides of the proportional counter, served as a charged particle rejection system for the neutron measurements. These detectors also provided omnidirectional charged particle count rates (protons above 13 MeV and electrons above 1.5 MeV) and count rates for particles that gave coincident counts in detectors on opposing sides of the proportional counter (protons above 50 MeV and electrons above 13 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 system performed normally until December 24, 1969, when the power supply failed. No useful data were obtained after that date. For a more detailed description of the experiment see J. A. Lockwood et al., "Cosmic ray neutron monitor for OGO-F," IEEE Transactions on Geoscience Electronics, v. GE-7, pp. 88-93, April 1969. NSSDC has all the useful data that exist from this investigation.

------- OGO 6, MASLEY----------

INVESTIGATION NAME- LOW-ENERGY COSMIC-RAY MEASUREMENT

NSSDC ID- 69-051A-19

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
COSMIC RAYS

PERSONNEL

PI - A.J.	MASLEY	TRW SYSTEMS GROUP
OI - P.R.	SATTERBLOM	MCDONNELL-DOUGLAS CORP

BRIEF DESCRIPTION

This experiment was designed to study solar cosmic radiation and geomagnetically trapped and precipitating radiation. The instrumentation consisted of two solid-state detector disks mounted coaxially to form a telescope that looked away from the earth with a 28-deg conical half-angle. Protons in 14 contiguous energy intervals between 5 and 78 MeV and alpha particles in 12 intervals between 17 and 125 MeV were counted. The sum of counts of protons above 78 MeV and electrons above 250 keV was also obtained. A complete set of measurements was obtained in five main frames (0.864 s at an 8-kbs telemetry rate). This experiment functioned normally from launch until August 29, 1970, at which time a spacecraft failure prevented the transmission of any further experiment data.

------- OGO 6, NAGY----------

INVESTIGATION NAME- LANGMUIR PROBES

NSSDC ID- 69-051A-02

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL

PI - A.F.	NAGY	U OF MICHIGAN
OI - L.H.	BRACE	NASA-GSFC

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 OPEP 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 OPEP rotational axis. Each probe consisted of a collector 22.9 cm long and 5.6 cm in diameter extending outward from a concentric guard 22.9 cm long and 16.5 mm in diameter. Both components were stainless steel and were insulated from each other with teflon. The electronics package in the main spacecraft body provided sawtooth voltage sweeps to the probe, detected the ensuing current flow between ground and collector, provided a calibration sequence every 10 min, and provided control system circuitry necessary for varying the mode of operation and for processing the experiment-generated information for telemetry. The probes could be operated in two modes (systems). One mode allowed sweeps -2.5 to +3.5 V about the bias voltage, which produced zero current (absolute limits were -4.5 to +13.5 V). The second mode allowed -3.5 to +2.5 V sweeps about a selectable (0, 2, 4, 6, 8, or 10 V) bias voltage and alternately observed voltage-current curves from each of the two probes. In either mode, the normal cycle time (from beginning of one voltage sweep to beginning of the next voltage sweep) was 9.2 s. In the first mode, there was a fast sweep option in which one cycle required only 2.3 s. Also in the first mode for either cycle time, operation could be scheduled for either probe or alternate probe data. With spacecraft motion approximately 8 km per s, data resolution for the normal sweep was no better than one observation per 80 km, and in the fast mode 20 km. This experiment operated nominally until the daytime spacecraft potential shift occurred on June 22, 1969. After this time, daylight data were not useful. After September 1969, an attempt was made to make some of the daytime observations usable. Within these limitations, some useful electron temperatures and density data were taken from the telemetered measurements. NSSDC has all the useful data that exist from this investigation.

------- OGO 6, REBER----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE COMPOSITION

NSSDC ID- 69-051A-04

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - C.A. REBER		NASA-GSFC
OI - D.N. HARPOLD		NASA-GSFC
OI - G.R. CARIGNAN		U OF MICHIGAN
OI - D.R. TAEUSCH		U OF MICHIGAN

BRIEF DESCRIPTION

The primary objective of this experiment was to study, by obtaining appropriate direct in situ composition measurements, the variation of the concentrations of the major constituents (nitrogen, oxygen, helium, and hydrogen) of the earth's neutral upper atmosphere during changing solar and magnetic activity as a function of time and location. The spectrometer system consisted of a quadrupole analyzer, in which mass separation occurred within a direct current and a radio frequency electric field, an enclosed dual-filament electron bombardment ion source, an electron multiplier, supporting electronics for operating the analyzer and source, and a break-off device for exposing the evacuated mass spectrometer to the atmosphere after the spacecraft achieved orbit. Oriented continually into the orbit plane, the spectrometer's entrance aperture normally faced into the direction of motion. Entering gas particles interacted with the surfaces of an antechamber before being ionized by a 90-V electron beam, after passing through electric fields, the selected ions struck the first dynode of a multiplier. The resulting multiplier output pulses were counted, and the measured count was proportional to the number density of the selected mass in the antechamber. This versatile experiment was designed to operate in any one of three modes, depending on the command given. In mode C the spectrometer was tuned to a particular neutral species mass and measured its concentration only. In the other two modes, both pretuned stepping and mass sweeping approaches were used. The experiment was automatically placed in mode A each time it was turned on, and the bulk of the transmitted data was obtained in mode A. Here, the analyzer was fixed tuned sequentially to the masses of principal interest, 2, 4, 16, 28, and 32. There were 28 stepping sequences, each lasting 9.2 s. In addition, there were two sweeping sequences, each of 55.2-s duration, so that a complete measurement cycle lasted 368 s. In the sweeping mode, the analyzer was tuned over the mass ranges 2 to 1.2, 4 to 2.2, 16 to 9, 28 to 15.5, 32 to 18, and 45 to 25.3 atomic mass units. A complete measurement cycle in mode B also took 368 s and consisted of six sweeping sequences and four stepping sequences. More details can be found in D. R. Taeusch et al., "Neutral composition variation above 400 km during a magnetic storm," J. Geophys. Res., v. 76, n. 34, pp. 8318-8325, 1971. NSSDC has all the useful data that exist from this investigation.

------- OGO 6, SHARP----------

INVESTIGATION NAME- MICROPHONE ATMOSPHERIC DENSITY GAUGE

NSSDC ID- 69-051A-01

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - G.W. SHARP(NLA)		NASA HEADQUARTERS
OI - T.J. CROWTHER(NLA)		LOCKHEED PALO ALTO

BRIEF DESCRIPTION

The microphone atmospheric neutral density gauge experiment measured the spatial and temporal variations of density in the altitude range from 250 to 700 km. The instrumentation consisted of a thin metal ribbon suspended in a magnetic field looking along the spacecraft's velocity vector and exposed to the moving air stream. The air entering the apparatus was mechanically chopped so that the ribbon was forced to oscillate in the magnetic field, the amplitude of the oscillations being proportional to the applied pressure. 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 min, the air flow was stopped for 20 s to establish a zero reference value for inflight calibration. For more details of experiment operation, see G. W. Sharp et al., "Atmospheric density measurements with a satellite-borne microphone gage," J. Geophys. Res., v. 67, n. 4, pp. 1375-1382, April 1962. The experiment was a success, and good data were obtained from launch until the second week in February 1970, when there occurred an unexpected phase shift in the sensor output. The experiment operated in this manner until the spacecraft was deactivated on June 28, 1971.

------- OGO 6, SMITH----------

INVESTIGATION NAME- TRIAXIAL SEARCH-COIL MAGNETOMETER

NSSDC ID- 69-051A-22

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL

PI - E.J. SMITH		NASA-JPL
OI - R.E. HOLZER		U OF CALIF, LA

BRIEF DESCRIPTION

The UCLA-JPL search coil magnetometer sampled ambient field fluctuations from 0.01 to 1000 Hz in two modes. The triaxial search coils mounted at the end of a 6.1-m boom provided triaxial waveform data in three bands, from 0.03 to 0.1 Hz, 0.1 to 0.3 Hz, and 0.3 Hz to cutoff, which depended on sampling rate and gain mode in the following way: for bit rates of 8, 16 or 64 kbs, the cutoff was 4, 8, or 32 Hz for dual gain mode; and 8, 16, and 64 Hz for single gain mode, respectively. Signals from the triaxial search coils were also sampled by seven comb filters with center frequencies of 10, 22, 47, 100, 216, 550 and 1000 Hz. The time required for a complete triaxial spectrum analysis (21 data values) was 1.01, 0.504 or 0.126 s, depending on the satellite bit rate. Interference occurred between the seven-channel spectrum analyzer and the broadband channels, seriously degrading the broadband signals throughout the operational life of the experiment. The experiment operated adequately throughout the mission.

------- OGO 6, STONE----------

INVESTIGATION NAME- COSMIC-RAY STUDY

NSSDC ID- 69-051A-20

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS
COSMIC RAYS

PERSONNEL

PI - E.C. STONE		CALIF INST OF TECH
OI - R.E. VOGT		CALIF INST OF TECH

BRIEF DESCRIPTION

This experiment was designed to measure the energy spectra and chemical composition of cosmic-ray particles of both solar and galactic origin over selected energy intervals using three charged particle telescopes. First a range telescope was used, composed of seven solid-state detectors, D1 through D7, and an anticoincidence shield detector, D8, with threshold energies for protons and alpha particles of 1.0, 3.3, 18.5, 46.6, 156, 235, 315, and 1 MeV/nucleon, respectively. The output of each of the eight detectors was monitored separately in addition to the coincidence modes D1notD8, D12notD8, and D2notD8 (this mode could be changed back and forth on command to D23notD8). The telescope geometric factor varied as a function of particle range from 1.5 to 0.19 cm sq sr. Second, a Cerenkov telescope, composed of two thin

solid-state detectors, D1' and D2', a Cerenkov detector, D3', and an anticoincidence cup, C4', triggered only on particles with Z from 1 through 12 with energies no less than 400 MeV/nucleon. However, in addition to this coincidence (D1'D2'D3'notD4'), the individual detector rates D1', D2', D3', and D4' were also monitored for use in deleting accidental coincidences from the D1'D2'D3'notD4' mode. The telescope geometric factor was 2.8 cm sq sr. Third, a flare telescope composed of two solid-state detectors, D5' and D6', with respective threshold energies for protons and alpha particles of 3.3 and 8.5 MeV/nucleon was used. The output from each detector was monitored as well as the coincidence mode D5' and D6'. The telescope geometric factor was 0.02 cm sq sr. Three 256-channel pulse-height analyzers were used to analyze the output of D1, D2, D3 of the range telescope or D1', D2', D3' of the Cerenkov telescope, or D5', D6' (for D5' D6' events only) of the flare telescope once per counting rate accumulation period. In general, the accumulation period ranged from 0.02 to 3.4 s depending on the spacecraft telemetry bit rate. There existed a priority as to which telescope output would be analyzed for a given accumulation interval. Aside from the D6 range telescope detector being noisy for the first 2 months after launch, the experiment 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 recorder. For further details, see W. E. Althouse et al., "A solar and galactic cosmic ray experiment," IEEE Trans. Nucl. Sci., v. 15, pp. 229-237, Feb. 1967. NSSDC has all the useful data that exist from this investigation.

------- OGO 6, TAYLOR, JR.----------

INVESTIGATION NAME- ION MASS SPECTROMETER

NSSDC ID- 69-051A-05

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES
AERONOMY

PERSONNEL
PI - H.A. TAYLOR, JR. NASA-GSFC
OI - R.A. PICKETT(NLA) NASA-GSFC
OI - F.R. ALLUM U OF TEXAS, DALLAS

BRIEF DESCRIPTION
This experiment was cesigned to obtain data that would describe the global distribution of the ion compcsition of the upper ionosphere, with emphasis on the temporal and spatial variations. Specific flight objectives included the following: (1) to continue the detailed study of ion composition as a function of magnetic coordinates (latitude, longitude, time and McIlwain L parameter), to investigate the means and degree of magnetic control of ion distribution, (2) to study the earth-sun relationship effects on the concentrations of the ion species in both the chemical and diffusive equilibrium regions--for example, the pronounced variation in the atomic oxygen atomic hydrogen ions transition level, and (3) to study the magnetic polar transition regions with special emphasis on the inner and outer ionosphere coupling and the low-altitude sharp transition in ion composition and density. The detector, a Bennett radio frequency ion mass spectrometer, consistec of a tube with a series of plane-parallel knitted grids mounted normal to the tube axis. Both ac and dc fields accelerated the ions down the length of the tube toward a collector. Only those ions satisfying the velocity and phase conditions established by the fields received sufficient energy from the fields to pass a retarding potential grid and impinge on the collector. Ambient thermal positive ions in the mass range from 1 to 45 atomic mass units (u) were measured with a resolution of approximately 1 in 20 u. The instrument's sensitivity ranged from approximately 1.E6 ions/cc to approximately 10 ions/cc. Measurements of a given ion were repeated once every 36.8 s, for an average spatial resolution of about 2 deg in latitude. The sensor was mounted on the orbit plane experiment package (OPEP) and was positioned to point into the direction of motion whenever possible. Periodic (inflight) calibrations were performec. In addition, the selection of the mass scan rate and instrument sensitivity could be changed by ground command. The OGO 6 experiment operated essentially continuously from launch until September 1, 1970, when the spacecraft's operation became intermittent as a result of spacecraft malfunction. All spacecraft operations were terminated on June 28, 1971. At that time the experiment was still operational. NSSDC has all the useful data that exist from this investigation.

------- OGO 6, WILLIAMS----------

INVESTIGATION NAME- TRAPPED AND PRECIPITATING ELECTRONS
GSFC

NSSDC ID- 69-051A-17

INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - D.J. WILLIAMS APPLIED PHYSICS LAB
OI - J.M. TRAINOR NASA-GSFC

BRIEF DESCRIPTION
The primary objective of this experiment was to study the temporal anc spatial behavior of medium- to high-energy electrons at low altitudes in the outer radiation zone. This experiment used surface barrier, solid-state directional detectors to count electrons in the integral energy ranges above 30 keV, 100 keV, 300 keV, and 1 MeV. Two detectors looked away from the earth, four detectors were aimed parallel to the earth, and one faced the earth. The detectors functioned normally until a spacecraft malfunction on August 29, 1970, prevented the telemetering of any further data. NSSDC has all the useful data that exist from this investigation.

********** OV1- 2**********

SPACECRAFT COMMON NAME- OV1- 2
ALTERNATE NAMES- SATAR, 01613
ORBITING VEHICLE 1-2

NSSDC ID- 65-078A

LAUNCH DATE- 10/05/65 WEIGHT- 88. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 10/06/65
ORBIT PERICD- 125.58 MIN INCLINATION- 144.30 DEG
PERIAPSIS- 403. KM ALT APOAPSIS- 3462. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
This spacecraft carried instrumentation for the study of energetic particle fluxes and spectra and the resulting dose rates. A major objective of the experiment package was to obtain data with which to check approximations made in theoretical cose calculations. The spacecraft had a slowly varying tumble period of tens of seconds. Spacecraft performance initially was normal. However, the onboard clock and the tape recorder failed on December 1, 1965, and on January 13, 1966, respectively. Limited real-time operations were carried out until total spacecraft failure in April 1967.

------- OV1- 2, FARLEY----------

INVESTIGATION NAME- ELECTRON AND PROTON DETECTORS

NSSDC ID- 65-078A-02

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - T.A. FARLEY(NLA) U OF CALIF, LA

BRIEF DESCRIPTION
Directional fluxes of electrons were measured by a CsI scintillator attached to an RCA 4439 photomultiplier tube. A plastic anticoincidence scintillator surrounded this detector. The anode output yielded count rates of electrons >560 keV. Eight-channel pulse-height analysis was applied to the last dynode pulse for each appropriate incident particle. A loss in dynode output gain shifted the measurable electron energies upward so that only the lowest five channels yielded useful information. The electron energy range 1.2 to 4.7 MeV was covered by these five channels. All local pitch angles were sampled during each spacecraft spin period. Except for the loss in dynode gain, the detector worked well from launch until December 1, 1965, when the onboard clock failed. Two plastic scintillators measured the directional fluxes of protons with all local pitch angles and in the energy intervals 10 to 23 MeV and 22 to 50 MeV. The proton detectors also functioned normally until the onboard clock failed. The experiment package also contained a four-channel proton spectrum analyzer that produced no useful information. A complete data sampling sequence required 2 s. This sequence included four readings each of the fluxes of electrons >560 keV and of protons between 10 and 23 MeV and between 22 and 50 MeV and one reading of each electron and proton pulse-height analysis channel.

------- OV1- 2, FORTNEY----------

INVESTIGATION NAME- X-RAY CSI CRYSTAL DOSIMETER

NSSDC ID- 65-078A-03 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - R. FORTNEY TRW SYSTEMS GROUP

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/sq cm, 4 g/sq cm, and 16 g/sq cm, respectively. They had a nominal energy threshold of 0.5 MeV and an energy resolution of 6%. Satisfactory dose-rate data (rad/h) were obtained from these detectors through 658 orbits (October 5 to December 1, 1965), even through the region of peak proton flux. The response of the surface dosimeter, 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/sq cm. It measured the dose rate (rad/h) 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 had a dynamic range of 0.3 to 30 rad/h, was accurate to plus or minus 10%, and had a counting accuracy of better than 0.1%. The fifth and sixth dosimeters were the Air Force Weapons Laboratory tissue-equivalent ion chambers with minimum amounts of equivalent aluminum shielding of 0.19 and 1.2 g/sq cm, 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. H. Coop and M. C. Chapman, "A space flight experiment to assess radiation shielding calculations," AMRL-TR-66-34, 1966, and R. Fortney, "General results from the OV1-2 satellite," Aerospace Medicine, pp. 1476-1485, December 1969.

********** OV1-10**********

SPACECRAFT COMMON NAME- OV1-10
ALTERNATE NAMES- 02611

NSSDC ID- 66-111B

LAUNCH DATE- 12/11/66 WEIGHT- 130. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS D

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/12/66
ORBIT PERIOD- 98.87 MIN INCLINATION- 93.43 DEG
PERIAPSIS- 641. KM ALT APOAPSIS- 769. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
The spacecraft was placed into a polar orbit to study Lyman-alpha, airglow, auroral emissions, solar X rays, cosmic radiation, and magnetic and electric fields. The track of the satellite followed a meridian of nearly constant local time (initially about 0100 h on the night side, with progression toward earlier times at 1 h per month). A full nightime pass between the terminators was completed in 30 min. The spacecraft was earth-oriented by gravity gradient booms.

------- OV1-10, HEPPNER----------

INVESTIGATION NAME- MAGNETIC AND ELECTRIC FIELDS

NSSDC ID- 66-111B-08 INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - J.P. HEPPNER NASA-GSFC
PI - T.L. AGGSON NASA-GSFC

BRIEF DESCRIPTION
The floating potential difference between the two 51-ft booms, gravity-oriented along the local vertical, was recorded by a high impedance voltmeter. Each antenna was insulated over the inner 19 ft to move the active element away from spacecraft interference fields. A short circuit between one boom and the spacecraft made the dc measurements useless, but the ac measurements provided useful data for about 10 months. Since the configuration of the booms was not normal due to the short, and since the gravity gradient stabilization was weak, the direction of the component measured was ambiguous.

********** OV1-13**********

SPACECRAFT COMMON NAME- OV1-13
ALTERNATE NAMES- PL-682D, 03173

NSSDC ID- 68-026A

LAUNCH DATE- 04/06/68 WEIGHT- 107. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 04/06/68
ORBIT PERIOD- 199.7 MIN INCLINATION- 100.05 DEG
PERIAPSIS- 588. KM ALT APOAPSIS- 9316. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
The OV1-13 spacecraft (S/C) was placed into a polar orbit to study energetic particle phenomena along its orbit. The S/C was spin-stabilized, with a spin period of about 7.5 s and a spin axis direction normal to the orbit plane. The S/C provided useful data from its launch until November 3, 1969.

------- OV1-13, KATZ----------

INVESTIGATION NAME- ELECTRON SPECTROMETER

NSSDC ID- 68-026A-02 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - L. KATZ(NLA) USAF GEOPHYS LAB
OI - P.L. ROTHWELL USAF GEOPHYS LAB
OI - J.G. KELLEY(NLA) USAF GEOPHYS LAB

BRIEF DESCRIPTION
This experiment was designed to measure electrons in eight energy windows between 0.1 and 1.0 MeV. A magnetic analyzer focused particles onto eight separate solid-state detectors according to particle energy. Upper level discrimination was used to reject most counts due to penetrating protons. The instrument look direction was normal to the spacecraft spin axis which was itself normal to the orbit plane. The counting rate in a given solid-state detector was measured 24 times in one second, and then the next detector was sampled. Thus the full experiment cycle required 8 s, i.e., approximately the same time as the spin period. The instrument provided useful electron data in five energy windows: 160, 210, 503, 685, and 930 keV for the period April 6, 1968, to August 15, 1968.

------- OV1-13, KATZ----------

INVESTIGATION NAME- HIGH ENERGY ELECTRON SCINTILLATOR

NSSDC ID- 68-026A-04 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - L. KATZ(NLA) USAF GEOPHYS LAB
OI - P.L. ROTHWELL USAF GEOPHYS LAB
OI - J.G. KELLEY(NLA) USAF GEOPHYS LAB

BRIEF DESCRIPTION
This experiment was designed to measure the energy spectrum, intensity, and pitch angle distribution of 1.0- to 10-MeV electrons in the earth's magnetosphere. The instrument consisted of two collinear sensors, a thin (300-micron) solid-state detector and an anthracene scintillator. The 10-cm sensor separation yielded a 6.5-deg conical look angle. Coincidence requirements and pulse height analysis were to have yielded information on 1- to 10-MeV electrons in eight energy bins. However, proton contamination rendered the data very difficult to use. For further details see F. R. Paolini et al., IEEE Trans. Nuc. Sci., NS-15, pp. 200-204, February 1968.

********** OV1-15**********

SPACECRAFT COMMON NAME- OV1-15
ALTERNATE NAMES- PL-682F, SPADES 1968-059A
03318, ARSP 68-1

NSSDC ID- 68-059A

LAUNCH DATE- 07/11/68 WEIGHT- 215. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 07/12/68
ORBIT PERIOD- 104.82 MIN INCLINATION- 89.88 DEG
PERIAPSIS- 154. KM ALT APOAPSIS- 1818. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
OV1-15, also referred to as SPADES (Solar Perturbation of Atmospheric Density Experimental Satellite), was designed to study synoptically the fluctuations of atmospheric density, composition, and temperature as a function of solar magnetospheric disturbances. The cylindrical spacecraft, 69 cm in diameter, was 1.4 m long. Electrical power was supplied by solar cells mounted on multifaced domes on each end of the spacecraft. OV1-15 was spin stabilized. The instrumentation consisted of a microphone density gauge, an ion gauge, mass spectrometers, energetic particle detectors, solar X ray and UV flux monitors, an ionospheric monitor, and a triaxial accelerometer. The spacecraft performed normally after launch, and re-entered the earth's atmosphere on November 6, 1968, after successfully completing the mission objectives.

------- OV1-15, CHAMPION----------

INVESTIGATION NAME- TRIAXIAL ACCELEROMETER

NSSDC ID- 68-059A-01 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - K.S.W.CHAMPION USAF GEOPHYS LAB
OI - F.A. MARCOS USAF GEOPHYS LAB

BRIEF DESCRIPTION
The accelerometer experiment on OV1-15 was designed to obtain atmospheric densities between 100 and 200 km. The accelerometer system consisted of three sensors mounted along orthogonal axes. Each sensor measured the electrostatic force required to restore a hollow cylindrical proof mass, electrostatically suspended and electrostatically pulse-rebalanced, constrained to move along a single axis under external acceleration. From these data, atmospheric densities were calculated. The experiment was a success, and good data were obtained until vehicle re-entry on November 6, 1968.

------- OV1-15, ELLIOTT----------

INVESTIGATION NAME- RAM ATMOSPHERE DENSITY GAUGE

NSSDC ID- 68-059A-05 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - D.D. ELLIOTT SRI INTERNATIONAL
OI - B.K. CHING AEROSPACE CORP
OI - V.L. CARTER(NLA) AEROSPACE CORP

BRIEF DESCRIPTION
The ram atmospheric density experiment was designed to measure atmospheric density and its variations with location and time in the 100- to 200-km altitude region. The density gauge consisted of a thin metallic ribbon suspended in a magnetic field and exposed to the air stream. The air entering the apparatus was mechanically chopped, and the modulated ram stream oscillated the ribbon with an amplitude proportional to the ram pressure. Atmospheric density was then calculated from the observed ram pressure. The gauge output was sampled by telemetry 10 times per second, or at about every 6 deg of satellite rotation. The experiment was a success, and good data were obtained until satellite re-entry on November 6, 1968.

********** OV1-19**********

SPACECRAFT COMMON NAME- OV1-19
ALTERNATE NAMES- 03825

NSSDC ID- 69-025C

LAUNCH DATE- 03/18/69 WEIGHT- 425. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 03/20/69
ORBIT PERIOD- 153.44 MIN INCLINATION- 104.77 DEG
PERIAPSIS- 466. KM ALT APOAPSIS- 5764. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
OV1-19 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 hemispheric multifaced solar panel domes on either end. The spin-stabilized spacecraft had two major objectives: (1) to make 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 deactivated in March 1970.

------- OV1-19, FREDEN----------

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

NSSDC ID- 69-025C-04 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - S.C. FREDEN NASA-GSFC
OI - G.A. PAULIKAS AEROSPACE CORP
OI - J.B. BLAKE AEROSPACE CORP

BRIEF DESCRIPTION
Semiconcuctor detectors comprised a dE/dx (energy loss), E (total energy) telescope which looked perpendicular to the spacecraft spin axis. Protons were measured in four energy channels between 690 keV and 10.6 MeV, and in 120 energy channels between 3.8 MeV and 9.5 MeV. The detectors worked well from launch to the end of the spacecraft life (March 1970).

********** OV3-3**********

SPACECRAFT COMMON NAME- OV3-3
ALTERNATE NAMES- 02389

NSSDC ID- 66-070A

LAUNCH DATE- 08/04/66 WEIGHT- 75. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 08/04/66
ORBIT PERIOD- 137. MIN INCLINATION- 81.44 DEG
PERIAPSIS- 360. KM ALT APOAPSIS- 4492. KM ALT

PERSONNEL
PM - UNKNOWN
PS - UNKNOWN

BRIEF DESCRIPTION
The OV3-3 spacecraft (S/C) was placed into a polar orbit to measure trapped and precipitating particles and correlated electromagnetic wave fields. The S/C was spin stabilized at 8 rpm, and its systems performed well for 14 months, until September 1967 when the onboard tape recorder failed. After that time, low-latitude, real-time tracking continued into 1969 when the spacecraft was deactivated.

------- OV3-3, JACCHIA----------

INVESTIGATION NAME- SATELLITE DRAG ATMOSPHERIC DENSITY

NSSDC ID- 66-070A-09 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
AERONOMY

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

BRIEF DESCRIPTION
Because of its symmetrical shape, OV3-3 was selected by the experimenters 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 near perigee were deduced from sequential observations of the spacecraft position using optical (Baker-Nunn 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 OV3-3 has an expected orbital lifetime of 300 years.

------- OV3-3, VAMPOLA----------

INVESTIGATION NAME- MAGNETIC ELECTRON SPECTROMETER

NSSDC ID- 66-070A-05
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - A.L. VAMPOLA — AEROSPACE CORP
OI - P.A.M.GRAM — 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 MeV and 2.31 MeV. Nine lithium-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 27, 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. Vampola, J. Geophys. Res., v. 74, n. 5, p. 1254, 1969.

********** P 11-AS**********

SPACECRAFT COMMON NAME- P 11-AS
ALTERNATE NAMES- 00851

NSSDC ID- 64-045B

LAUNCH DATE- 08/14/64 — WEIGHT- 79. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES — DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC — EPOCH DATE- 08/18/64
ORBIT PERIOD- 127.40 MIN — INCLINATION- 95.67 DEG
PERIAPSIS- 275. KM ALT — APOAPSIS- 3748. 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 directional 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 commutators had one real-time and one tape-recorded channel. Two weeks after launch, one of the commutators temporarily stopped and thereafter operated intermittently. Four weeks later, the tape-recorded channel on the other commutator failed. On September 1, 1965, 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- 64-045B-06
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - F.L. SCARF — TRW 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 overcounter 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, 7.35, 14.5 kHz, overcounter, 7.35, 3.9, and 1.7 kHz. Each point was separated by 1 s. In real time, 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, malfunctions in the system caused data from all but 16 complete 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 F. L. Scarf et al., "Survey of VLF electric fields in the magnetosphere with the polar orbiting spacecraft, 1964-45A," Radio Science, v. 1, pp. 939-956, August 1966.

********** RADSAT**********

SPACECRAFT COMMON NAME- RADSAT
ALTERNATE NAMES- SESP 72-1, 06212
S72-1, STP 72-1B

NSSDC ID- 72-076B

LAUNCH DATE- 10/02/72 — WEIGHT- 208. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES — DOD-ARMY
UNITED STATES — DOD-USAF
UNITED STATES — DOD-NAVY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC — EPOCH DATE- 10/05/72
ORBIT PERIOD- 99.6 MIN — INCLINATION- 98.4 DEG
PERIAPSIS- 731.0 KM ALT — APOAPSIS- 749.0 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-kV range and in the >700-kV 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 extreme and far UV originating in interaction of solar wind with interplanetary medium or from galactic sources. The cylindrical spacecraft, which was 2.13 m long and 1.37 m in diameter carried a gamma-ray spectrometer, a low-altitude particle measuring sensor, and an extreme 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
SOLID-STATE TELESCOPE

NSSDC ID- 72-076B-01
INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
SOLAR PHYSICS

PERSONNEL
PI - L. KATZ(NLA) — USAF GEOPHYS LAB
OI - P.L. ROTHWELL — USAF GEOPHYS LAB
OI - R.C. FILZ — USAF GEOPHYS LAB

BRIEF DESCRIPTION
This experiment was specifically designed to measure protons from 5 to 70 MeV, deuterons from 3.1 to 30.6 MeV/nucleon, and tritons from 2.4 to 23.0 MeV/nucleon during solar events. The detector assembly consisted of four solid-state detectors with a plastic-scintillator anticoincidence shield. The two frontmost detectors were 101 and 109 microns thick; they were oriented perpendicular to the spacecraft spin axis and they provided a field of view of 6 deg half-angle for the telescope. The remaining sensors, 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 limits to flare-produced deuterium and tritium," Phys. Rev. Lett., v. 31, n. 6, pp. 407-410, August 1973.

********** RELAY 1**********

SPACECRAFT COMMON NAME- RELAY 1
ALTERNATE NAMES- 1962 BETA UPSILON 1, A 15
00503, RELAY A

NSSDC ID- 62-068A

LAUNCH DATE- 12/13/62 WEIGHT- 170. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 12/14/62
ORBIT PERIOD- 185. MIN INCLINATION- 47.5 DEG
PERIAPSIS- 1322. KM ALT APOAPSIS- 7439. KM ALT

PERSONNEL
PM - W.S. SUNDERLIN(RETIRED) NASA-GSFC
PS - R.C. WADDEL(RETIRED) NASA-GSFC

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 167.3 rpm 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 the first 2 weeks of satellite operation to be useless. After this period, satellite operation returned to normal. The satellite carried one transmitter for tracking and one for telemetry. The telemetry system was PCM at 1152 bps. Each 128 words per telemetry frame (of 1 s duration) used 113 words for the particle experiment. The leakage problem caused the spacecraft to revert to a low voltage state early in 1965. Sporadic transmission occurred until February 10, 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 EE-8, 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 ionization chambers to map the earth's radiation environment. Counts were accumulated only when the detectors looked 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. Magnets surrounding the diode effectively excluded electrons less than 300 keV. The detector responded to protons with energies between 1.8 MeV to 18 MeV, and had three pulse-height discriminator levels corresponding to protons which lost 1.8, 3.2, or 4.7 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 10 deg, aperture diameter of 2 mm, and sufficient shielding to exclude protons less than 60 MeV and electrons less than 6 MeV. (No magnetic shield was used on the electron detector.) The detection scheme employed pulse-height analysis to discriminate between 0.2- to 0.35-, 0.35- to 0.55-, 0.55- to 0.75-, and 0.75- to 1-MeV electrons. The basic measurement sequence required 12 s. Counts from each detector were accumulated for 10 s. Samples were telemetered each second during the accumulation time. The registers were then frozen, and one redundant reading (the 10th) was telemetered. For protons, this procedure was carried out three times for each bias mode, interspaced by a 12-s allowance for bias change. The entire sequence of three modes required 144 s. For electrons, the sequence was repeated every 12 s. NSSDC has all the data that now exist from this investigation.

------- RELAY 1, MCILWAIN----------

INVESTIGATION NAME- PROTON-ELECTRON DETECTORS

NSSDC ID- 62-068A-03 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
MAGNETOSPHERIC PHYSICS

PERSONNEL
PI - C.E. MCILWAIN U OF CALIF, SAN DIEGO
OI - R.W. FILLIUS 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 34 MeV and electrons above 3.7 MeV. Using magnetometer gating, the remaining detectors (B, C, D) and associated electronic discrimination circuitry measured fluxes of approximately locally mirroring particles. A solid-state surface barrier detector (B) measured protons in the nested intervals 1.1 to 14 MeV, 1.6 to 7.1 MeV, and 2.25 to 4.7 MeV. A two-element, solid-state telescope (C) measured protons in the energy intervals 18.2 to 25 MeV, 25 to 35 MeV, and 35 to 63 MeV. A plastic scintillator (D) measured in four discrimination states the sums of protons with energies above 5.2 MeV and electrons with energies above 0.30, 0.45, 0.62, and 0.82 MeV, respectively. Background counts were accumulated by these detectors when their axes were not perpendicular (to within 10 deg) to the local magnetic field. Detector A cumulative counts were telemetered every second. Detectors B, C, and D directional flux data were transmitted as follows during successive 12-s intervals every 48 s. Counts from the various discrimination states of a given detector were each telemetered once per second while accumulating for 10 s. (The spacecraft spin period was approximately 0.37 s.) Two redundant readouts followed the cessation of counting. Most useful data were telemetered between launch and October 20, 1964. Detector B provided no useful data after May 10, 1963. NSSDC has all the data that now exist from this investigation.

********** RELAY 2**********

SPACECRAFT COMMON NAME- RELAY 2
ALTERNATE NAMES- A 16, 00737
RELAY B

NSSDC ID- 64-003A

LAUNCH DATE- 01/21/64 WEIGHT- 184. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 01/23/64
ORBIT PERIOD- 194.6 MIN INCLINATION- 46.3 DEG
PERIAPSIS- 2091. KM ALT APOAPSIS- 7411. KM ALT

PERSONNEL
PM - W.S. SUNDERLIN(RETIRED) NASA-GSFC
PS - R.C. WADDEL(RETIRED) NASA-GSFC

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 130 deg and a declination of about -60 deg. Accurate spin axis orientation information was not available. The initial spin rate was about 173 rpm. Relay 2, physically similar to Relay 1, had on board two transmitters, one of which was used for PCM telemetry (the sequence requiring 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 transponders operated normally until November 20, 1966. From that time until its failure on January 20, 1967, it required a longer time than normal to come on. The other transponder 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- 64-003A-02 INVESTIGATIVE PROGRAM
CODE EE-8, 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 ionization chambers to map the earth's radiation environment. Counts were accumulated only when the detectors looked 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. Magnets surrounding the diode 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, 3.60, or 5.00 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 10 deg, aperture diameter of 2 mm, and sufficient shielding to exclude protons less than 60 MeV and electrons less than 6 MeV. (No magnetic shield was used on the electron detector.) The detection scheme employed pulse-height analysis to discriminate between 0.223- to 0.403-, 0.403- to 0.580-, 0.580- to 0.775-, and 0.775- to 1.120-MeV electrons. The basic measurement sequence required 12 s. Counts from each detector were accumulated for 10 s. Samples were telemetered each second during the accumulation time. The registers were then frozen, and one redundant reading (the 10th) was telemetered. For protons, this procedure was carried out three times for each bias mode, interspaced by a 12-s allowance for bias change. The entire sequence of three modes required 144 s. For electrons, the sequence was repeated every 12 s. NSSDC has all the data that now exist from this investigation.

********** S3-3**********

SPACECRAFT COMMON NAME- S3-3
ALTERNATE NAMES- SESP S74-2A, S74-2
SS74-2A

NSSDC ID- 76-065B

LAUNCH DATE- 07/08/76 WEIGHT- KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- UNKNOWN

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 07/08/76
ORBIT PERIOD- 176.6 MIN INCLINATION- 97.5 DEG
PERIAPSIS- 246. KM ALT APOAPSIS- 7856. KM ALT

PERSONNEL
PM - R.B. KEHL USAF SPACE DIVISION
PS - H.E. WANG AEROSPACE CORP

BRIEF DESCRIPTION
This spacecraft was a small observatory in a near-polar orbit with eight different sensors on board. It was designed to observe various magnetospheric parameters and their interrelationships. Sensors, which observed energetic protons and alpha particles, also provided real-time observations for use by the U.S. Air Force Air Weather Service.

------- S3-3, FENNELL----------

INVESTIGATION NAME- ION-ELECTRON MASS SPECTROMETER

NSSDC ID- 76-065B-08 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
MAGNETOSPHERIC PHYSICS

PERSONNEL
PI - J.F. FENNELL AEROSPACE CORP

BRIEF DESCRIPTION
This experiment measured the hydrogen and helium particle distribution at injection into the radiation belts and throughout the outer regions of the magnetosphere. This instrument measured the flux of 1H+, 4He++ in the energy range from 0.09 to 4 keV/Q, and electrons from 0.17 to 8.4 keV.

------- S3-3, MOZER----------

INVESTIGATION NAME- DC ELECTRIC FIELDS

NSSDC ID- 76-065B-01 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
MAGNETOSPHERIC PHYSICS

PERSONNEL
PI - F.S. MOZER U OF CALIF, BERKELEY

BRIEF DESCRIPTION
This experiment made vector electric-field measurements, under various conditions, at a variety of magnetospheric locations. The measurements were used in correlative studies with other onboard experiments studying variations in radio frequency, wave propagation, optical emissions, etc.

------- S3-3, SHARP----------

INVESTIGATION NAME- LOW-ENERGY PARTICLE SPECTROMETER

NSSDC ID- 76-065B-02 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
MAGNETOSPHERIC PHYSICS

PERSONNEL
PI - R.D. SHARP LOCKHEED PALO ALTO

BRIEF DESCRIPTION
This instrument consisted of an electrostatic analyzer followed by a crossed electric-magnetic field velocity selector to measure ions from 1 to 32 atomic mass units (u) and above 32 u. The energy/charge ranged from 0.5 to 16 keV. Electrons were measured from 0.07 to 24 keV. Observations were made perpendicular to the orbit plane.

------- S3-3, VAMPOLA----------

INVESTIGATION NAME- ENERGETIC ELECTRON MAGNETIC SPECTROMETER

NSSDC ID- 76-065B-07 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
MAGNETOSPHERIC PHYSICS

PERSONNEL
PI - A.L. VAMPOLA AEROSPACE CORP

BRIEF DESCRIPTION
This experiment consisted of a 12-channel magnetic spectrometer used to obtain values and monitor changes in the equatorial pitch-angle and energy distribution of 0.012- to 1.6-MeV electrons as a function of magnetic activity. The experiment also measured protons from 0.08 to 3 MeV and alpha particles above 4 MeV.

********** SAN MARCO 3**********

SPACECRAFT COMMON NAME- SAN MARCO 3
ALTERNATE NAMES- SAN MARCO-C, SMARC-C
05176, SM-C

NSSDC ID- 71-036A

LAUNCH DATE- 04/24/71 WEIGHT- 160. KG
LAUNCH SITE- SAN MARCO PLATFORM, OFF COAST OF KENYA
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
ITALY CRA
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 04/25/71
ORBIT PERIOD- 94.05 MIN INCLINATION- 3.3 DEG
PERIAPSIS- 226. KM ALT APOAPSIS- 723. KM ALT

PERSONNEL
PM - A.J. CAPORALE NASA-GSFC
PS - G.P. NEWTON(NLA) NASA-GSFC

BRIEF DESCRIPTION
The Italian-built San Marco 3 was a cooperative space effort between the Italian Space Commission (CRS) and NASA. The primary objectives of the mission were (1) to provide density, neutral composition, and temperature data describing the equatorial upper atmosphere at altitudes of 200 km and above and (2) to measure variations in these parameters as functions of solar and geomagnetic activity. A secondary objective was to determine the neutral density by using three incependent measuring techniques. The spacecraft was a 75-cm-diameter sphere. Four 48-cm antennas protruded from the top of the sphere, for command and telemetry transmission. The structure of the spacecraft formed an integral part of the drag balance experiment. A light, external, outer shell was connected by a series of elastic arms to a heavier internal framework. Thus, from changes in the flexible arms connecting the two structures, atmospheric drag (and therefore density) was determined. Other onboard experiments included an omegatron mass spectrometer that directly measured the density and temperature of molecular nitrogen and a Neutral Atmospheric Composition Experiment (NACE) that directly measured the density of the molecular nitrogen, molecular oxygen, atomic oxygen, argon, and helium. Unlike the earlier San Marco spacecraft, San Marco 3 employed an attitude control system,

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- 71-036A-02

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

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - G.P. NEWTON — NASA HEADQUARTERS
OI - D.T. PELZ(NLA) — NASA-GSFC

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 count, 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 couble-focusing magnetic sector instrument and was a modification of the sensors flown on Explorer 17 (63-009A-01) and Explorer 32 (66-044A-02). Entering through a knife-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-filament enclosed ion source which was also gold-plated. Simultaneous measurements were obtained of the following species: helium (4), atomic oxygen (16), molecular nitrogen (28), molecular oxygen (32), ard argon (40). The analyzer could be tuned by ground command, and therefore occasional measurements were made of the concentrations of the following species: atomic nitrogen (14), water vapor (18), and carbon dioxide (44). 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 modulated signals, the ambient concentrations were obtained. Preliminary results showec 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. Geophys. Res., v. 80, n. 16, p. 2289, 1975. Data from this investigation no longer exist.

------- SAN MARCO 3, SPENCER----------

INVESTIGATION NAME- ATMOSPHERIC NITROGEN DENSITY

NSSDC ID- 71-036A-03

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

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - N.W. SPENCER — NASA-GSFC
OI - G.R. CARIGNAN — U OF MICHIGAN

BRIEF DESCRIPTION
The omegatron experiment was designed to provide direct measurements of the temperature and density of the thermospheric molecular nitrogen. The experiment employed a small omegatron mass spectrometer which was tuned to molecular nitrogen. The sensor elements were enclosed in a special orificed spherical chamber whose center line lay in the equatorial plane of the satellite. The motion of the chamber during satellite roll caused a variation in chamber pressure, from which the nitrogen concentration and particle energy distribution could be derivec. 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 samples were too small (only a few minutes per orbit) to be of much value.

********** SAN MARCO 4**********

SPACECRAFT COMMON NAME- SAN MARCO 4
ALTERNATE NAMES- SAN MARCO-C-2, 07154
SM-C2

NSSDC ID- 74-009A

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

SPONSORING COUNTRY/AGENCY
ITALY — CRA
UNITED STATES — NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC — EPOCH DATE- 02/19/74
ORBIT PERIOD- 96.3 MIN — INCLINATION- 2.9 DEG
PERIAPSIS- 232.0 KM ALT — APOAPSIS- 905.0 KM ALT

PERSONNEL
PM - A.J. CAPORALE — NASA-GSFC
PS - G.P. NEWTON(NLA) — NASA-GSFC

BRIEF DESCRIPTION
The Italian-built San Marco 4 spacecraft was part of a cooperative space effort between the Italian Space Commission (CRS) and NASA. The scientific objective of this flight was to measure the diurnal variations of the equatorial neutral thermosphere density, composition, and temperature for correlation with simultaneous Atmospheric Explorer C data. Studies of the physics and dynamics of the lower thermosphere were included. The spacecraft carried (1) a Neutral Atmosphere Composition Experiment (NACE) to determine upper atmospheric (160 km and above) concentrations of argon, helium, atomic oxygen and molecular oxygen and nitrogen, (2) a Neutral Atmospheric Temperature Experiment (NATE) to determine the temperature of ambient molecular nitrogen and (3) an accelerometer to measure atmospheric density near satellite perigee.

------- SAN MARCO 4, NEWTON----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE COMPOSITION

NSSDC ID- 74-009A-02

INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, 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 concentrations and temporal variations of the following neutral upper atmosphere constituents: argon, molecular anc atomic oxygen, molecular nitrogen, and helium. A magnetic mass spectrometer was used. Because of some anomalies which developed that complicated data analysis, no data were reduced from this experiment.

------- SAN MARCO 4, SPENCER----------

INVESTIGATION NAME- NEUTRAL ATMOSPHERE TEMPERATURE

NSSDC ID- 74-009A-03

INVESTIGATIVE PROGRAM
CODE EE-8/CO-OP, 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 omegatron tuned to measure molecular nitrogen, and it had a knife-edged orifice. Temperature was measured during a spin-scan by observing the response as a function of angle with the satellite velocity vector. The experiment functioned correctly but the data samples were too small (only a few minutes per orbit) to be of much value.

********** SME**********

SPACECRAFT COMMON NAME- SME
ALTERNATE NAMES- SOLAR MESOSPHERE EXPL, 12887

NSSDC ID- 81-100A

LAUNCH DATE- 10/06/81 — WEIGHT- 145. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES — NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC — EPOCH DATE- 10/16/81
ORBIT PERIOD- 95.5 MIN — INCLINATION- 97.5 DEG
PERIAPSIS- 535. KM ALT — APOAPSIS- 551. KM ALT

PERSONNEL

PM - J.J. PAULSON		NASA-JPL
PS - C.A. BARTH		U OF COLORADO

BRIEF DESCRIPTION

The Solar Mesosphere Explorer (SME) primary mission objective was to investigate the processes that create and destroy ozone in the earth's mesosphere and upper stratosphere. 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 dioxide and ozone. The satellite experiment complement consisted of a solar ultraviolet spectrometer, a UV ozone spectrometer, an infrared radiometer, a 1.27 micrometer spectrometer, and a nitrogen dioxide spectrometer. In addition, a solar proton alarm detector was carried to measure the integrated solar flux in the range 30 to 500 MeV. Spin stabilized at 5 rpm, the satellite moved in a 3 am to 3 pm sun-syrchronous orbit. The spacecraft body was a cylinder approximately 1.7 by 1.25 m and consisted of two major modules: the observatory module which housed the scientific instruments, and the spacecraft bus. The spin axis was oriented normal to the orbital plane. The command system 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.

------- SME, BARTH----------

INVESTIGATION NAME- UV OZONE

NSSDC ID- 81-100A-01

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

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - C.A.	BARTH	U OF COLORADO
OI - G.J.	ROTTMAN	U OF COLORADO
OI - R.J.	THOMAS	U OF COLORADO
OI - J.C.	GILLE	NATL CTR FOR ATMOS RES
OI - A.I.	STEWART	U OF COLORADO
OI - C.W.	HORD	U OF COLORADO
OI - P.J.	CRUTZEN	MPI-CHEMISTRY
OI - R.E.	DICKINSON	NATL CTR FOR ATMOS RES
OI - P.L.	BAILEY	NATL CTR FOR ATMOS RES
OI - J.F.	NOXON	NOAA-ERL
OI - G.E.	THOMAS	U OF COLORADO
CI - J.	LONDON	U OF COLORADO

BRIEF DESCRIPTION

The objective of the Ultraviolet Ozone Experiment was to measure ozone absorption of rayleigh-scattered sunlight in the middle ultraviolet region. A dual-channel Ebert-Fastie spectrometer operated in the regions 1880-3100 Angstroms (A) and 2230-3404 A and viewed normal to the spin axis. At half maximum the full width of the signal was 15 A. There were 208/11 grating steps per scan, respectively.

------- SME, BARTH----------

INVESTIGATION NAME- INFRARED RADIOMETER (4 CHANNELS)

NSSDC ID- 81-100A-02

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

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - C.A.	BARTH	U OF COLORADO
OI - G.J.	ROTTMAN	U OF COLORADO
OI - R.J.	THOMAS	U OF COLORADO
OI - J.C.	GILLE	NATL CTR FOR ATMOS RES
OI - P.L.	BAILEY	NATL CTR FOR ATMOS RES
OI - J.F.	NOXON	NOAA-ERL
OI - A.I.	STEWART	U OF COLORADO
OI - C.W.	HORD	U OF COLORADO
OI - G.E.	THOMAS	U OF COLORADO
OI - J.	LONDON	U OF COLORADO
OI - P.J.	CRUTZEN	MPI-CHEMISTRY
OI - R.E.	DICKINSON	NATL CTR FOR ATMOS RES

BRIEF DESCRIPTION

The objective of the Infrared Radiometer Experiment was to determine the altitude-mixing ratio profiles for water and ozone from thermal emissions. Also, pressure and temperature were determined between 20 and 70 km altitude. The four-channel radiometer/telescope had the following spectral ranges (in micrometers): 17.2 to 13.2, 15.7 to 14.7, 10.6 to 8.6, and 7.2 to 6.1. The full widths at half-maximum were 4.0, 1.0, 2.0, and 1.1 micrometers, respectively. All four channels utilized (Hg-Cd)Te detectors. Wavelength separation was accomplished with multilayer bandpass filters. The instrument line of sight was normal to the spin axis.

------- SME, BARTH----------

INVESTIGATION NAME- 1.27 MICROMETER AIRGLOW

NSSDC ID- 81-100A-03

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

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL

PI - C.A.	BARTH	U OF COLORADO
OI - G.J.	ROTTMAN	U OF COLORADO
OI - R.J.	THOMAS	U OF COLORADO
OI - J.C.	GILLE	NATL CTR FOR ATMOS RES
OI - P.L.	BAILEY	NATL CTR FOR ATMOS RES
OI - J.F.	NOXON	NOAA-ERL
OI - A.I.	STEWART	U OF COLORADO
OI - C.W.	HORD	U OF COLORADO
OI - G.E.	THOMAS	U OF COLORADO
OI - J.	LONDON	U OF COLORADO
OI - P.J.	CRUTZEN	MPI-CHEMISTRY
OI - R.E.	DICKINSON	NATL CTR FOR ATMOS RES

BRIEF DESCRIPTION

The objective of the 1.27-Micrometer Airglow Experiment was to obtain limb-scanning measurements of the 1.27-micrometer airglow in the 50- to 90-km altitude range, and of the hydroxyl emission between 60 and 90 km altitude. A dual-channel Ebert-Fastie spectrometer operated in the region 1.1 to 2.5 micrometers and viewed normal to the spin axis. The full width of the signal at half-maximum was 123 A. There were 512 grating steps per scan.

------- SME, BARTH----------

INVESTIGATION NAME- VISIBLE NITROGEN DIOXIDE

NSSDC ID- 81-100A-04

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

INVESTIGATION DISCIPLINE(S)
METEOROLOGY

PERSONNEL

PI - C.A.	BARTH	U OF COLORADO
OI - G.J.	ROTTMAN	U OF COLORADO
OI - R.J.	THOMAS	U OF COLORADO
OI - J.C.	GILLE	NATL CTR FOR ATMOS RES
OI - P.L.	BAILEY	NATL CTR FOR ATMOS RES
OI - J.F.	NOXON	NOAA-ERL
OI - A.I.	STEWART	U OF COLORADO
OI - C.W.	HORD	U OF COLORADO
OI - G.E.	THOMAS	U OF COLORADO
OI - J.	LONDON	U OF COLORADO
OI - P.J.	CRUTZEN	MPI-CHEMISTRY
OI - R.E.	DICKINSON	NATL CTR FOR ATMOS RES

BRIEF DESCRIPTION

The objective of the Visible Nitrogen Dioxide Experiment was to measure the distribution of nitrogen dioxide in the 25- to 40-km altitude region. This was done by measuring the differential absorption of scattered sunlight by NO2 at two wavelengths near 4400 A. A dual-channel Ebert-Fastie spectrometer operated in the following wavelength intervals: 4390 to 4420 A and 3200-6400 A. The signal at half maximum had a full width of 9.8 A/19.6 A, respectively. There were 512/438 grating steps per scan, respectively. The instrument line of sight was normal to the spin axis.

------- SME, BARTH----------

INVESTIGATION NAME- SOLAR UV MONITOR

NSSDC ID- 81-100A-05

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

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS
IONOSPHERES
AERONOMY

PERSONNEL

PI - C.A.	BARTH	U OF COLORADO
OI - G.J.	ROTTMAN	U OF COLORADO
OI - R.J.	THOMAS	U OF COLORADO
OI - J.C.	GILLE	NATL CTR FOR ATMOS RES
OI - P.L.	BAILEY	NATL CTR FOR ATMOS RES
OI - J.F.	NOXON	NOAA-ERL
OI - A.I.	STEWART	U OF COLORADO
OI - C.W.	HORD	U OF COLORADO
OI - G.E.	THOMAS	U OF COLORADO
OI - J.	LONDON	U OF COLORADO
OI - P.J.	CRUTZEN	MPI-CHEMISTRY
OI - R.E.	DICKINSON	NATL CTR FOR ATMOS RES

BRIEF DESCRIPTION

The objective of the Ultraviolet Solar Monitor Experiment was to monitor the incoming solar radiation to determine the effect on the ozone 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 orbit, the instrument scanned through the

sun once per orbit. The full width at half maximum was 14 A. There were 512 grating steps per scan.

------- SME, BARTH----------

INVESTIGATION NAME- SOLAR PROTON ALARM

NSSDC ID- 81-100A-06

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

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
SOLAR PHYSICS

PERSONNEL

PI - C.A.	BARTH	U OF COLORADO
OI - G.J.	ROTTMAN	U OF COLORADO
OI - R.J.	THOMAS	U OF COLORADO
OI - J.C.	GILLE	NATL CTR FOR ATMOS RES
OI - P.L.	BAILEY	NATL CTR FOR ATMOS RES
OI - J.F.	NOXON	NOAA-ERL
OI - A.I.	STEWART	U OF COLORADO
OI - C.W.	HORD	U OF COLORADO
OI - G.E.	THOMAS	U OF COLORADO
OI - J.	LONDON	U OF COLORADO
OI - P.J.	CRUTZEN	MPI-CHEMISTRY
OI - 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 commandable value, the instrument signaled an opportunity to alter science commands to observe the effects of solar protons on atmospheric constituents.

********** SPUTNIK 3**********

SPACECRAFT.COMMON NAME- SPUTNIK 3
ALTERNATE NAMES- 1958 DELTA 2, 00008

NSSDC ID- 58-004B

LAUNCH DATE- 05/15/58
WEIGHT- 1327. KG
LAUNCH SITE- TYURATAM (BAIKONUR COSMODROME), U.S.S.R.
LAUNCH VEHICLE- A

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

INITIAL ORBIT PARAMETERS

ORBIT TYPE- GEOCENTRIC	EPOCH DATE- 05/15/58
ORBIT PERIOD- 105.9 MIN	INCLINATION- 65.18 DEG
PERIAPSIS- 217. KM ALT	APOAPSIS- 1864. 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 (12 instruments) provided data on pressure and composition of the upper atmosphere, concentration of charged particles, photons in cosmic rays, heavy nuclei in cosmic 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, UNKNOWN----------

INVESTIGATION NAME- BEACON

NSSDC ID- 58-004B-12

INVESTIGATIVE PROGRAM
SCIENCE

INVESTIGATION DISCIPLINE(S)
IONOSPHERES AND RADIO PHYSICS

PERSONNEL
PI - UNKNOWN

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

********** STP P78-1**********

SPACECRAFT COMMON NAME- STP P78-1
ALTERNATE NAMES- SPACE TEST PROGRAM P78-1, P78-1
11278, SOLWIND

NSSDC ID- 79-017A

LAUNCH DATE- 02/24/79
WEIGHT- 849.6 KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- ATLAS

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-USAF

INITIAL ORBIT PARAMETERS

ORBIT TYPE- GEOCENTRIC	EPOCH DATE- 02/24/79
ORBIT PERIOD- 96.3 MIN	INCLINATION- 97.9 DEG
PERIAPSIS- 560. KM ALT	APOAPSIS- 600. KM ALT

PERSONNEL

PM - R.B.	KEHL	USAF SPACE DIVISION
PS - H.E.	WANG	AEROSPACE CORP

BRIEF DESCRIPTION
The space test program (STP) P78-1 mission was designed to obtain 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 spectroheliograph, (4) an extreme-ultraviolet spectrometer, (5) a high-latitude particle spectrometer, (6) an X-ray monitor, and (7) a preliminary aerosol monitor.

------- STP P78-1, BOWYER----------

INVESTIGATION NAME- EXTREME ULTRAVIOLET SPECTROMETER

NSSDC ID- 79-017A-04

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
AERONOMY
IONOSPHERES

PERSONNEL

PI - C.S.	BOWYER	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-deg by 6-deg field of view and measured a selected 600-A bandwidth with 5-A resolution within the 200- to 1400-A range.

------- STP P78-1, IMHOF----------

INVESTIGATION NAME- GAMMA RAY SPECTROMETER

NSSDC ID- 79-017A-01

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

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

PERSONNEL

PI - 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. There were two GE detectors, cooled by a mechanical refrigerator, two CsI/plastic Phoswich detectors, and an array of eight cadmium tellurium detectors. Each GE detector had a conical field of view (FOV) of 45 deg half angle, was 80 cc in volume and 15 sq cm in front area, and measured energy loss from 40 keV to 2.5 MeV in 4096 channels. A factor-of-3 gain change allowed the range to change to 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 10.16-cm diameter disks of 1.27 cm thickness; they measured energy loss from 40 keV to 2.5 MeV in 256 channels. The cadmium tellurium detectors had a fan-shaped FOV of 90 deg by 10 deg and were equally spaced in the 10-deg widths around the circle. The energy loss range was 20 to 200 keV in six channels.

------- STP P78-1, MCKENZIE----------

INVESTIGATION NAME- SOLAR X-RAY SPECTROMETER

NSSDC ID- 79-017A-03

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS

PERSONNEL

PI - D.L.	MCKENZIE	AEROSPACE CORP
PI - R.W.	KREPLIN	US NAVAL RESEARCH LAB
OI - G.A.	DOSCHEK	US NAVAL RESEARCH LAB

BRIEF DESCRIPTION
This investigation was composed of four parts: Solex, Solflex, Monex, and Magmap. The objective of these four experiments was the study of solar flares and active regions. Solex obtained 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 multigrid collimators and Bragg crystal spectrometers. Solflex obtained flare spectra in four narrow-wavelength bands between 1.8 and 8.6 A using uncollimated Bragg crystal spectrometers. Monex recorded full solar-disk intensity with 32 ms time resolution from 0.1 to 12 A using uncollimated proportional counters. Magmap obtained full-disk solar maps from 8 to 12 A using filtered collimated proportional counters.

------- STP P78-1, MICHELS----------

INVESTIGATION NAME- SOLAR WIND MONITOR

NSSDC ID- 79-017A-02

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
SOLAR PHYSICS

PERSONNEL
PI - D.J. MICHELS US NAVAL RESEARCH LAB

BRIEF DESCRIPTION
This investigation used a white-light coronagraph 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 form and structure of solar flares, coronal holes, and Alfven waves. Due to background light problems, the EUV heliograph data were completely compromised.

------- STP P78-1, PEPIN----------

INVESTIGATION NAME- PRELIMINARY AEROSOL MONITOR

NSSDC ID- 79-017A-07

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
METEOROLOGY

PERSONNEL
PI - T.J. PEPIN 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

NSSDC ID- 79-017A-06

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
X-RAY ASTRONOMY

PERSONNEL
PI - S.D. SHULMAN(NLA) 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 emission.

------- STP P78-1, VANCOUR----------

INVESTIGATION NAME- HIGH LATITUDE PARTICLE SPECTROMETER

NSSDC ID- 79-017A-05

INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS
MAGNETOSPHERIC PHYSICS

PERSONNEL
PI - R.P. VANCOUR USAF GEOPHYS 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 substorm periods. One 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.

********** TIP 1**********

SPACECRAFT COMMON NAME- TIP 1
ALTERNATE NAMES- TRIAD 1, TRIAD OI 1X
TRIAD A, 06173
TRIAD

NSSDC ID- 72-069A

LAUNCH DATE- 09/02/72 WEIGHT- 94. KG
LAUNCH SITE- VANDENBERG AFB, UNITED STATES
LAUNCH VEHICLE- SCOUT

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-NAVY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 09/04/72
ORBIT PERIOD- 100.7 MIN INCLINATION- 90.1 DEG
PERIAPSIS- 716.0 KM ALT APOAPSIS- 863.0 KM ALT

PERSONNEL
PM - J. DASSOULAS APPLIED PHYSICS LAB
PS - R.E. FISCHELL APPLIED PHYSICS LAB

BRIEF DESCRIPTION
This three-body spacecraft was connected by booms which served as gravity-gradient stabilizers in the radial direction. A momentum wheel was used for stabilization in roll and yaw. The primary function of the spacecraft was to test various concepts for improving the USN Transit Navigation System. The power was supplied by a radioisotope thermal electric generator.

------- TIP 1, POTEMRA----------

INVESTIGATION NAME- TRIAXIAL FLUXGATE MAGNETOMETER

NSSDC ID- 72-069A-01

INVESTIGATIVE PROGRAM
NAVIGATION TECHNOLOGY

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - T.A. POTEMRA APPLIED PHYSICS LAB

BRIEF DESCRIPTION
This experiment consisted of a triaxial fluxgate magnetometer designed to measure vector fields with magnitudes up to 5.E4 nT. Measurements were made by sampling each axis sequentially at a rate of 2.25 samples/s. Digitization resolution was about 10 nT as given by a 13-bit analog-to-digital converter, but zero-level drifts were not readily checked. Therefore, the experiment was most useful in studies of magnetic fluctuations. Due to the real-time data transmission and the locations of the tracking stations, most of the data obtained related to northern and southern hemisphere high latitudes.

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

SPACECRAFT COMMON NAME- TRANSIT 2A
ALTERNATE NAMES- 1960 ETA 1, 00045

NSSDC ID- 60-007A

LAUNCH DATE- 06/22/60 WEIGHT- 101. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- THOR

SPONSORING COUNTRY/AGENCY
UNITED STATES DOD-NAVY

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 06/22/60
ORBIT PERIOD- 101.7 MIN INCLINATION- 66.69 DEG
PERIAPSIS- 628. KM ALT APOAPSIS- 1047. KM ALT

PERSONNEL
PM - T. WYATT APPLIED PHYSICS LAB
PS - T. WYATT APPLIED PHYSICS LAB

BRIEF DESCRIPTION
The two Transit program objectives were (1) to develop and demonstrate equipment to provide a reliable means of fixing the position of surface craft, submarines, and aircraft--anywhere and in any weather--more precisely, and (2) to provide more accurate maritime and aerial navigation in any weather than currently available. The Transit 2A spacecraft hac as its instrument complement the following: cosmic-noise radiometer, transmitters, infrared scanner to measure satellite rotation before despin was initiated, and temperature sensors. The power supply was a nickel-cadmium battery, recharged by solar cells. The transmitters operated at the following frequencies: 54, 162, 216, and 324 MHz.

------- TRANSIT 2A, UNKNOWN----------

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 324 MHz) were operated for the navigation experiment. Ionospheric physicists used the characteristics of these beacons, such as Faraday rotation, phase shift, Doppler shift, signal intensity, etc., to determine ionospheric characteristics which included total electron content and scintillation along the propagation path. Ground stations recorded the beacon signals as input to study the ionosphere.

********** TRANSIT 4A**********

SPACECRAFT 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 EPOCH DATE- 06/29/61
ORBIT PERIOD- 103.8 MIN INCLINATION- 66.81 DEG
PERIAPSIS- 881. KM ALT APOAPSIS- 998. KM ALT

PERSONNEL
PM - T. WYATT APPLIED PHYSICS LAB
PS - T. WYATT 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-faced right prisms 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 nominally 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 324 MHz and 150 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**********

SPACECRAFT COMMON NAME- VANGUARD 1
ALTERNATE NAMES- 1958 BETA 2, 00005
VANGUARD TV4

NSSDC ID- 58-002B

LAUNCH DATE- 03/17/58 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 EPOCH DATE- 03/17/58
ORBIT PERIOD- 134.2 MIN INCLINATION- 34.25 DEG
PERIAPSIS- 650. KM ALT APOAPSIS- 4010. KM ALT

PERSONNEL
PM - J.P. HAGEN(NLA) US NAVAL RESEARCH LAB
PS - J.P. HAGEN(NLA) 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 also was 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-mW, 108-MHz mercury-battery-powered transmitter and a 5-mW, 108.03-MHz transmitter powered by six 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 satellite, 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 SAO
OI - J.R. SLOWEY SAO

BRIEF DESCRIPTION
Because of its symmetrical shape, Vanguard 1 was selected by the experimenters for use in determining upper atmospheric densities as a function of altitude, latitude, season, 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-Nunn camera network) and radio and/or radar tracking techniques. This experiment obtained reasonable density values. Vanguard 1 has an expected orbital lifetime of 400 yr.

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

SPACECRAFT COMMON NAME- VANGUARD 2
ALTERNATE NAMES- 1959 ALPHA 1, 00011
VANGUARD SLV 4

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 EPOCH DATE- 02/17/59
ORBIT PERIOD- 125.60 MIN INCLINATION- 32.88 DEG
PERIAPSIS- 559. KM ALT APOAPSIS- 3320. KM ALT

PERSONNEL
PM - J.P. HAGEN(NLA) US NAVAL RESEARCH LAB
PS - J.P. HAGEN(NLA) US NAVAL RESEARCH LAB

BRIEF DESCRIPTION
Vanguard 2 was 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 photocells. 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 10-mW, 108-MHz beacon transmitter that sent a continuous signal for tracking purposes. A command receiver was used to activate a tape recorder that relayed telescope experiment data to the telemetry transmitter. Both transmitters functioned normally for 19 days. The satellite was spin 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

NSSDC ID- 59-001A-02 INVESTIGATIVE PROGRAM
SPACE TEST PROGRAM

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - L.G. JACCHIA SAO
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, season, 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-Nunn 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**********

SPACECRAFT COMMON NAME- VANGUARD 3
ALTERNATE NAMES- 1959 ETA 1, 00020
VANGUARD TV4 BACKUP

NSSDC ID- 59-007A

LAUNCH DATE- 09/18/59 WEIGHT- 22.7 KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- VANGUARD

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSSA

INITIAL ORBIT PARAMETERS
ORBIT TYPE- GEOCENTRIC EPOCH DATE- 09/18/59
ORBIT PERIOD- 129.7 MIN INCLINATION- 33.3 DEG
PERIAPSIS- 512. KM ALT APOAPSIS- 3744. KM ALT

PERSONNEL
PM - J.W. TOWNSEND(NLA) NASA-GSFC
PS - J.P. HEPPNER NASA-GSFC

BRIEF DESCRIPTION
Vanguard 3 was launched by a Vanguard rocket from the Easterr Test Range into a geocentric orbit. The objectives of the flight were to measure the earth's magnetic field, the solar X-ray radiation and its effects on the earth's atmosphere, and the near-earth micrometeoroid environment. Instrumentation included a proton magnetometer, X-ray ionization chambers, and various micrometeoroid detectors. The spacecraft was a 50.8-cm-diameter magnesium sphere. The magnetometer was housed in a glass fiber phenolic resin conical tube attached to the sphere. Data transmission stopped on December 11, 1959, after 84 days of operation. The data obtained provided a comprehensive survey of the earth's magnetic field over the area covered, defined the lower edge of the Van Allen radiation belt, and provided a count of micrometeoroid impacts. Vanguard 3 has an expected orbital lifetime of 300 yr.

------- VANGUARD 3, HEPPNER----------

INVESTIGATION NAME- PROTON PRECESSIONAL MAGNETOMETER

NSSDC ID- 59-007A-01 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
PARTICLES AND FIELDS

PERSONNEL
PI - J.P. HEPPNER NASA-GSFC

BRIEF DESCRIPTION
This experiment had a proton precessional magnetometer to measure the earth's magnetic field at altitudes ranging from 514 to 3714 km and at latitudes between plus or minus 33.4 deg. The measurements were made or command as the spacecraft passed seven minitrack stations in North anc South America and one each in Australia and South Africa. When switched on by command, the polarization coil around the proton sample (normal hexane) was turned on for 2 s followed by a 2-s readout of the precession signal. Several readings were taken during each pass over a station. The experiment worked well during its 85-day active life, and approximately 4.3E3 readings were recorded. The experiment is describeo in J. C. Cain et al., "Measurements of the geomagnetic field by the Vanguard 3 satellite," NASA TN D-1418, 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

NSSDC ID- 59-007A-04 INVESTIGATIVE PROGRAM
CODE EE-8, SCIENCE

INVESTIGATION DISCIPLINE(S)
AERONOMY

PERSONNEL
PI - L.G. JACCHIA SAO
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, season, 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-Nunn camera network) and radio and/or radar tracking techniques. This experiment obtained reasonable density values. Vanguard 3 has an expected lifetime of 300 yr.

Index of Spacecraft and Investigations

SPACECRAFT NAME / *PRINC.INVEST.NAME	COUNTRY AND AGENCY / INVESTIGATION NAME	LAUNCH DATE	ORBIT TYPE	NSSDC ID	PAGE NO.
NAGY	LANGMUIR PROBES			69-051A-02	65
REBER	NEUTRAL ATMOSPHERE COMPOSITION			69-051A-04	66
SHARP	MICROPHONE ATMOSPHERIC DENSITY GAUGE			69-051A-01	66
SMITH	TRIAXIAL SEARCH-COIL MAGNETOMETER			69-051A-22	66
STONE	COSMIC-RAY STUDY			69-051A-20	66
TAYLOR, JR.	ION MASS SPECTROMETER			69-051A-05	67
WILLIAMS	TRAPPED AND PRECIPITATING ELECTRONS GSFC			69-051A-17	67
OGO-C	SEE OGO 2				
OGO-D	SEE OGO 4				
OGO-F	SEE OGO 6				
ORBITING VEHICLE 1-2	SEE OV1- 2				
OV1- 2	UNITED STATES DOD-USAF	10/05/65	GEOCENTRIC	65-078A	67
FARLEY	ELECTRON AND PROTON DETECTORS			65-078A-02	67
FORTNEY	X-RAY CSI CRYSTAL DOSIMETER			65-078A-03	68
OV1-10	UNITED STATES DOD-USAF	12/11/66	GEOCENTRIC	66-111B	68
HEPPNER	MAGNETIC AND ELECTRIC FIELDS			66-111B-08	68
OV1-13	UNITED STATES DOD-USAF	04/06/68	GEOCENTRIC	68-026A	68
KATZ	ELECTRON SPECTROMETER			68-026A-02	68
KATZ	HIGH ENERGY ELECTRON SCINTILLATOR			68-026A-04	68
OV1-15	UNITED STATES DOD-USAF	07/11/68	GEOCENTRIC	68-059A	69
CHAMPION	TRIAXIAL ACCELEROMETER			68-059A-01	69
ELLIOTT	RAM ATMOSPHERE DENSITY GAUGE			68-059A-05	69
OV1-19	UNITED STATES DOD-USAF	03/10/69	GEOCENTRIC	69-025C	69
FREDEN	HI ENERGY RESOLU PROTON MEAS ANAL WITH A DE/DX TELESCOPE	ISOTOPIC		69-025C-04	69
OV3-3	UNITED STATES DOD-USAF	08/04/66	GEOCENTRIC	66-070A	69
JACCHIA	SATELLITE DRAG ATMOSPHERIC DENSITY			66-070A-09	69
VAMPOLA	MAGNETIC ELECTRON SPECTROMETER			66-070A-05	70
OVAL	SEE COSMOS 900				
P 11-AS	UNITED STATES DOD-USAF	08/14/64	GEOCENTRIC	64-045B	70
SCARF	VLF ELECTRIC FIELD DETECTOR			64-045B-06	70
P78-1	SEE STP P78-1				
POGO 1	SEE OGO 2				
POGO 2	SEE OGO 4				
POGO 3	SEE OGO 6				
RADSAT	UNITED STATES DOD-ARMY UNITED STATES DOD-USAF UNITED STATES DOD-NAVY	10/02/72	GEOCENTRIC	72-076B	70
KATZ	SOLAR PROTON, DEUTERON, TRITON SOLID-STATE TELESCOPE			72-076B-01	70
RELAY 1	UNITED STATES NASA-OSSA	12/13/62	GEOCENTRIC	62-068A	71
BROWN	SOLID-STATE ION CHAMBER ELECTRON AND PROTON DETECTOR			62-068A-02	71
MCILWAIN	PROTON-ELECTRON DETECTORS			62-068A-03	71
RELAY 2	UNITED STATES NASA-OSSA	01/21/64	GEOCENTRIC	64-003A	71
BROWN	SOLID-STATE ION CHAMBER ELECTRON AND PROTON DETECTOR			64-003A-02	71
RELAY A	SEE RELAY 1				
RELAY B	SEE RELAY 2				
S 1A	SEE EXPLORER 7				
S 6	SEE AE-A				
S 6A	SEE AE-B				
S 6C	SEE AE-C				
S 6D	SEE AE-D				
S 6E	SEE AE-E				
S 27	SEE ALOUETTE 1				

Appendix

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.

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.

NASA
National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

NSSDC/WDC-A-R&S DOCUMENT REQUEST FORM

Researchers WITHIN the United States send order to:	Researchers OUTSIDE the United States send order to:
NATIONAL SPACE SCIENCE DATA CENTER CODE 601.4 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771	WORLD DATA CENTER A ROCKETS AND SATELLITES CODE 601 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771 U.S.A.

REQUESTER INFORMATION (Please print)

NAME	TITLE
ORGANIZATION	
ADDRESS	
CITY	STATE
ZIP CODE OR COUNTRY	
TELEPHONE (Area Code) (Number) (Ext.)	
DATE OF REQUEST	DATE DESIRED

(Our average processing time for a request is 3 to 4 weeks after receipt of request. Please allow ample time for delivery. We will notify you if we cannot meet the date specified.)

INTENDED USE OF MATERIAL (Check all that apply)

- ☐ Support of a NASA effort (project, study, etc.)
- ☐ Support of a U.S. Government effort (other than NASA)
- ☐ Research and analysis project (individual or company)
- ☐ Educational purposes (explain below)
- ☐ Preparation of Master's thesis
- ☐ Preparation of Doctoral thesis
- ☐ Exhibit or display
- ☐ Reference material
- ☐ Use in publication
- ☐ Other: _____

_____

_____

_____

_____

DOCUMENT DISTRIBUTION CATEGORIES

Please indicate the document you wish to receive on routine distribution by placing an X in the box next to the specific category desired. Use reverse side of this form to order specific documents.

☐ Documents Describing the Operation of NSSDC and WDC-A-R&S

Documents Describing the Availability of Satellite Experiment Data

- ☐ NSSDC Data Listing
- ☐ Astronomy
- ☐ Geodesy and Gravimetry
- ☐ Ionospheric Physics
- ☐ Meteorology
- ☐ Particles and Fields
- ☐ Planetary Atmospheres
- ☐ Planetology
- ☐ Solar Physics

☐ 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)

SPECIFIC DOCUMENTS

ORDER NUMBER	PUBLICATION TITLE

NASA
National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

NSSDC/WDC-A-R&S DOCUMENT REQUEST FORM

Researchers WITHIN the United States send order to:	Researchers OUTSIDE the United States send order to:
NATIONAL SPACE SCIENCE DATA CENTER CODE 601.4 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771	WORLD DATA CENTER A ROCKETS AND SATELLITES CODE 601 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771 U.S.A.

REQUESTER INFORMATION (Please print)

NAME	TITLE
ORGANIZATION	
ADDRESS	
CITY	STATE
ZIP CODE OR COUNTRY	
TELEPHONE (Area Code) (Number) (Ext.)	
DATE OF REQUEST	DATE DESIRED

(Our average processing time for a request is 3 to 4 weeks after receipt of request. Please allow ample time for delivery. We will notify you if we cannot meet the date specified.)

INTENDED USE OF MATERIAL (Check all that apply)

- ☐ Support of a NASA effort (project, study, etc.)
- ☐ Support of a U.S. Government effort (other than NASA)
- ☐ Research and analysis project (individual or company)
- ☐ Educational purposes (explain below)
- ☐ Preparation of Master's thesis
- ☐ Preparation of Doctoral thesis
- ☐ Exhibit or display
- ☐ Reference material
- ☐ Use in publication
- ☐ Other: _____

_____

_____

_____

_____

DOCUMENT DISTRIBUTION CATEGORIES

Please indicate the document you wish to receive on routine distribution by placing an X in the box next to the specific category desired. Use reverse side of this form to order specific documents.

☐ Documents Describing the Operation of NSSDC and WDC-A-R&S

Documents Describing the Availability of Satellite Experiment Data

- ☐ NSSDC Data Listing
- ☐ Astronomy
- ☐ Geodesy and Gravimetry
- ☐ Ionospheric Physics
- ☐ Meteorology
- ☐ Particles and Fields
- ☐ Planetary Atmospheres
- ☐ Planetology
- ☐ Solar Physics

☐ 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

SPECIFIC DOCUMENTS

ORDER NUMBER	PUBLICATION TITLE

NASA
National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

NSSDC/WDC-A-R&S DOCUMENT REQUEST FORM

Researchers WITHIN the United States send order to:	Researchers OUTSIDE the United States send order to:
NATIONAL SPACE SCIENCE DATA CENTER CODE 601.4 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771	WORLD DATA CENTER A ROCKETS AND SATELLITES CODE 601 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771 U.S.A.

REQUESTER INFORMATION (Please print)

NAME	TITLE
ORGANIZATION	
ADDRESS	
CITY	STATE
ZIP CODE OR COUNTRY	
TELEPHONE (Area Code) (Number) (Ext.)	
DATE OF REQUEST	DATE DESIRED

(Our average processing time for a request is 3 to 4 weeks after receipt of request. Please allow ample time for delivery. We will notify you if we cannot meet the date specified.)

INTENDED USE OF MATERIAL (Check all that apply)

- ☐ Support of a NASA effort (project, study, etc.)
- ☐ Support of a U.S. Government effort (other than NASA)
- ☐ Research and analysis project (individual or company)
- ☐ Educational purposes (explain below)
- ☐ Preparation of Master's thesis
- ☐ Preparation of Doctoral thesis
- ☐ Exhibit or display
- ☐ Reference material
- ☐ Use in publication
- ☐ Other: _____

_____

_____

_____

_____

DOCUMENT DISTRIBUTION CATEGORIES

Please indicate the document you wish to receive on routine distribution by placing an X in the box next to the specific category desired. Use reverse side of this form to order specific documents.

☐ Documents Describing the Operation of NSSDC and WDC-A-R&S

Documents Describing the Availability of Satellite Experiment Data

- ☐ NSSDC Data Listing
- ☐ Astronomy
- ☐ Geodesy and Gravimetry
- ☐ Ionospheric Physics
- ☐ Meteorology
- ☐ Particles and Fields
- ☐ Planetary Atmospheres
- ☐ Planetology
- ☐ Solar Physics

☐ 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)

SPECIFIC DOCUMENTS

ORDER NUMBER	PUBLICATION TITLE

NSSDC DATA REQUEST FORM*

Scientists OUTSIDE the United States send order to:	Requesters WITHIN the United States send order to:
WORLD DATA CENTER A ROCKETS AND SATELLITES CODE 601 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771, USA	NATIONAL SPACE SCIENCE DATA CENTER CODE 601.4 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771

REQUESTER INFORMATION (Please print)

NAME	TITLE/POSITION
DIVISION/BRANCH/DEPARTMENT	MAIL CODE
ORGANIZATION	
ADDRESS	
CITY	STATE
ZIP CODE OR COUNTRY	TELEPHONE (Area Code) (Number) (Extension)
DATE OF REQUEST	DATE DATA DESIRED (Our average processing time for a request is 3 to 4 weeks. Please allow ample time for delivery. We will notify you if we cannot meet the date specified.)

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.

NSSDC CHARGE AND SERVICE POLICY

The purpose of the National Space Science Data Center (NSSDC) is to provide data and information from space science flight experiments in support of additional studies beyond those performed by the principal investigators. Therefore, NSSDC will provide data and information upon request to any individual or organization resident in the United States. In addition, the same services are available to scientists outside the United States through the World Data Center A (WDC–A) for Rockets and Satellites. (The addresses for both NSSDC and WDC–A are given on the reverse side.) Normally, a charge is made for the requested data to cover the cost of reproduction and the processing of the request. The requester will be notified of the cost, and payment must be received prior to processing the request. However, the Director of NSSDC may waive, as resources permit, the charge for modest amounts of data when they are to be used for scientific studies or for specific educational purposes and when they are requested by an individual affiliated with: (1) NASA installations, NASA contractors, or NASA grantees; (2) other U.S. Government agencies, their contractors, or their grantees; (3) universities or colleges; (4) state and local governments; and (5) non–profit organizations.

DATA REQUESTED

NSSDC DATA SET ID NUMBER	Spacecraft, Experiment, and Data Set Names	Form of Data* (e.g., 16mm microfilm) Refer to data set brief descriptions.	Timespan Needed

Additional Specifications

*If requesting data on magnetic tape, please supply the necessary information below.

Density	Mode	No. of Tracks	Computer
☐ 556 bpi	☐ BIN	☐ 7	
☐ 800 bpi	☐ BCD	☐ 9	_____
☐ 1600 bpi			

☐ New tapes will be supplied prior to processing.
☐ Original NSSDC tapes will be returned.
☐ I shall pay for new tapes.

NSSDC DATA REQUEST FORM*

Scientists OUTSIDE the United States send order to:	Requesters WITHIN the United States send order to:
WORLD DATA CENTER A ROCKETS AND SATELLITES CODE 601 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771, USA	NATIONAL SPACE SCIENCE DATA CENTER CODE 601.4 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771

REQUESTER INFORMATION (Please print)

NAME	TITLE/POSITION
DIVISION/BRANCH/DEPARTMENT	MAIL CODE
ORGANIZATION	
ADDRESS	
CITY	STATE
ZIP CODE OR COUNTRY	TELEPHONE (Area Code) (Number) (Extension)
DATE OF REQUEST	DATE DATA DESIRED (Our average processing time for a request is 3 to 4 weeks. Please allow ample time for delivery. We will notify you if we cannot meet the date specified.)

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.

NSSDC CHARGE AND SERVICE POLICY

The purpose of the National Space Science Data Center (NSSDC) is to provide data and information from space science flight experiments in support of additional studies beyond those performed by the principal investigators. Therefore, NSSDC will provide data and information upon request to any individual or organization resident in the United States. In addition, the same services are available to scientists outside the United States through the World Data Center A (WDC-A) for Rockets and Satellites. (The addresses for both NSSDC and WDC-A are given on the reverse side.) Normally, a charge is made for the requested data to cover the cost of reproduction and the processing of the request. The requester will be notified of the cost, and payment must be received prior to processing the request. However, the Director of NSSDC may waive, as resources permit, the charge for modest amounts of data when they are to be used for scientific studies or for specific educational purposes and when they are requested by an individual affiliated with: (1) NASA installations, NASA contractors, or NASA grantees; (2) other U.S. Government agencies, their contractors, or their grantees; (3) universities or colleges; (4) state and local governments; and (5) non-profit organizations.

DATA REQUESTED

NSSDC DATA SET ID NUMBER	Spacecraft, Experiment, and Data Set Names	Form of Data* (e.g., 16mm microfilm) Refer to data set brief descriptions.	Timespan Needed

Additional Specifications

*If requesting data on magnetic tape, please supply the necessary information below.

Density	Mode	No. of Tracks	Computer
☐ 556 bpi	☐ BIN	☐ 7	
☐ 800 bpi	☐ BCD	☐ 9	_____
☐ 1600 bpi			

☐ New tapes will be supplied prior to processing.
☐ Original NSSDC tapes will be returned.
☐ I shall pay for new tapes.

NSSDC DATA REQUEST FORM*

Scientists OUTSIDE the United States send order to:	Requesters WITHIN the United States send order to:
WORLD DATA CENTER A ROCKETS AND SATELLITES CODE 601 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771, USA	NATIONAL SPACE SCIENCE DATA CENTER CODE 601.4 GODDARD SPACE FLIGHT CENTER GREENBELT, MARYLAND 20771

REQUESTER INFORMATION (Please print)

NAME	TITLE/POSITION	
DIVISION/BRANCH/DEPARTMENT		MAIL CODE
ORGANIZATION		
ADDRESS		
CITY	STATE	
ZIP CODE OR COUNTRY	TELEPHONE (Area Code) (Number) (Extension)	
DATE OF REQUEST	DATE DATA DESIRED	(Our average processing time for a request is 3 to 4 weeks. Please allow ample time for delivery. We will notify you if we cannot meet the date specified.)

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)

NSSDC CHARGE AND SERVICE POLICY

The purpose of the National Space Science Data Center (NSSDC) is to provide data and information from space science flight experiments in support of additional studies beyond those performed by the principal investigators. Therefore, NSSDC will provide data and information upon request to any individual or organization resident in the United States. In addition, the same services are available to scientists outside the United States through the World Data Center A (WDC–A) for Rockets and Satellites. (The addresses for both NSSDC and WDC–A are given on the reverse side.) Normally, a charge is made for the requested data to cover the cost of reproduction and the processing of the request. The requester will be notified of the cost, and payment must be received prior to processing the request. However, the Director of NSSDC may waive, as resources permit, the charge for modest amounts of data when they are to be used for scientific studies or for specific educational purposes and when they are requested by an individual affiliated with: (1) NASA installations, NASA contractors, or NASA grantees; (2) other U.S. Government agencies, their contractors, or their grantees; (3) universities or colleges; (4) state and local governments; and (5) non–profit organizations.

DATA REQUESTED

NSSDC DATA SET ID NUMBER	Spacecraft, Experiment, and Data Set Names	Form of Data* (e.g., 16mm microfilm) Refer to data set brief descriptions.	Timespan Needed

Additional Specifications

*If requesting data on magnetic tape, please supply the necessary information below.

Density	Mode	No. of Tracks	Computer	
☐ 556 bpi	☐ BIN	☐ 7		☐ New tapes will be supplied prior to processing.
☐ 800 bpi	☐ BCD	☐ 9	_____	☐ Original NSSDC tapes will be returned.
☐ 1600 bpi				☐ I shall pay for new tapes.

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771