DATA CATALOG SERIES FOR SPACE SCIENCE AND APPLICATIONS FLIGHT MISSIONS

Volume 1A

Descriptions of Planetary and Heliocentric Spacecraft and Investigations

September 1982

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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.
DATA CATALOG SERIES FOR SPACE SCIENCE
AND APPLICATIONS FLIGHT MISSIONS

Volume 1A

DESCRIPTIONS OF PLANETARY AND HELIOCENTRIC
SPACECRAFT AND INVESTIGATIONS

Edited By

Winifred Sawtell Cameron
Robert W. Vostreys

September 1982

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, Brief Descriptions of Planetary and Heliocentric Spacecraft and Investigations, part of the Data Catalog Series for Space Science and Applications Flight Missions, represents the work of many people. The series will describe the data sets held by NSSDC, some of the data sets held by NASA-funded investigators, and some of the data sets 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 spacecraft and experiment personnel who over the years provided much of the information contained in this volume. The cooperation of the investigators in supplying current status information is gratefully acknowledged. Thanks also are extended to the other NSSDC personnel, employees of the on-site contractor, M/A-COM Sigma Data, Inc., 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 and to the File Management group, supervised by Dorothy Rosenblatt, for their special computer processing to accommodate the format of this volume.

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 comments to NSSDC. Catalog recipients are urged to inform potential data users of its availability.

Winifred Sawtell Cameron
Robert W. Vostreys
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Introduction
1.1 PURPOSE

The National Space Science Data Center (NSSDC) was established by the National Aeronautics and Space Administration (NASA) to provide data and information from space science and applications flight investigations in support of additional studies beyond those performed as the principal part of any flight mission. This volume is one of a series of eleven that will describe (1) the holdings of 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; and 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 (experiments) separated, mainly, into various orbit categories, (2) five corresponding volumes that describe the various orbital information and investigation data sets, and (3) a master index volume. In some cases certain data sets appear in more than one data set volume, since they are important to a discipline not normally related to most of the investigations on a given spacecraft. 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.

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 standard types of orbital information, i.e., predicted, refined, and definitive, the information is 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 serviced 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. Unfortunately, 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 of 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 non-responsive. The investigations that are being dropped from the NSSDC catalogs are identified in the appropriate volumes in the series. A small, but non-trivial, 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.

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, so that a user will know whom to contact for an obscure or detailed piece of information relative to a given data set that NSSDC may not possess. Consequently, we have tried to provide the current affiliation of the investigators. 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. Since this series is oriented toward helping interested persons to obtain data from flight investigations and helping NSSDC to serve as an effective switching center, the spacecraft/mission personnel are identified at the institution where they performed their relevant duties. The term NLA is printed with the names of these personnel if they are no longer associated with the given institution.

It is hoped that this series will serve for many years as the source documents for data in the disciplines that NSSDC handles. The annual NSSDC Data Listing will be used to update the time intervals for which data are available and to identify in brief form the new data sets that become available in the future. The annual Report of Active and Planned Spacecraft and Experiments will be used to describe the new spacecraft and experiments which are placed in orbit.
This catalog contains descriptions of the planetary and heliocentric spacecraft launched for which NSSDC has information. Described for those spacecraft are the investigations for which NSSDC has archived data.

The catalog is organized by planet, out from the sun, and then by heliocentric missions that collected interplanetary data. Included are the Pioneers 10 and 11 spacecraft which are on trajectories to take them out of the solar system. A description of missions to the moon, with descriptions of the spacecraft, experiments, and data archived is contained in the Catalog of Lunar Missions Data (NSSDC/WDC-A-R&S 77-02) and is not repeated here. It was not possible to obtain information from the following investigations on the availability of data and they are not included in the catalog.

The format for the experiments has been ordered by categories generally in order of the number of investigations. The categories discussed are (1) Imaging, (2) Particles and Fields, (3) Ultraviolet, (4) Infrared, (5) Radio Science and Celestial Mechanics, (6) Atmospheres, (7) Surface Chemistry, (8) Biology, and (9) Polarization.

Only investigations with some data either available from NSSDC or where the source of data is known are discussed. Table 1, however, lists all the experiments that were aboard the various spacecraft and indicates the status (all or partial, no data, or failed) of the data. Since NSSDC has only a few photographs from the U.S.S.R. -- Veneras 9, 10, 13, and 14 -- and no other data, only these investigations will be presented and included in Table 1; Table 2 contains planetary missions with planetary investigations listed by categories of data that are available at NSSDC. For complete coverage of the solar system, and for reference, Table 3 (from the Catalog of Lunar Missions), similar to Table 1, except that it covers lunar missions, is presented at the end of this catalog. Appendix A is an index to planetary missions, Appendix B is an index to missions that were primarily planetary but had investigations that only collected interplanetary data in the cruise mode, and Appendix C
contains an index to missions whose investigations were designed to collect only interplanetary data. Appendix D contains definitions for terms and acronyms that may not be readily recognized by the users of this document. In Table 1 there are many similar investigations with similar names, but they are listed separately in order to indicate status of availability of data. Under Radio Science and Celestial Mechanics, for example, there is only one investigation named Radio Occultation, yet occultation data were obtained at all the planets. These will be identified in Volume 1B, which is a companion volume describing the data sets obtained by the experiments described in this volume. It should be pointed out that many of the investigations obtained data from the interplanetary region, particularly in the particles and fields category.
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 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 (and see 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 that information 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
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.
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**LEGEND**
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- ⬤: Experiment failed
- ⬤: Data from another experiment
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Mercury
Plate 1. This is a collection of press release photographs of various aspects of the planet Mercury from the Mariner 10 mission, the only mission to go to Mercury. It was the first mission to use the gravitational assist from one planet (Venus) to go on to another planet (Mercury). (A) P14470 is a mosaic of medium-resolution images presenting the hemisphere of Mercury seen by the spacecraft on the incoming trajectory on the first encounter of the flyby. It shows the lunar highlands-like nature of Mercury. (B) P14580 is a mosaic of medium-resolution images of the hemisphere of Mercury seen by the spacecraft on its outgoing trajectory on the first encounter. It shows some smooth areas. The spacecraft later had two more encounters, each spaced 6 months apart. (C) P14469 is a high-resolution (about 100m) photo showing a two-level flow in a large crater. (D) P15046 is a high-resolution (about 100m) image showing some of the long ridges traversing all topography which are apparently unique to Mercury among the planets.
INTRODUCTION

It was felt that the presentation of investigations in categories and by planets would be most useful to the scientific community. In this way, a possible user of data could determine quickly and easily the data that have been gathered at each planet. This information can be obtained most quickly by consulting Table 1 for all investigations and their status in regard to data archived at NSSDC from planetary and interplanetary missions, Table 2 for general categories at each planet, and Appendix A for details.

The first planet to be covered in this catalog is Mercury. There has been only one mission to Mercury, namely Mariner 10. There were, however, three passes (encounters) past the planet. In the second part of this catalog, which contains discussions of the data sets pertaining to the investigations on Mariner 10 that covered Mercury, the data sets will be presented according to encounter. There were seven investigations for which NSSDC either has the data archived or knows the source of the archived data; these investigations fall under five categories: (1) Imaging, (2) Particles and Fields, (3) Ultraviolet, (4) Infrared, and (5) Radio Science and Celestial Mechanics, and they are presented in that order. All investigations that dealt with a category are discussed under that category.

Following the planetary investigations sections for the planets, those planetary missions that carried the interplanetary region investigations are presented. Appendix B indexes this section. This section, in turn, is followed by the interplanetary missions whose investigations collected only interplanetary data. These missions all had heliocentric orbits. Appendix C indexes this section in detail.
**SPACESHIP**

**SPACECRAFT COMMON NAME:** MARINER 10

**ALTERNATE NAMES:** MARINER 73; PL-732A

**PLANNED MISSIONS:** VENUS/mercury; MARINER VENUS/mercury 7

**MISSION ID:** T3-055A

**LAUNCH DATE:** 11/15/73

**WEIGHT:** 504, KG

**LAUNCH SITE:** CAPE CANAVERAL, UNITED STATES

**LAUNCH VEHICLE:** ATLAS

**SPONSORING COUNTRY/AGENCY:** UNITED STATES

**SATELLITE PARAMETERS:** OROGRAPHY

**INITIAL ORBIT PARAMETERS:** TYPE - MERCURY FLIGHT

**PERSONNEL:** R D. GOVEREN PS - S D. DUNNE

**RAISE DESCRIPTION:** This was the first to use the gravitational pull of one planet (venus) to reach another (mercury). The spacecraft was 146,194 by 167,161 single-frequency with eight electronics compartments. It measured 1.19 m diagonally and 0.457 m in depth. Two solar panels each 2.7 m long and 1.97 m wide were located on the top. The spacecraft was placed on a box of the solar cells. The rocket engine was liquid-fueled with two sets of reaction jets used to stabilize the spacecraft on three axes. It carried a high-grain, medium-sized antenna, composed of a honeycomb-class parabolic reflector, 1.37 m in diameter with focal length 55 cm. Feeds enabled the spacecraft to transmit at 1.8 and 8-band frequencies. The spacecraft carried a Canon 300 mm camera located on the upper-right structure of the spacecraft, and an equipment-on the solar panels. The camera is equipped with a multiflare internal lens on the right side. Instruments aboard the spacecraft measured the atmosphere, surface, and chemical composition of Mercury and Venus. Experiments included television photography, magnetic fields, plasma, infrared radiometry, ultraviolet spectroscopy, and radio science detectors. An experimental solar wind, high-frequency transmitter was flown for the first time on this spacecraft. Mariner 10 was placed in a parking orbit after a 33-mo flight period. It then placed in orbit around the sun enroute to Venus. The orbit direction was opposite to the motion of the earth around the sun. Mid-course corrections were made. The spacecraft passed Venus on February 19, 1974, at 2.6 AU, at a distance of about 47,464 by 43,000 km. A second encounter with Mercury when more photographs were taken occurred on September 21, 1974, at an altitude of about 327,824 km, with additional photography of about 300 photographs and magnetic field measurements occurred on March 16, 1975. Engineering tests were continued until March 24, 1975. The most of the attitude-control gas was depleted and the mission was terminated.

**INVESTIGATIONS**

**IMAGING**

**INVESTIGATION NAME:** TELEVISION PHOTOGRAPH

**MISSION ID:** T3-055A-61

**INVESTIGATIVE PROGRAM:** CODE EL-4C SCIENCE

**INVESTIGATION DISCIPLINE(S):** PLANETARY Atmospheres PLANETOGEOLOGY

**PERSONNEL:** R D. GOVEREN P - S D. DUNNE

**DIRECTIONS:** The objective of this experiment was to photograph the spacecraft surfaces at high resolution. In the case of Venus, the goal was to obtain images of the planet's surface. For Mercury, the objective was to map the major photogeologic provinces and to determine the current state of the surface and to derive information about the planet's interior. The photographs were taken with high-resolution cameras onboard the spacecraft. The images were then processed to enhance their clarity and to reveal details about the planet's surface. The images were used to study the planet's geology, to determine its composition, and to search for signs of past and present activity on the surface.

**PARTICLES AND FIELDS**

**INVESTIGATION NAME:** MEASUREMENT OF PLASMA ENVIRONMENT

**MISSION ID:** T3-055A-03

**INVESTIGATIVE PROGRAM:** CODE EL-4C SCIENCE

**INVESTIGATION DISCIPLINE(S):** PARTICLES AND FIELDS

**PERSONNEL:** R D. GOVEREN P - S D. DUNNE

**DIRECTIONS:** The objective of this experiment was to study the interactions between the solar wind and the planets. The spacecraft carried instruments to measure the solar wind, plasma, and magnetic fields. The data were used to understand the dynamics of the planets' magnetospheres and to determine the effects of solar wind on planetary surfaces. The results were used to improve our understanding of the interaction between the solar wind and the planets, and to better predict the behavior of the solar system.
In this experiment, a two-channel infrared radiometer was flown in a rocket payload to observe the thermal emission from Venus and Mercury in two broad spectral bands. The infrared radiometer was capable of measuring the thermal radiation from both planets simultaneously. The radiometer was designed using a dual-channel design with separate antenna fields and was capable of measuring thermal emissions from both planets. The instrument was flown during the Venus flyby mission and provided valuable data on the thermal characteristics of Venus and Mercury.
Venus
Plate 2. This is a composite of press release illustrations of features on the surface of Venus. (A) P80-25 is an artist's rendition of the continent-sized structures and most of the planet's surface derived from the results from the Radar Altimeter investigation on the Pioneer Venus 1 - Orbiter spacecraft. (B) P80-13A is an artist's rendition of the continent-sized mass, Aphrodite, with the outline of the United States on it for comparison. This was also derived from the Pioneer Venus 1 - Orbiter Radar Altimeter. (C) P80-17 is an air brush map of the surface of Venus as revealed by the Pioneer Venus 1 - Orbiter Radar Altimeter measurements. (D) YI-000811 is a reproduction of the photos of the surface of Venus surrounding each Descent Craft landing area of Veneras 9 and 10 launched by the U.S.S.R. Note the different appearance of the rocks at the two sites which are separated by several thousand kilometers. (E) YG-06848 is a photograph of the surface surrounding the USSR's Venera 14 Descent Craft at its landing site. Note the still different structure of the platy, rocky outcrops compared with those of Veneras 9 and 10. Venera 14 landed in still another part of Venus, near the Phoebe Regio part of Venus.
PRELIMINARY TOPOGRAPHIC MAP OF VENUS
CONTOUR INTERVAL 1 km ALL ELEV REFER TO A RADIUS OF 6045 kilometers
INTRODUCTION

The next planet out from the sun is Venus. There were four U.S. missions and four U.S.S.R. missions (for which data are available) that either flew by, orbited, or entered the atmosphere and landed on the surface of Venus. The last U.S. mission, Pioneer Venus was composed of six separate spacecraft: (1) Pioneer Venus 1 - Orbiter, (2) Pioneer Venus 2 - Bus, (3) Pioneer Venus - Large Probe, (4) Pioneer Venus - Small Probe 1, (5) Pioneer Venus - Small Probe 2, and (6) Pioneer Venus - Small Probe 3. All of the probes and the bus traveled together as one unit, Pioneer Venus 2, from the earth to Venus. The Large Probe and Small Probe 3 entered on the day side of Venus, and the Small Probes 1 and 2 entered on the night side. Two of the Small Probes actually survived and transmitted data for a short time, while the other two may have survived but were oriented wrong to transmit their data to the Orbiter. There were 65 separate investigations when each spacecraft on the Pioneer Venus mission is treated separately. These cover seven categories which are (1) Imaging, (2) Particles and Fields, (3) Ultraviolet, (4) Infrared, (5) Radio Science and Celestial Mechanics, (6) Atmosphere, and (7) Polarization. See Tables 1 and 2 and Appendix A for more details. The U.S.S.R. has sent many missions to Venus, many of which were successful. NSSDC, however, has data archived from only four missions -- namely Veneras 9, 10, 13 and 14 -- from which imaging was obtained. Only these are presented in this catalog.
BRIEF DESCRIPTION

This spacecraft was the first to use the gravitational pull of one planet (Venus) to reach another (Mercury). The spacecraft was able to conduct a comprehensive investigation of the atmosphere of Venus. The spacecraft was a solar-powered cylinder about 175 cm in diameter with its spin axis stabilized perpendicular to the ecliptic plane. A high-speed antenna mechanically designed to remain fixed on the earth. The spacecraft was placed in a parking orbit around Venus for a month. It then made four close passes of Venus and then entered an elliptical orbit around Venus. It continued to transmit data for a month. The spacecraft was powered by its solar panels and its main mission was to study the atmosphere of Venus. The spacecraft was able to use the gravitational pull of Venus to reach Mercury. The spacecraft was able to conduct a comprehensive investigation of the atmosphere of Venus. The spacecraft was a solar-powered cylinder about 175 cm in diameter with its spin axis stabilized perpendicular to the ecliptic plane. A high-speed antenna mechanically designed to remain fixed on the earth. The spacecraft was placed in a parking orbit around Venus for a month. It then made four close passes of Venus and then entered an elliptical orbit around Venus. It continued to transmit data for a month.
The spacecraft was the bus portion of the Pioneer Venus Multiprobe mission. On this mission four instrumented atmospheric entry probes were carried by this bus to the vicinity of Venus for descent through the atmosphere to the planetary surface. Two Small Probes entered on the nightside and one Small Probe and the Large Probe entered on the dayside of the planet. The spacecraft was again stabilized. The trip to Venus took 232 days. The four Probes separated from the Bus about 16 to 20 days before entry. The Large Probe took 1-1/2 h to descend through the atmosphere, while the three smaller probes reached the surface of the planet 15 min after entry. The Bus portion of the spacecraft was targeted to enter the Venusan atmosphere at a shallow entry angle and transmit data to Earth until the Bus was destroyed by the heat of atmospheric friction during its descent. Investigators emphasized the study of the structure and composition of the atmosphere down to the surface, the nature and composition of the clouds, the radiation field and energy exchange in the lower atmosphere, and local information on the atmospheric circulation pattern. A sister mission, Pioneer Venus Orbiter, placed an orbiting spacecraft around Venus two weeks before the Probes were released. Simultaneous measurements by the Probes and Orbiter permitted relating specific local measurements to the general state of the planet and its environment as observed from orbit.

**PIONEER VENUS PROBE 1L**

**Spacecraft Common Name: Pioneer Venus Probe 1L**

**Alternate Names: Pioneer Venus 1978**

**NSSDC ID: 78-078D**

**Launch Date: 08/08/78**

**Launch Site: Cape Canaveral, United States**

**Launch Vehicle: Atlas**

**Sponsoring Country/Agency: United States NASA-ARC**

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<td>Brief Description</td>
<td>This spacecraft was the first Small Probe of the Pioneer Venus Multiprobe mission. On this mission four instrumented atmospheric entry probes were carried by a spacecraft bus to the vicinity of Venus for descent through the atmosphere to the planetary surface, two Small Probes entered on the nightside, and one Small Probe and one Large Probe entered on the dayside of the planet. The spacecraft bus entered the atmosphere and obtained atmospheric composition data until burnup. Investigations emphasized the study of the structure composition and nature of the atmosphere down to the surface, and of the clouds, the radiation field and energy exchange in the lower atmosphere, and local information on the atmospheric circulation pattern. A sister mission, Pioneer Venus Orbiter, placed an orbiting spacecraft around Venus two weeks before the Probes were released. Simultaneous measurements by the Probes and Orbiter permitted relating specific local measurements to the general state of the planet and its environment as observed from orbit.</td>
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**PIONEER VENUS PROBE 2S2**

**Spacecraft Common Name: Pioneer Venus Probe 2S2**

**Alternate Names: Pioneer Venus 1978**

**NSSDC ID: 78-078E**

**Launch Date: 08/08/78**

**Launch Site: Cape Canaveral, United States**

**Launch Vehicle: Atlas**

**Sponsoring Country/Agency: United States NASA-ARC**

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<td>Brief Description</td>
<td>This spacecraft was the second Small Probe of the Pioneer Venus Multiprobe mission. On this mission four instrumented atmospheric entry probes were carried by a spacecraft bus to the vicinity of Venus for descent through the atmosphere to the planetary surface, two Small Probes entered on the nightside, and one Small Probe and one Large Probe entered on the dayside of the planet. The spacecraft bus entered the atmosphere and obtained atmospheric composition data until burnup. Investigations emphasized the study of the structure composition and nature of the atmosphere down to the surface, and of the clouds, the radiation field and energy exchange in the lower atmosphere, and local information on the atmospheric circulation pattern. A sister mission, Pioneer Venus Orbiter, placed an orbiting spacecraft around Venus two weeks before the Probes were released. Simultaneous measurements by the Probes and Orbiter permitted relating specific local measurements to the general state of the planet and its environment as observed from orbit.</td>
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**PIONEER VENUS PROBE 3M1**

**Spacecraft Common Name: Pioneer Venus Probe 3M1**

**Alternate Names: Pioneer Venus 1978**

**NSSDC ID: 78-078F**

**Launch Date: 08/08/78**

**Launch Site: Cape Canaveral, United States**

**Launch Vehicle: Atlas**

**Sponsoring Country/Agency: United States NASA-ARC**

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<td>This spacecraft was the third Small Probe of the Pioneer Venus Multiprobe mission. On this mission four instrumented atmospheric entry probes were carried by a spacecraft bus to the vicinity of Venus for descent through the atmosphere to the planetary surface, two Small Probes entered on the nightside, and one Small Probe and one Large Probe entered on the dayside of the planet. The spacecraft bus entered the atmosphere and obtained atmospheric composition data until burnup. Investigations emphasized the study of the structure composition and nature of the atmosphere down to the surface, and of the clouds, the radiation field and energy exchange in the lower atmosphere, and local information on the atmospheric circulation pattern. A sister mission, Pioneer Venus Orbiter, placed an orbiting spacecraft around Venus two weeks before the Probes were released. Simultaneous measurements by the Probes and Orbiter permitted relating specific local measurements to the general state of the planet and its environment as observed from orbit.</td>
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The spacecraft was separated from the orbiters and landing was made with the sun near zenith at 0513 UT on October 22. A system of circulating fluid was used to distribute the heat load. This system plus precooling prior to entry, permitted operation of the spacecraft for 55 min after landing. During descent, heat dissipation and deceleration were accomplished sequentially: (a) protective hemispheric shells; (b) parabolas; (c) disk-shaped drag brake; and (d) a metal-coated, doughnut-shaped landing cushion. The landing was about 2200 km from the Venus 12 landing site. Preliminary results indicated: (a) cloud base 30 km thick with bases at 30-35 km altitude, (b) atmospheric constituents including CO2, H2O, O3, and N2, (c) surface pressure about 90 earth atmospheres, (d) temperature 485 deg C, (e) light levels comparable to those at Earth midlatitudes or a cloudy summer day, and (f) successful TV photography showing shadows, no apparent dust in the air, and a variety of 30 to 40 cm rocks which were not eroded.

Spacecraft common name - Venera 13 descent craft
Alternate names -
NSSDC ID - 75-0540
Launch date - 10/26/75
Launch site - Tyuratam (Baikonur cosmodrome), U.S.S.R.
Launch vehicle - 8-1/E
Sponsoring country/agency - U.S.S.R. SAS
Initial orbit parameters:
Orbit type - Venus lander
Personnel: PM = Unknown, PS = Unknown

Brief description:
On October 26, 1975, this spacecraft was separated from the orbiters and landing was made with the sun near zenith at 0513 UT on October 22. A system of circulating fluid was used to distribute the heat load. This system plus precooling prior to entry, permitted operation of the spacecraft for 55 min after landing. During descent, heat dissipation and deceleration were accomplished sequentially: (a) protective hemispheric shells; (b) parabolas; (c) disk-shaped drag brake; and (d) a metal-coated, doughnut-shaped landing cushion. The landing was about 2200 km distant from the Venus 13 landing site. Preliminary results indicated: (a) cloud base 30 km thick with bases at 30-35 km altitude, (b) atmospheric constituents including CO2, H2O, O3, and N2, (c) surface pressure about 90 earth atmospheres, (d) temperature 485 deg C, (e) light levels comparable to those at Earth midlatitudes or a cloudy summer day, and (f) successful TV photography showing shadows, no apparent dust in the air, and a variety of 30 to 40 cm rocks which were not eroded.

Spacecraft common name - Venera 13 descent craft
Alternate names -
NSSDC ID - 75-0540
Launch date - 10/26/75
Launch site - Tyuratam (Baikonur cosmodrome), U.S.S.R.
Launch vehicle - 8-1/E
Sponsoring country/agency - U.S.S.R. SAS
Initial orbit parameters:
Orbit type - Venus lander
Personnel: PM = Unknown, PS = Unknown

Brief description:
On October 26, 1975, this spacecraft was separated from the orbiters and landing was made with the sun near zenith at 0513 UT on October 22. A system of circulating fluid was used to distribute the heat load. This system plus precooling prior to entry, permitted operation of the spacecraft for 55 min after landing. During descent, heat dissipation and deceleration were accomplished sequentially: (a) protective hemispheric shells; (b) parabolas; (c) disk-shaped drag brake; and (d) a metal-coated, doughnut-shaped landing cushion. The landing was about 2200 km distant from the Venus 13 landing site. Preliminary results indicated: (a) cloud base 30 km thick with bases at 30-35 km altitude, (b) atmospheric constituents including CO2, H2O, O3, and N2, (c) surface pressure about 90 earth atmospheres, (d) temperature 485 deg C, (e) light levels comparable to those at Earth midlatitudes or a cloudy summer day, and (f) successful TV photography showing shadows, no apparent dust in the air, and a variety of 30 to 40 cm rocks which were not eroded.

Spacecraft common name - Venera 14 descent craft
Alternate names -
NSSDC ID - 75-1100
Launch date - 11/22/75
Launch site - Tyuratam (Baikonur cosmodrome), U.S.S.R.
Launch vehicle - 8-1/E
Sponsoring country/agency - U.S.S.R. SAS
Initial orbit parameters:
Orbit type - Venus lander
Personnel: PM = Unknown, PS = Unknown

Brief description:
Venera 14 landed at 13 deg 15 min S by 316 deg, about 950 km southwest of Venera 13. Surface temperature was 465 deg C and pressure was 94 earth atmospheres. Venera 14 carried instruments to take chemical and isotopic measurements, monitored the spectrum of scattered sunlight, and recorded electric discharges during its descent phase through the Venusian atmosphere. The spacecraft utilized a camera system, an X-ray fluorescence spectrometer, and a 10-meter to conduct investigations on the surface.

Investigations:

Imaging:

--Mariner 10, Murray--

Investigation name - Television photography
Investigation ID - 73-085A-01
Investigative program code 01-1A-SCIENCE
Investigation discipline(s) Planetary Atmospheres Planetology

Personnel:
PI = C. Murray
O1 = J. J. Kneale
O2 = G. F. Kuiper
O3 = J. J. Trumpler
O4 = J. J. Trumpler
O5 = J. J. Trumpler
O6 = J. J. Trumpler
O7 = J. J. Trumpler
O8 = J. J. Trumpler
O9 = J. J. Trumpler
O10 = J. J. Trumpler

Brief description:
The objectives of this experiment were to photograph the surfaces (upper atmosphere in the case of Venus of the planets Venus and Mars) for comparative studies. To investigate the climatologies and geology of the planet's surface, to obtain high-resolution imagery of the planet's surface, the observations were to 1000 km and its major photophysiologic expressions, determine the surface pressure profiles, and search for Mercury.
blue bandpass. (3) UV polarimetry. (4) UV/CXUV high pass. (5) clear. (6) UV bandpass. (7) detecting lens (for calibration), and (8) yellow bandpass. About 7500 photographs were obtained of Venus and Mercury with a maximum resolution of 100 m for Mercury. Three photographs, passed separately by 0.6 mm intervals, were made for Mercury. Further details of the experiment can be obtained from NSSDC 75-052, or Science v. 155, p. 14. Transportation of the CNES plate to Paris was done by a special air vehicle. The, or Venus 9 Science results in Mercury may be obtained from 25. G. Siscoe, Environ. Rev. v. 81, p. 75. June 1975., and on Venus in Science. v. 155, p. 4531. March 1975.

---------- PIONEER VENUS 1: HANSEN

INVESTIGATION NAME: CLOUD PHOTOPOLARIMETER

NSSDC ID: 75-0504-06 INVESTIGATIVE PROGRAM CODE 05-4, SCIENCE

INVESTIGATION DISCIPLINE(S): PLANETARY ATMOSPHERES

PERSONNEL

PI: J. H. HANSEN NASA-GSFC

O1: A. L. STONE NASA-GSFC

O1: A. A. KACSER NASA-GSFC

O1: T. J. COFFEN NASA-GSFC

O1: L. J. TRAVES NASA-GSFC

BRIEF DESCRIPTION

This experiment used a modified version of the imaging polarimeter (IPP). Thin on Pioneers 10 and 11 to provide low-resolution horizontal distribution of the polarized light. The principal objective of this investigation was to determine the properties of the clouds and haze including the vertical and horizontal distribution of the particulate size and refractive index, the eccentricity heights, and the number density of particles. The principal objective of this investigation was to determine the properties of the clouds and haze including the vertical and horizontal distribution of the particulate size and refractive index, the eccentricity heights, and the number density of particles.

---------- VENERA 9 DESCENT CRAFT: UNKNOWN

INVESTIGATION NAME: PANORAMIC TELEPHOTOMETER FOR SURFACE IMAGERY

NSSDC ID: 75-0504-01 INVESTIGATIVE PROGRAM CODE 05, PLANETARY

INVESTIGATION DISCIPLINE(S): PLANETOLOGY

PERSONNEL

PI: UNKNOWN

BRIEF DESCRIPTION

This experiment used a television camera to photograph the surface of Venus. One successful image was obtained. The principal objective of this investigation was to determine the properties of the clouds and haze including the vertical and horizontal distribution of the particulate size and refractive index, the eccentricity heights, and the number density of particles.

---------- VENERA 9 DESCENT CRAFT: UNKNOWN

INVESTIGATION NAME: PANORAMIC TELEPHOTOMETER FOR SURFACE IMAGERY

NSSDC ID: 75-0504-01 INVESTIGATIVE PROGRAM CODE 05, PLANETARY

INVESTIGATION DISCIPLINE(S): PLANETOLOGY

PERSONNEL

PI: UNKNOWN

BRIEF DESCRIPTION

This experiment used a television camera to photograph the surface of Venus. One successful image was obtained. The principal objective of this investigation was to determine the properties of the clouds and haze including the vertical and horizontal distribution of the particulate size and refractive index, the eccentricity heights, and the number density of particles.

---------- VENERA 10 DESCENT CRAFT: UNKNOWN

INVESTIGATION NAME: PANORAMIC TELEPHOTOMETER FOR SURFACE IMAGERY

NSSDC ID: 81-0504-01 INVESTIGATIVE PROGRAM CODE 05, PLANETARY

INVESTIGATION DISCIPLINE(S): PLANETOLOGY

PERSONNEL

PI: UNKNOWN

BRIEF DESCRIPTION

This experiment used a television camera to photograph the surface of Venus. One successful image was obtained.

---------- VENERA 10 DESCENT CRAFT: UNKNOWN

INVESTIGATION NAME: PANORAMIC TELEPHOTOMETER FOR SURFACE IMAGERY

NSSDC ID: 81-0504-01 INVESTIGATIVE PROGRAM CODE 05, PLANETARY

INVESTIGATION DISCIPLINE(S): PLANETOLOGY

PERSONNEL

PI: UNKNOWN

BRIEF DESCRIPTION

This experiment used a television camera to photograph the surface of Venus. One successful image was obtained.

---------- VENERA 14 DESCENT CRAFT: UNKNOWN

INVESTIGATION NAME: PANORAMIC TELEPHOTOMETER FOR SURFACE IMAGERY

NSSDC ID: 81-1004-01 INVESTIGATIVE PROGRAM CODE 05, PLANETARY

INVESTIGATION DISCIPLINE(S): PLANETOLOGY

PERSONNEL

PI: UNKNOWN

BRIEF DESCRIPTION

This experiment used a television camera to photograph the surface of Venus. One successful image was obtained.

---------- VENERA 14 DESCENT CRAFT: UNKNOWN

INVESTIGATION NAME: PANORAMIC TELEPHOTOMETER FOR SURFACE IMAGERY

NSSDC ID: 81-1004-01 INVESTIGATIVE PROGRAM CODE 05, PLANETARY

INVESTIGATION DISCIPLINE(S): PLANETOLOGY

PERSONNEL

PI: UNKNOWN

BRIEF DESCRIPTION

This experiment used a television camera to photograph the surface of Venus. One successful image was obtained.

---------- VENERA 14 DESCENT CRAFT: UNKNOWN

INVESTIGATION NAME: PANORAMIC TELEPHOTOMETER FOR SURFACE IMAGERY

NSSDC ID: 81-1004-01 INVESTIGATIVE PROGRAM CODE 05, PLANETARY

INVESTIGATION DISCIPLINE(S): PLANETOLOGY

PERSONNEL

PI: UNKNOWN

BRIEF DESCRIPTION

This experiment used a television camera to photograph the surface of Venus. One successful image was obtained.
parameters is necessarily dependent on the validity of the spacecraft sheath model explored in the analysis, and is thus affected by the charge in the ambient solar wind.

--- PIONEER VENUS 1: SCARP

INVESTIGATION NAME: ELECTRIC FIELD DETECTOR

NSDC ID: 78-0514-13 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS
SPACE PLASMAS

PERSONNEL
PI - J.L. SCARP
01 - I.W. GREEN
TWF SYSTEMS GROUP

BRIEF DESCRIPTION
The instrument performed a modified version of the Pioneer 8 and Pioneer 9 experiments to measure the electric field at the spacecraft. The experiment consisted of four 15-channel channels centered at 11.5, 31.5, 51.5, and 61.5 kHz. The data was analyzed to study plasma interactions between the solar wind and the ionosphere or exosphere plasma. The role of plasma instabilities in modulating the ion flow from the solar wind and in thermalizing neutral ions from Venus was also studied. A self-contained balanced Wheatstone bridge was used to measure the plasma. At the 11.5-15 kHz satellite side, one frequency was varied to measure the plasma.

--- PIONEER VENUS 1: KNUISEN

INVESTIGATION NAME: RETARDING POTENTIAL ANALYZER

NSDC ID: 78-0514-17 INVESTIGATIVE PROGRAM CODE EL-4/CO-0, SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY ATMOSPHERES
PLANETARY SINFONIES

PERSONNEL
PI - M.F. KNUISEN
01 - R.C. SPEAKER
02 - R.E. WHITEN
NASA-ARC

BRIEF DESCRIPTION
This instrument used a Langmuir-probe technique. The probe was designed to measure electron concentrations and temperatures, major ion concentrations and temperatures, ion drift velocities, and the energy distribution function of ambient neutrals. It was an adaptation of the Langmuir-probe technique used on other spacecraft. The probe measured the energy distributions of ion and electron concentrations in the solar wind and the ionosphere. The data was analyzed to study the effects of plasma instabilities in modulating the ion flow from the solar wind and in thermalizing neutral ions from Venus. The data was also analyzed to study plasma interactions between the solar wind and the ionosphere or exosphere plasma. The role of plasma instabilities in modulating the ion flow from the solar wind and in thermalizing neutral ions from Venus was also studied. A self-contained balanced Wheatstone bridge was used to measure the plasma. At the 11.5-15 kHz satellite side, one frequency was varied to measure the plasma.

--- PIONEER VENUS 1: WOLFE

INVESTIGATION NAME: PLASMA ANALYZER (CPA)

NSDC ID: 78-0514-10 INVESTIGATIVE PROGRAM CODE EL-4/A, SCIENCE
INVESTIGATION DISCIPLINE(S) PLASMA PLASMAS
PARTICLES AND FIELDS

PERSONNEL
PI - J.H. WOLFE
01 - A. BARNES
02 - D. COLE
NASA-ARC
01 - D.B. MCKIBBEN
NASA-ARC
02 - R.E. WHITEN
NASA-ARC

BRIEF DESCRIPTION
The instrument for this experiment was a quadrupole analyzer that was designed to measure electron concentrations and temperatures, major ion concentrations and temperatures, ion drift velocities, and the energy distribution function of ambient neutrals. The energy range was 5000-50000 V (300-5000 eV). The data was analyzed to study the effects of plasma instabilities in modulating the ion flow from the solar wind and in thermalizing neutral ions from Venus. The role of plasma instabilities in modulating the ion flow from the solar wind and in thermalizing neutral ions from Venus was also studied. A self-contained balanced Wheatstone bridge was used to measure the plasma. At the 11.5-15 kHz satellite side, one frequency was varied to measure the plasma.

--- MARKER 5: BRIDGE

INVESTIGATION NAME: INTERPLANETARY ION PLASMA PROBE FOR ELECTRONS IN THE VENUS ENVIRONMENT

NSDC ID: 67-0604-02 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS
INTERPLANETARY PHYSICS

PERSONNEL
PI - M.S. BRIDGE
01 - J.W. SYNDER
MASS INST OF TECH
NASA-PLS

BRIEF DESCRIPTION
This instrument used a Langmuir-probe technique. The probe was designed to measure electron concentrations and temperatures, major ion concentrations and temperatures, ion drift velocities, and the energy distribution function of ambient neutrals. The energy range was 5000-50000 V (300-5000 eV). The data was analyzed to study the effects of plasma instabilities in modulating the ion flow from the solar wind and in thermalizing neutral ions from Venus. The role of plasma instabilities in modulating the ion flow from the solar wind and in thermalizing neutral ions from Venus was also studied. A self-contained balanced Wheatstone bridge was used to measure the plasma. At the 11.5-15 kHz satellite side, one frequency was varied to measure the plasma.

--- MARKER 5: NESS

INVESTIGATION NAME: FLUORIDE MAMETEBOMETERS

NSDC ID: 67-0604-08 INTERPLANETARY DISCIPLINE(S) PLANETARY PHYSICS
PLANETARY MAGNETIC FIELDS

PERSONNEL
PI - J.H. NESS
01 - R.P. LEPPING
02 - W. HARRISON
NASA-GSFC
CATHOLIC U OF AMERICA

BRIEF DESCRIPTION
This experiment used a Langmuir-probe technique. The probe was designed to measure the vector magnetic field in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet.

--- MARKER 5: NESS

INVESTIGATION NAME: FLUORIDE MAMETEBOMETERS

NSDC ID: 78-0514-10 INTERPLANETARY DISCIPLINE(S) PLANETARY PHYSICS
PLANETARY MAGNETIC FIELDS

PERSONNEL
PI - J.H. NESS
01 - R.P. LEPPING
02 - W. HARRISON
NASA-GSFC
CATHOLIC U OF AMERICA

BRIEF DESCRIPTION
This experiment used a Langmuir-probe technique. The probe was designed to measure the vector magnetic field in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet.

--- MARKER 5: NESS

INVESTIGATION NAME: FLUORIDE MAMETEBOMETERS

NSDC ID: 78-0514-16 INTERPLANETARY DISCIPLINE(S) PLANETARY PHYSICS
PLANETARY MAGNETIC FIELDS

PERSONNEL
PI - J.H. NESS
01 - R.P. LEPPING
02 - W. HARRISON
NASA-GSFC
CATHOLIC U OF AMERICA

BRIEF DESCRIPTION
This experiment used a Langmuir-probe technique. The probe was designed to measure the vector magnetic field in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet.

--- MARKER 5: NESS

INVESTIGATION NAME: FLUORIDE MAMETEBOMETERS

NSDC ID: 78-0514-18 INTERPLANETARY DISCIPLINE(S) PLANETARY PHYSICS
PLANETARY MAGNETIC FIELDS

PERSONNEL
PI - J.H. NESS
01 - R.P. LEPPING
02 - W. HARRISON
NASA-GSFC
CATHOLIC U OF AMERICA

BRIEF DESCRIPTION
This experiment used a Langmuir-probe technique. The probe was designed to measure the vector magnetic field in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet. The vector magnetic field was measured in the vicinity of the planet.
and spacecraft and was on the earthward side of the spacecraft. During the 3.5 month intervals, data for operations from the detector during a 9,688s interval was read out once every 833 s. During the encounter, the accumulated number of counts during a 9,688s interval was read out once every 344 s. There was an absence of any discernible increase in counting rate during passage by Venus at radial distances as small as 41,400 km on the earthward side of the planet.

--- PIONEER VENUS 2, TAYLOR, JR.--------------

INVESTIGATION NAME- ION MASS SPECTROMETER
NSSDC ID- 78-0854-17 INVESTIGATIVE PROGRAM CODE 01-4-6 SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY IONOSPHERES PLANETARY ATMOSPHERES
PERSONNEL
PJ- H.A. TAYLOR, JR. NASA-GSFC
01- J.R. BAUER GRAD U
01- F.C. BABSON NASA-GSFC
01- R.C. BROWN NASA-GSFC
01- J.W. DONAHUE U OF MICHIGAN
01- F.C. CLOUTIER RICE U
01- F.C. MEICH RICE U

BRIEF DESCRIPTION
This experiment was designed to measure energetic electrons, protons, and alpha particles in the interplanetary medium and in the vicinities of Venus and Mercury. The instrumentation consisted of a main telescope and a low-energy telescope. The main telescope consisted of six collinear sensors (five silicon detectors and one CsI scintillator) surrounded by a photonic CsI scintillator antisolvent cup. The pulse height analysis was performed on 0.53-1.9 MeV electrons and below approximately 170 keV. The aperture half angle for this mode was 90° and the geometric factors were 184 s cm2 for electrons and 7.4 s cm2 for protons and alpha particles. The half angle decreased to 32° for coincident counts in the first and second sensors. The low-energy telescope, a two-element (plus anticoincidence) detector with a 36°-dep half angle aperture and a 3°-0° angular geometrical factor, was used to measure 0.33-1.9 and 1.9-8.9 MeV protons without responding to electrons over a wide range of electron energies and intensities. See J. Geophys. Res., v. 66, p. 4026 and references therein for further details.

--- PIONEER VENUS 2, TAYLOR, JR.--------------

INVESTIGATION NAME- ION MASS SPECTROMETER
NSSDC ID- 78-0854-17 INVESTIGATIVE PROGRAM CODE 01-4-6 SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY IONOSPHERES PLANETARY ATMOSPHERES
PERSONNEL
PJ- H.A. TAYLOR, JR. NASA-GSFC
01- J.R. BAUER GRAD U
01- F.C. BABSON NASA-GSFC
01- R.C. BROWN NASA-GSFC
01- J.W. DONAHUE U OF MICHIGAN
01- F.C. CLOUTIER RICE U
01- F.C. MEICH RICE U

BRIEF DESCRIPTION
The composition and concentration of thermal positrons in the ionosphere of Venus were determined and interpreted in terms of vertical and horizontal components. The instrument used was a Bennett radio-frequency mass spectrometer based on the design of those flown on GOS and Atmospheric Explorer satellites. A mass range of 1 to 66 was covered with a variety of automatic scan-search modes available.

--- PIONEER VENUS 2, TAYLOR, JR.--------------

INVESTIGATION NAME- ION MASS SPECTROMETER
NSSDC ID- 78-0854-17 INVESTIGATIVE PROGRAM CODE 01-4-6 SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY IONOSPHERES PLANETARY ATMOSPHERES
PERSONNEL
PJ- H.A. TAYLOR, JR. NASA-GSFC
01- J.R. BAUER GRAD U
01- F.C. BABSON NASA-GSFC
01- R.C. BROWN NASA-GSFC
01- J.W. DONAHUE U OF MICHIGAN
01- F.C. CLOUTIER RICE U
01- F.C. MEICH RICE U

BRIEF DESCRIPTION
The composition and concentration of thermal positive ions in the ionosphere of Venus were determined and interpreted in terms of vertical and horizontal components. The instrument used was a Bennett radio-frequency mass spectrometer based on the design of those flown on GOS and Atmospheric Explorer satellites. A mass range of 1 to 66 was covered with a variety of automatic scan-search modes available.

--- PIONEER VENUS 2, TAYLOR, JR.--------------

INVESTIGATION NAME- ION MASS SPECTROMETER
NSSDC ID- 78-0854-17 INVESTIGATIVE PROGRAM CODE 01-4-6 SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY IONOSPHERES PLANETARY ATMOSPHERES
PERSONNEL
PJ- H.A. TAYLOR, JR. NASA-GSFC
01- J.R. BAUER GRAD U
01- F.C. BABSON NASA-GSFC
01- R.C. BROWN NASA-GSFC
01- J.W. DONAHUE U OF MICHIGAN
01- F.C. CLOUTIER RICE U
01- F.C. MEICH RICE U

BRIEF DESCRIPTION
The composition and concentration of thermal positive ions in the ionosphere of Venus were determined and interpreted in terms of vertical and horizontal components. The instrument used was a Bennett radio-frequency mass spectrometer based on the design of those flown on GOS and Atmospheric Explorer satellites. A mass range of 1 to 66 was covered with a variety of automatic scan-search modes available.

--- PIONEER VENUS 2, TAYLOR, JR.--------------

INVESTIGATION NAME- ION MASS SPECTROMETER
NSSDC ID- 78-0854-17 INVESTIGATIVE PROGRAM CODE 01-4-6 SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY IONOSPHERES PLANETARY ATMOSPHERES
PERSONNEL
PJ- H.A. TAYLOR, JR. NASA-GSFC
01- J.R. BAUER GRAD U
01- F.C. BABSON NASA-GSFC
01- R.C. BROWN NASA-GSFC
01- J.W. DONAHUE U OF MICHIGAN
01- F.C. CLOUTIER RICE U
01- F.C. MEICH RICE U

BRIEF DESCRIPTION
The composition and concentration of thermal positive ions in the ionosphere of Venus were determined and interpreted in terms of vertical and horizontal components. The instrument used was a Bennett radio-frequency mass spectrometer based on the design of those flown on GOS and Atmospheric Explorer satellites. A mass range of 1 to 66 was covered with a variety of automatic scan-search modes available.

--- PIONEER VENUS 2, TAYLOR, JR.--------------

INVESTIGATION NAME- ION MASS SPECTROMETER
NSSDC ID- 78-0854-17 INVESTIGATIVE PROGRAM CODE 01-4-6 SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY IONOSPHERES PLANETARY ATMOSPHERES
PERSONNEL
PJ- H.A. TAYLOR, JR. NASA-GSFC
01- J.R. BAUER GRAD U
01- F.C. BABSON NASA-GSFC
01- R.C. BROWN NASA-GSFC
01- J.W. DONAHUE U OF MICHIGAN
01- F.C. CLOUTIER RICE U
01- F.C. MEICH RICE U

BRIEF DESCRIPTION
The composition and concentration of thermal positive ions in the ionosphere of Venus were determined and interpreted in terms of vertical and horizontal components. The instrument used was a Bennett radio-frequency mass spectrometer based on the design of those flown on GOS and Atmospheric Explorer satellites. A mass range of 1 to 66 was covered with a variety of automatic scan-search modes available.

--- PIONEER VENUS 2, TAYLOR, JR.--------------

INVESTIGATION NAME- ION MASS SPECTROMETER
NSSDC ID- 78-0854-17 INVESTIGATIVE PROGRAM CODE 01-4-6 SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY IONOSPHERES PLANETARY ATMOSPHERES
PERSONNEL
PJ- H.A. TAYLOR, JR. NASA-GSFC
01- J.R. BAUER GRAD U
01- F.C. BABSON NASA-GSFC
01- R.C. BROWN NASA-GSFC
01- J.W. DONAHUE U OF MICHIGAN
01- F.C. CLOUTIER RICE U
01- F.C. MEICH RICE U

BRIEF DESCRIPTION
The composition and concentration of thermal positive ions in the ionosphere of Venus were determined and interpreted in terms of vertical and horizontal components. The instrument used was a Bennett radio-frequency mass spectrometer based on the design of those flown on GOS and Atmospheric Explorer satellites. A mass range of 1 to 66 was covered with a variety of automatic scan-search modes available.

--- PIONEER VENUS 2, TAYLOR, JR.--------------

INVESTIGATION NAME- ION MASS SPECTROMETER
NSSDC ID- 78-0854-17 INVESTIGATIVE PROGRAM CODE 01-4-6 SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY IONOSPHERES PLANETARY ATMOSPHERES
PERSONNEL
PJ- H.A. TAYLOR, JR. NASA-GSFC
01- J.R. BAUER GRAD U
01- F.C. BABSON NASA-GSFC
01- R.C. BROWN NASA-GSFC
01- J.W. DONAHUE U OF MICHIGAN
01- F.C. CLOUTIER RICE U
01- F.C. MEICH RICE U

BRIEF DESCRIPTION
The composition and concentration of thermal positive ions in the ionosphere of Venus were determined and interpreted in terms of vertical and horizontal components. The instrument used was a Bennett radio-frequency mass spectrometer based on the design of those flown on GOS and Atmospheric Explorer satellites. A mass range of 1 to 66 was covered with a variety of automatic scan-search modes available.
This ion mass spectrometer experiment obtained mass spectrograms at Venus' upper atmosphere on 12 occasions. Two line-of-sight channels were used to observe the vertical and horizontal components of the ion flux. These measurements provided information on the ion composition, which was observed during Mariner 2's closest approach to Venus on 20 August 1962. The ion composition was found to be dominated by oxygen ions, with minor contributions from other elements such as carbon and nitrogen. This finding was consistent with the inferred lower atmosphere composition and supported the idea of a warm, wet atmosphere on Venus. The results of this experiment were important in understanding the planet's upper atmosphere and in planning future missions to Venus.
that was in turn split by a dichroic filter into two perpendicular beams that were incident on two two-channel bolometer-coupled detectors. The successful bolometer-coupled detectors were achieved during planetary flyby on December 5th, 1962. The accuracy of the radiative transfer functions obtained varied from 2% for source temperatures near 200 deg K to 10% for source temperatures near 500 deg K. A complete description and performance summary for the Mariner 2 radiometer is given in "Mariner-Venus 1962 Final Project Results," NASA SP-59, 1962.

----- MARINER 2: CHASE, JR.-----

INVESTIGATION NAME: TWO-CHANNEL IR RADIOMETER

NSSEC 10- 73-0554-06 INVESTIGATIVE PROGRAM CORE El-4, SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY ATMOSPHERES

PERSONNEL
PI = G. CHASE, JR. SANTA BARBARA RES CTR
01 = E.J. MINER NASA-JPL
01 = G. MORRISON U OF ARIZONA
01 = G. NEUBURGER MIT-HEIDELBERG
01 = J.M. SKERRE (DECEASED) DOEING SCI RES LAB

BRIEF DESCRIPTION
This infrared radiometer having two channels 0.2 to 30 micrometers (0.5 to 0.071 micrometers = 200 K to 450 K) was used to observe the thermal emission from Venus and Mercury in two broad spectral bands. The F thermal emission from the planets, the surface temperatures, and the brightness temperatures were measured. Measurements were made of the brightness temperatures of Venusian cloud tops and the dark areas between the day and night sides. Analysis was made to separate the thermal temperature variations with an emphasis on the surface temperature variations with photographs and measurements by other instruments of the Earth, Venus, and Mercury. The objectives were to locate regions of radiative convergence and divergence as a function of altitude and to indicate the height at which solar energy is absorbed by the atmosphere. This experiment used a small net flux radiometer on the Probe targeted to the dayside of Venus to measure the net solar flux in the 0.2 to 0.5 micrometer region. The two Probes targeted to the nightside of the planet carried net infrared flux sensors covering the 1 to 25 micrometer region. The instrument weighed about 0.5 kg and used 2.5 W of power.

----- PIONEER VENUS II: TAYLOR-----

INVESTIGATION NAME: INFRARED RADIOMETER (IR)

NSSEC 10- 78-0534-16 INVESTIGATIVE PROGRAM CORE El-4, SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY ATMOSPHERES

PERSONNEL
PI = J.R. TAYLOR NASA-JPL
01 = H.W. ALVANN NASA-JPL
01 = R.T. CHAINNE NASA-JPL
01 = C.D. FARMER NASA-JPL
01 = J.J. MASTONHECH NASA-JPL
01 = A.P. INGERELL CALIF INST OF TECH
01 = J.T. HOUGHTON OXFORD U
01 = G.P. KEEPSY CLARKSON LAB
01 = C.D. ROGERS OXFORD U
01 = E.J. WILLIAMS CLARKSON LAB
01 = N.E. DICKIE NAVY CTR FOR ATMOS RES
01 = J.C. GELLE NASA-JPL

BRIEF DESCRIPTION
This investigation used an f-channel radiometer for vertical temperature sounding of the atmosphere from the cloud tops at 300 to 450 K and for investigations of cloud morphology, including the identification of possible multiple layers and water vapor mapping. The instrument was based on the selective chopper radiometer and the pressure modulator radiometer flown on Nimbus satellites.

----- PIONEER VENUS PROBE LRG. DOISE-----

INVESTIGATION NAME: INFRARED RADIOMETER (IR)

NSSEC 10- 78-0702-02 INVESTIGATIVE PROGRAM CORE El-4, SCIENCE
INVESTIGATION DISCIPLINE(S) PLANETARY ATMOSPHERES

PERSONNEL
PI = G. DOISE NASA-JPL
01 = J.D. POLLACK NASA-JPL
01 = L.P. GIVER NASA-JPL

BRIEF DESCRIPTION
The objective of this experiment was to measure the atmosphere thermal flux profile, detect cloud layers and infer their cloud characteristics, and estimate the atmospheric water content. This experiment used a "channel infrared radiometer looking down from the probe. Two internal blackbodies were used to allow absolute measurements of the flux in each channel. The instrument weighed about 5 kg and used about 1 W of power.
NSSDC 10- 62-044A-38  INVESTIGATIVE PROGRAM  CODE EL-4, SCIENCE  INVESTIGATION DISCIPLINE(S)  CELESTIAL MECHANICS
PERSONNEL  PI - J.A. ANDERSON  NASA-JPL
BRIEF DESCRIPTION  Deep Space Network tracking data on Mariner 2 were used to obtain improved determinations of the masses of Venus and the moon, the astronomical unit, and improved ephemerides of the earth and Venus. The experimenter used the onboard receiver and transmitter equipment in conjunction with the Deep Space Station equipment to obtain Doppler measurements. Data were obtained at 12-h intervals from September 5 to December 15, 1962, at 1-h intervals until December 16, and then again at 12-h intervals until January 4, 1963.

---- PIONEER VENUS 3, SHAPIRO----

INVESTIGATION NAME= CELESTIAL MECHANICS (CPM)
NSSDC 10- 78-051A-21  INVESTIGATIVE PROGRAM  CODE EL-4, SCIENCE  INVESTIGATION DISCIPLINES( ) PLANTARY ATMOSPHERES  CELESTIAL MECHANICS
PERSONNEL  PI - J.J. SHAPIRO  MASS INST OF TECH
BRIEF DESCRIPTION  This experiment used the S-band and X-band radio signals for data measurements. The objectives were: (1) to model the gravity field of Venus, (2) to evaluate the direction and amplitude of the Venus spin vector, (3) to bound the amplitude of (and possibly estimate) the solar motion of Venus, (4) to determine the density profile of the upper atmosphere, and (5) to determine a correction between the coordinate system of planetary ephemerides and an inertial coordinate system reference to extraterrestrial radio sources.

---- MARINER 5, ESHLEMAN----

INVESTIGATION NAME= TWO-FREQUENCY BEACON RECEIVER
NSSDC 10- 67-068A-02  INVESTIGATIVE PROGRAM  CODE EL-4, SCIENCE  INVESTIGATION DISCIPLINES( ) PARTICLES AND FIELDS  COSMO PHYSICS  IONOSPHERES AND RADIO PHYSICS
PERSONNEL  PI - V.A. COLEMAN  NASA-JPL  CI - T.A. CROFT  SRI INTERNATIONAL
BRIEF DESCRIPTION  Both 425.1-MHz and the 2/27 subharmonics of 6.6-MHz signals were transmitted from a 4.8-kW steerable parabolic antenna at Stanford University to the two-frequency radio receiver in the spacecraft. The high-frequency signal served a reference signal since its propagation time was not appreciably delayed. The low-frequency signal was delayed in proportion to the total electron content in the propagation path. On the spacecraft a phase-locked receiver counted the beat-frequency zero crossings of the received signals to obtain measurements of phase-path differences. Differential delay of the group velocity was also observed, and these values were telemetered to the ground station. From calculated total electron content values, the ionospheric effect (up to a selected altitude obtained from other experimental techniques) was subtracted to produce data describing the interplanetary electron content of the solar wind and its variations. The experiment operated nominally from launch to November 1967. For similar experiments covering other time periods, see Pioneers 1-9 (66-1085-63, 67-1224-63, 66-2754-64, and 65-1513-64). More detailed descriptions of the experiment can be found in J. Geophys. Res., v. 17 pp. 3325-3327, and on Radio Science, v. 6, pp. 57-63, NSSDC has all the data from this experiment.

---- MARINER 5, ANDERSON----

INVESTIGATION NAME= CELESTIAL MECHANICS
NSSDC 10- 67-068A-07  INVESTIGATIVE PROGRAM  CODE EL-4, SCIENCE  INVESTIGATION DISCIPLINES( ) CELESTIAL MECHANICS
PERSONNEL  PI - J.A. ANDERSON  NASA-JPL

BRIEF DESCRIPTION  Deep Space Network tracking data on Mariner 5 were used to obtain improved determinations of the masses of Venus and the moon, the astronomical unit, and improved ephemerides of the earth and Venus. The experimenter used the onboard receiver and transmitter equipment in conjunction with Deep Space Station equipment to obtain Doppler measurements. The system performed well to distances of 48,166 km (November 5, 1967).

---- PIONEER VENUS 3, KLIGRE--

INVESTIGATION NAME= RADIO OCCULTATION (PAGE)
NSSDC 10- 78-051A-20  INVESTIGATIVE PROGRAM  CODE EL-4, SCIENCE  INVESTIGATION DISCIPLINES( ) PLANETARY ATMOSPHERES
PERSONNEL  PI - A.J. KLIGRE  NASA-JPL
BRIEF DESCRIPTION  This experiment used the S-band and X-band radio signals for data measurements. The objectives were (1) to measure scattering of the radio signal, (2) to measure the solar wind radio, (3) to study the ionospheric occultation, and (4) to determine the electron density of the lower atmosphere.

---- PIONEER VENUS 3, KLIGRE--

INVESTIGATION NAME= GAS AND PLASMA ENVIRONMENT (GPE)
NSSDC 10- 78-051A-83  INVESTIGATIVE PROGRAM  CODE EL-4, SCIENCE  INVESTIGATION DISCIPLINES( ) GYROMAGNETIC PLANETARY IONOSPHERES  PLANETARY ATMOSPHERES
BRIEF DESCRIPTION  This experiment used data obtained from the S-band and X-band radio signals. The objectives were (1) to study the electron density of the Venusian ionosphere, (2) to study the solar wind microflow structure, and (3) to study the solar wind scintillations at the ionospheric occultation.

---- PIONEER VENUS 1, PETTENGILL----

INVESTIGATION NAME= RADAR MAPPER (CMOS)

15
This experimental used a quadrupole mass spectrometer with three ion-source operating modes and three mass-scanning modes. The ion source could be operated alternately in open and closed configurations to increase accuracy. An adaptive mass scan was used to reduce the hit rate required for a given information-return rate. The resolution was 1.6 e for adjacent masses, and the mass range was 1 to 45 u. Vertical and horizontal density variations of the major neutral constituents of the upper atmosphere of Venus were detected and measured to define the density-chemical, and thermal states of the upper atmosphere. Important constituents measured were Ne, O, Oz, CO, CO2 and N2, A. It was also possible to study H, D and/or /3, T, and 180.

------ PIONEER VENUS 2, VON ZAHN

INVESTIGATIVE NAME: NEUTRAL MASS SPECTROMETER (OMS)

NSSC 1S- 78-078A -03 INVESTIGATIVE PROGRAM
CODE 4-E + OP, SCIENCE
INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES
AERONOMY

PERSONNEL
PI - R. R. VON ZAHN
01- R. J. PHILLIPS
02 - R. H. MCCLURE
03 - A. F. PEDERSEN
04 - A. S. NAGY
05 - T. M. DURANGE

BRIEF DESCRIPTION
This experiment used the 5-band and 5-band radio signals for data measurements. The objectives were (1) to determine the internal mass distribution and the physical processes that have operated to produce the distribution, (2) to determine the relationship of the surface morphology to the internal density distributions, (3) to determine the amount of isotopic composition of the Venusian topography and (4) to describe the evolutionary track for Venus that is consistent with the above.

ATMOSPHERE

------ PIONEER VENUS 2, BrACE

INVESTIGATIVE NAME: ELECTRON TEMPERATURE PROBE

NSSC 1S- 78-0514 -01 INVESTIGATIVE PROGRAM
CODE 4-E + OP, SCIENCE
INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES
PLANETARY IONOSPHERES

PERSONNEL
PI - L. L. BRACE
01 - R. M. MCELROY
02 - A. L. PEIDERS
03 - A. S. NAGY
04 - T. M. DURANGE

BRIEF DESCRIPTION
This experiment consists of a pair of cylindrical Langmuir probes of the type used on the Atmosphere Explorer (AE) series. Two probes were required so that one was always out of the wake of the spacecrafts. In flight analyses, 50 measurements were carried at a rate of one per second. If high spatial resolution for the measurements of Ne and Te. The results of these high-resolution measurements were used with the study of the upper atmosphere and ionosphere and to investigate the interaction of the solar wind with the Venusian ionosphere. The experiments provided measurements over the whole region traversed by the orbiter, covering a large range of solar aspect angles, to yield a more complete configuration of the physical properties of the ionosphere region.

------ PIONEER VENUS 2, NIEMANN

INVESTIGATIVE NAME: NEUTRAL MASS SPECTROMETER (OMS)

NSSC 1S- 78-0514 -19 INVESTIGATIVE PROGRAM
CODE 4-E + OP, SCIENCE
INVESTIGATION DISCIPLINE(S)
AERONOMY
PLANETARY ATMOSPHERES

PERSONNEL
PI - R. M. NIEMANN
01 - G. B. CROISAN
02 - M. R. HAFLE
03 - J. R. SPEICHER

BRIEF DESCRIPTION
This experiment used the spacecraft's S-band and S-band radio signals for data measurements. The objectives were (1) to establish the diurnal variation of the Venusian density and density scale height (2) to determine the relationship of solar wind variations to variations in the atmospheric density, (3) to determine the relationship of long and short term variation in solar extreme UV radiation to density variations, (4) to search for phenomena such as a semi-annual variation and super rotation of the atmospheric conditions, and (5) to formulate a thermospheric model for the Venusian atmosphere.
BRIEF DESCRIPTION
This experiment used the Deep Space Network (DSN) telemetry data. The objective was to measure and study the small-scale turbulence characteristics of the atmosphere of Venus. Information obtained included the variation of intensity of turbulence with altitude, wind velocity transverse to the line-of-sight path, and distribution of scale size in the atmosphere. These measurements contributed to an understanding of the atmosphere's circulation and dynamics.

------ PIONEER VENUS 2, WOO-----------------------------

INVESTIGATION NAME- ATMOSPHERIC AND SOLAR CORONA TURBULENCE (MTM)

NSSDC 19- 78-051A-02 INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

PERSONNEL
PI - R. WOO NASA-JPL

BRIEF DESCRIPTION
This experiment made use of the S-band and E-band radio signals for data measurements. The objectives of the experiment were to measure: (1) the intensity variation of turbulence with altitude; (2) planetary latitude and longitudinal; and (3) the distribution of scale size in the atmosphere.

------ PIONEER VENUS PROBE SM2, AGENT-----------------------

INVESTIGATION NAME- NEMHELOMETER (LN)

NSSDC 19- 78-078L-02 INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

PERSONNEL
PI - R. AGENT NASA-ARC
PI - J. B. BLAMONT CHS-66

BRIEF DESCRIPTION
This experiment consisted of a nephelometer to measure the energy backscattered from cloud particles. It used a pulsed gallium arsenide laser diode to illuminate the clouds. The altitude history of the backscattered signal indicated the presence and vertical extent of clouds along the trajectory. Comparisons with the measurements from the other probes indicated the spatial variability of the cloud structure. The laser operated at about 9800 A. The experiment weighed about 6.5 kg and used about 1.3 W of power.

------ PIONEER VENUS PROBE SM2, AGENT-----------------------

INVESTIGATION NAME- NEMHELOMETER (LN)

NSSDC 19- 78-078I-02 INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

PERSONNEL
PI - R. AGENT NASA-ARC
PI - J. B. BLAMONT CHS-66

BRIEF DESCRIPTION
This experiment consisted of a nephelometer to measure the energy backscattered from cloud particles. It used a pulsed gallium arsenide laser diode to illuminate the clouds. The altitude history of the backscattered signal indicated the presence and vertical extent of clouds along the trajectory. Comparisons with the measurements from the other probes indicated the spatial variability of the cloud structure. The laser operated at about 9800 A. The experiment weighed about 6.5 kg and used about 1.3 W of power.

------ PIONEER VENUS PROBE SM2, AGENT-----------------------

INVESTIGATION NAME- NEMHELOMETER (LN)

NSSDC 19- 78-078F-02 INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

PERSONNEL
PI - R. AGENT NASA-ARC
PI - J. B. BLAMONT CHS-66

BRIEF DESCRIPTION
This experiment consisted of a nephelometer to measure the energy backscattered from cloud particles. It used a pulsed gallium arsenide laser diode to illuminate the clouds. The altitude history of the backscattered signal indicated the presence and vertical extent of clouds along the trajectory. Comparisons with the measurements from the other probes indicated the spatial variability of the cloud structure. The laser operated at about 9800 A. The experiment weighed about 6.5 kg and used about 1.3 W of power.
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------ PIONEER VENUS PROBE SMS: SEIFF

INVESTIGATION NAME: ATMOSPHERE STRUCTURE

NSSDC ID: 78-0799-02
INVESTIGATIVE PROGRAM: CODE EL-4 SCIENCE
INVESTIGATION DISCIPLINES: PLANETARY ATMOSPHERES METEOROLOGY AERONOMY

PERSONNEL
PI - B. RAGEN NASA-ARC
PI - J.J. BLUMENTHAL CNRS-SA

BRIEF DESCRIPTION
This experiment consisted of a nephelometer to measure the energy backscattered from cloud particles. It used a pulsed gallium arsenide laser diode to illuminate the clouds. The altitude history of the backscattered signal indicated the presence and vertical extent of clouds along the trajectory. Comparisons with the measurements from the other probes indicated the spatial variability of the cloud structure. The laser operated at about 9000 Å. The experiment weighed about 1.6 kg and used about 1.2 W of power.

------ PIONEER VENUS PROBE SMS: RAGEN

INVESTIGATION NAME: ATMOSPHERE STRUCTURE

NSSDC ID: 78-0799-03
INVESTIGATIVE PROGRAM: CODE EL-4 SCIENCE
INVESTIGATION DISCIPLINES: PLANETARY ATMOSPHERES METEOROLOGY AERONOMY

PERSONNEL
PI - B. RAGEN NASA-ARC
PI - J.J. BLUMENTHAL CNRS-SA

BRIEF DESCRIPTION
This experiment consisted of a nephelometer to measure the energy backscattered from cloud particles. It used a pulsed gallium arsenide laser diode to illuminate the clouds. The altitude history of the backscattered signal indicated the presence and vertical extent of clouds along the trajectory. Comparisons with the measurements from the other probes indicated the spatial variability of the cloud structure. The laser operated at about 9000 Å. The experiment weighed about 1.6 kg and used about 1.2 W of power.

------ PIONEER VENUS PROBE SMS: SEIFF

INVESTIGATION NAME: ATMOSPHERE STRUCTURE

NSSDC ID: 78-0799-04
INVESTIGATIVE PROGRAM: CODE EL-4 SCIENCE
INVESTIGATION DISCIPLINES: PLANETARY ATMOSPHERES METEOROLOGY AERONOMY

PERSONNEL
PI - A. SEIFF NASA-ARC
PI - S.C. SOMMER NASA-ARC
PI - R.J. BLANCHARD NASA-LARC
PI - D.J. SIKES NASA-ARC
PI - R.E. YOUNG NASA-ARC
PI - J.S. BERN NASA-ARC

BRIEF DESCRIPTION
The instruments for this experiment included a three-axis accelerometer, pressure sensors, and temperature sensors. They were based on the technology demonstrated by the PACE rocket vehicle (Planetary Atmosphere Experiment Test R 716-286). The experiments were used to construct a profile of atmospheric state properties for the trajectory from the surface to approximately 165 km altitude. They were also used to determine vertical wind velocity, horizontal wind velocity, and turbulence. By comparing atmospheric conditions along this trajectory with those measured by other probes, circulation models of the atmosphere were determined. The instruments weighed about 3.2 kg and consumed about 1.5 W of power.

------ PIONEER VENUS PROBE SMS: SEIFF
INVESTIGATION NAME - ATMOSPHERIC PROPAGATION (PMPS)

NSSDC 10- 70-078E-17 INVESTIGATIVE PROGRAM CORE EL-4, SCIENCE

INVESTIGATION DISCIPLINES(S) PLANETARY ATMOSPHERES RADIO PHYSICS CELESTIAL MECHANICS PLANETARY ATMOSPHERES

PERSONNEL
PI - T.A. CROFT SRI INTERNATIONAL

BRIEF DESCRIPTION
This experiment used the Deep Space Network (DSN) telemetry data. The objectives were (1) to determine the atmospheric structure of Venus as it affects the intensity and refraction of Probe telemetry signals and (2) to investigate the interference between the direct ray and a surface-reflected component as a means of assessing communications reliability for the design of future probe missions.

------ PIONEER VENUS PROBE SM2, CROFT-------------------------

INVESTIGATION NAME - ATMOSPHERIC PROPAGATION (PMPS)

NSSDC 10- 70-078F-17 INVESTIGATIVE PROGRAM CORE EL-4, SCIENCE

INVESTIGATION DISCIPLINES(S) PLANETARY ATMOSPHERES RADIO PHYSICS CELESTIAL MECHANICS PLANETARY ATMOSPHERE

PERSONNEL
PI - T.A. CROFT SRI INTERNATIONAL

BRIEF DESCRIPTION
This experiment used the Deep Space Network (DSN) telemetry data. The objectives were (1) to determine the atmospheric structure of Venus as it affects the intensity and refraction of Probe telemetry signals and (2) to investigate the interference between the direct ray and a surface-reflected component as a means of assessing communications reliability for the design of future probe missions.

------ PIONEER VENUS PROBE SM3, CROFT-------------------------

INVESTIGATION NAME - DIFFERENTIAL LONG BASELINE INTERFEROMETER (DLBI)

NSSDC 10- 70-078D-07 INVESTIGATIVE PROGRAM CORE EL-4, SCIENCE

INVESTIGATION DISCIPLINES(S) PLANETARY ATMOSPHERES RADIO PHYSICS CELESTIAL MECHANICS PLANETARY ATMOSPHERES

PERSONNEL
PI - T.A. CROFT SRI INTERNATIONAL

BRIEF DESCRIPTION
This experiment used the Deep Space Network (DSN) telemetry data. The objectives were (1) to determine the atmospheric structure of Venus as it affects the intensity and refraction of Probe telemetry signals and (2) to investigate the interference between the direct ray and a surface-reflected component as a means of assessing communications reliability for the design of future probe missions.

------ PIONEER VENUS PROBE SM4, CROFT-------------------------

INVESTIGATION NAME - DIFFERENTIAL LONG BASELINE INTERFEROMETER (DLBI)

NSSDC 10- 70-078E-05 INVESTIGATIVE PROGRAM CORE EL-4, SCIENCE

INVESTIGATION DISCIPLINES(S) PLANETARY ATMOSPHERES METEOROLOGY AERONOMY

PERSONNEL
PI - C.C. COUNSELMAN MASS INST OF TECH 01 - J.J. SHAPIRO MASS INST OF TECH 01 - R.C. PRINN MASS INST OF TECH 01 - J. CHARNEY MASS INST OF TECH 01 - G. PETTENGILL MASS INST OF TECH

BRIEF DESCRIPTION
This experiment involved applying differential very-long-baseline interferometry techniques to the radio signals from the entry Probe and Bus to infer or place upper limits on wind speeds in the lower atmosphere. These results were used in modeling the circulation patterns of Venus' atmosphere. Data taken prior to probe entry were used, where feasible, to infer characteristics of Venus' gravity field for use with probe entry operations as well as in later scientific evaluation.

------ PIONEER VENUS PROBE SM5, COUNSELMAN-------------------

INVESTIGATION NAME - DIFFERENTIAL LONG BASELINE INTERFEROMETER (DLBI)

NSSDC 10- 70-078F-05 INVESTIGATIVE PROGRAM CORE EL-4, SCIENCE

INVESTIGATION DISCIPLINES(S) PLANETARY ATMOSPHERES METEOROLOGY AERONOMY

PERSONNEL
PI - C.C. COUNSELMAN MASS INST OF TECH 01 - J.J. SHAPIRO MASS INST OF TECH 01 - R.C. PRINN MASS INST OF TECH 01 - J. CHARNEY MASS INST OF TECH 01 - G. PETTENGILL MASS INST OF TECH

BRIEF DESCRIPTION
This experiment involved applying differential very-long-baseline interferometry techniques to the radio signals from the entry Probe and Bus to infer or place upper limits on wind speeds in the lower atmosphere. These results were used in modeling the circulation patterns of Venus' atmosphere. Data taken prior to probe entry were used, where feasible, to infer characteristics of Venus' gravity field for use with probe entry operations as well as in later scientific evaluation.

------ PIONEER VENUS PROBE SM6, COUNSELMAN-------------------

INVESTIGATION NAME - CLOUD PARTICLE SIZE SPECTROMETER (CLPS)

NSSDC 10- 70-078G-03 INVESTIGATIVE PROGRAM CORE EL-4, SCIENCE

INVESTIGATION DISCIPLINES(S) PLANETARY ATMOSPHERES METEOROLOGY AERONOMY

PERSONNEL
PI - C.C. COUNSELMAN MASS INST OF TECH 01 - J.J. SHAPIRO MASS INST OF TECH 01 - R.C. PRINN MASS INST OF TECH 01 - J. CHARNEY MASS INST OF TECH 01 - G. PETTENGILL MASS INST OF TECH

BRIEF DESCRIPTION
This experiment involved applying differential very-long-baseline interferometry techniques to the radio signals from the entry Probe and Bus to infer or place upper limits on wind speeds in the lower atmosphere. These results were used in modeling the circulation patterns of Venus' atmosphere. Data taken prior to probe entry were used, where feasible, to infer characteristics of Venus' gravity field for use with probe entry operations as well as in later scientific evaluation.

------ PIONEER VENUS PROBE SM7, CHARNEY------------------------

INVESTIGATION NAME - CLOUD PARTICLE SIZE SPECTROMETER (CLPS)

NSSDC 10- 70-078H-03 INVESTIGATIVE PROGRAM CORE EL-4, SCIENCE

INVESTIGATION DISCIPLINES(S) PLANETARY ATMOSPHERES METEOROLOGY AERONOMY

PERSONNEL
PI - C.C. COUNSELMAN MASS INST OF TECH 01 - J.J. SHAPIRO MASS INST OF TECH 01 - R.C. PRINN MASS INST OF TECH 01 - J. CHARNEY MASS INST OF TECH 01 - G. PETTENGILL MASS INST OF TECH

BRIEF DESCRIPTION
This experiment involved applying differential very-long-baseline interferometry techniques to the radio signals from the entry Probe and Bus to infer or place upper limits on wind speeds in the lower atmosphere. These results were used in modeling the circulation patterns of Venus' atmosphere. Data taken prior to probe entry were used, where feasible, to infer characteristics of Venus' gravity field for use with probe entry operations as well as in later scientific evaluation.

------ PIONEER VENUS PROBE SM8, CHARNEY------------------------
The objective of this experiment was to measure Venus' cloud particle sizes and concentrations. A laser was used to illuminate cloud particles. Optical lenses imaged the particle shadows on arrays of detectors. The particle shadows were used to determine particle size and concentration. The flight sensor was similar to those flown in aircraft and balloons.

--- Pioneer Venus Probe LGR, OPANA--------------------------

INVESTIGATION NAME: GAS CHROMATOGRAPH (LGC)

PERSONNEL
PI - V.I. POLLACK
01 - J.R. PULLACK
01 - G. EAGLE
01 - F. WOELLER

INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

BRIEF DESCRIPTION
The objective of this experiment was to determine the composition of Venus' lower atmosphere. From these measurements, deductions were made of the gaseous sources of infrared opacity, the degree of differentiation of Venus' interior, the degree of similarity between the solid bodies of Earth and Venus, and evolution of Venus' atmosphere. Two gas chromatograph columns were used to analyze samples of the atmosphere during probe descent.

--- Pioneer Venus Probe LGR, TOPASKO--------------------------

INVESTIGATION NAME: SOLAR FLUX RADIOMETER (LSFR)

PERSONNEL
PI - M.G. TOMASKO
01 - A. WOLFE
01 - A. CLEMONS

INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

BRIEF DESCRIPTION
The objective of this investigation was to determine the regions in Venus' atmosphere where solar energy is deposited. Six narrow-field-of-view detectors were used to measure the intensity of scattered solar light. As the probe descended through the atmosphere, the difference between upward-looking and downward-looking detectors indicated the net downward flux.

POLARIZATION

--- Pioneer Venus 1: HANSEN--------------------------

INVESTIGATION NAME: CLOUD PHOTOPOLARIMETER

SEE THIS EXPERIMENT UNDER IMAGING
Mars
Plate 3. This is a composite of press release photographs from the Mariner 9, Vikings 1 and 2 Orbiter, and Vikings 1 and 2 Lander missions. (A) 211-5050 is a mosaic of Viking Orbiters' medium-resolution photos depicting most of one hemisphere of Mars and showing the Valles Marineris (4000-km-long canyon), the Tharsis bulge's giant volcanoes, and the very large Argyre basin. (B) P12732 is a Mariner 9 high-resolution photo of part of the Valles Marineris, discovered on this mission, showing some of the arroyos, the largest of which resembles our Grand Canyon in size and appearance. (C) 211-5248 is a mosaic from Viking Orbiter photography of Arsia Mons, one of the giant shield volcanoes on Mars. (D) P17002 is a Viking 1 Orbiter mosaic photo of the terrain near the Viking 1 Lander's site showing features that are best explained as the products from flowing water. Conditions in the past must have been different, permitting free water to form in large quantities, which is not possible at present on Mars. (E) 211-5685 is a Viking 1 Lander photo of the immediate surroundings of the spacecraft at its landing site in Chryse Planitia. Note the presence of many loose rocks, rock outcroppings, and dune-like areas. (F) P16848 is a Viking 1 Orbiter photo of Yuti, showing a type of crater unique to Mars which has an enormous, high central peak with a summit crater. The large central peak and large, multi-layered ejecta envelopes do not follow the Schroter rule for impact craters. (G) P12694 is a Mariner 9 photo of Phobos, the larger and closer of the two tiny satellites of Mars. The photo shows the moon to be irregular in shape (only 20 km long) and highly cratered. Mariner 9 was the first to obtain detailed photos of these moons. Viking Orbiter photos later revealed long grooves and crater chains on Phobos and deep dust on Deimos. (H) Viking 2 Lander photo shows the immediate surroundings of the spacecraft in the Utopia region of Mars. Note that most of the rocks have a pocked or vesicular surface and that they are quite different from those at the Lander 1 site in (E). One of the footpads landed on a rock.
INTRODUCTION

Mars is the next planet out from the sun that is treated in this catalog. Six missions have been sent to Mars by the U.S. and several by the U.S.S.R., but since NSSDC has no data from the U.S.S.R. missions, they are omitted in this catalog. The last missions, Vikings 1 and 2, consisted of two spacecraft each: (1) Viking Orbiter and (2) Viking Lander. Each spacecraft is treated separately. On these missions there were 49 investigations for which NSSDC has data or sources from which data may be obtained. These investigations cover eight categories: (1) Imaging, (2) Particles and Fields, (3) Ultraviolet, (4) Infrared, (5) Radio Science and Celestial Mechanics, (6) Atmosphere, (7) Surface Chemistry, and (8) Biology. The last two categories of investigations are unique to Mars. Tables 1 and 2 and Appendix A give more details of these investigations.
**SPACECRAFT**

**SPACECRAFT COMMON NAME: MARINER 7**

**ALTERNATE NAME: PL-57A, MARINER MARS 69A**

**NSSDC ID: 69-030**

**LAUNCH DATE: 08/20/69**

**WEIGHT: 500 KG**

**LAUNCH SITE: CAPE CANAVERAL, UNITED STATES**

**LAUNCH VEHICLE: TITAN**

**SPONSORING COUNTRY/AGENCY**

**UNITED STATES**

**NASA-CSS**

**INITIAL ORBIT PARAMETERS**

**ORBIT TYPE: MARS FLYBY**

**PERSONNEL**

PM N. M. SCHUMACHER NASA-JPL

PS J. J. STALLKAMP NASA-JPL

**BRIEF DESCRIPTION**

Mariner 6 was the sixth in a series of spacecraft used for planetary exploration in the flyby mode. It was designed to conduct low-altitude observations of the planet Mars and to transmit these observations to Earth. Other mission objectives were to determine the extent of surface field and particle measurements and to provide experience in interplanetary flight. The spacecraft flew by Mars on March 1, 1969, and returned 21 pictures plus 25 lines of profile data. The spacecraft operated successfully throughout the mission, and data returned from Earth until October 1969, when the distance from Earth and its antenna orientation temporarily halted the signal acquisition. Data acquisition resumed in late 1969 and continued until December 20, 1970.

**SPACECRAFT COMMON NAME: MARINER 7**

**ALTERNATE NAME: PL-67A, MARINER MARS 69**

**NSSDC ID: 69-030**

**LAUNCH DATE: 08/20/69**

**WEIGHT: 500 KG**

**LAUNCH SITE: CAPE CANAVERAL, UNITED STATES**

**LAUNCH VEHICLE: TITAN**

**SPONSORING COUNTRY/AGENCY**

**UNITED STATES**

**NASA-CSS**

**INITIAL ORBIT PARAMETERS**

**ORBIT TYPE: MARS FLYBY**

**PERSONNEL**

PM J. J. STALLKAMP NASA-JPL

PS G. A. MOFFETT NASA-JPL

**BRIEF DESCRIPTION**

Mariner 6 was the sixth in a series of spacecraft used for planetary exploration in the flyby mode. It was designed to conduct low-altitude observations of the planet Mars and to transmit these observations to Earth. Other mission objectives were to determine the extent of surface field and particle measurements and to provide experience in interplanetary flight. The spacecraft flew by Mars on March 1, 1969, and returned 21 pictures plus 25 lines of profile data. The spacecraft operated successfully throughout the mission, and data returned from Earth until October 1969, when the distance from Earth and its antenna orientation temporarily halted the signal acquisition. Data acquisition resumed in late 1969 and continued until December 20, 1970.

**SPACECRAFT COMMON NAME: MARINER 8**

**ALTERNATE NAME: PL-67B, MARINER MARS 69**

**NSSDC ID: 69-030**

**LAUNCH DATE: 08/20/69**

**WEIGHT: 500 KG**

**LAUNCH SITE: CAPE CANAVERAL, UNITED STATES**

**LAUNCH VEHICLE: TITAN**

**SPONSORING COUNTRY/AGENCY**

**UNITED STATES**

**NASA-CSS**

**INITIAL ORBIT PARAMETERS**

**ORBIT TYPE: MARS FLYBY**

**PERSONNEL**

PM J. J. STALLKAMP NASA-JPL

PS J. A. SCHMITZ NASA-JPL

**BRIEF DESCRIPTION**

Mariner 7 was the sixth in a series of spacecraft used for planetary exploration in the flyby mode. It was designed to conduct low-altitude observations of the planet Mars and to transmit these observations to Earth. Other mission objectives were to determine the extent of surface field and particle measurements and to provide experience in interplanetary flight. The spacecraft flew by Mars on March 1, 1969, and returned 21 pictures plus 25 lines of profile data. The spacecraft operated successfully throughout the mission, and data returned from Earth until October 1969, when the distance from Earth and its antenna orientation temporarily halted the signal acquisition. Data acquisition resumed in late 1969 and continued until December 20, 1970.

**SPACECRAFT COMMON NAME: MARINER 9**

**ALTERNATE NAME: PL-733 B, VIKING-B**

**NSSDC ID: 71-0518**

**LAUNCH DATE: 11/14/71**

**WEIGHT: 973 KG**

**LAUNCH SITE: CAPE CANAVERAL, UNITED STATES**

**LAUNCH VEHICLE: TITAN-CENT**

**SPONSORING COUNTRY/AGENCY**

**UNITED STATES**

**NASA-CSS**

**INITIAL ORBIT PARAMETERS**

**ORBIT TYPE: AREOCENTRIC**

**EPOCH DATE: 11/16/71**

**ORBIT PERIOD: 375 MIN**

**INCLINATION: 44.6°**

**PERIAPSIS: 1307 KM ALT**

**APOLLEPSIS: 16000 KM ALT**

**PERSONNEL**

PM H. SCHMEISSER NASA-JPL

PS R. H. STEINBACHER NASA-JPL

**BRIEF DESCRIPTION**

The Mariner Mars 71 mission was planned to consist of two spacecraft on complementary missions but due to the failure of Mariner 8 to launch properly, only one spacecraft was available. Mariner 9 combined mission objectives of both Mariner 8 (a study of temporal changes in the Martian atmosphere and on the Martian surface), for the survey portion of the mission, and also measured the solar wind, plasma, and magnetic field in the vicinity of Mars and to provide experience in interplanetary flight. The spacecraft flew by Mars on September 6, 1971, and returned 55 pictures plus 25 lines of profile data. The spacecraft operated successfully throughout the mission, and data returned from Earth until October 1971, when the distance from Earth and its antenna orientation temporarily halted the signal acquisition. Data acquisition resumed in late 1971 and continued until December 20, 1972.

**SPACECRAFT COMMON NAME: VIKING 1 ORBITER**

**ALTERNATE NAME: PL-733B, VIKING-B**

**NSSDC ID: 71-0518**

**LAUNCH DATE: 05/20/75**

**WEIGHT: 500 KG**

**LAUNCH SITE: CAPE CANAVERAL, UNITED STATES**

**LAUNCH VEHICLE: TITAN-CENT**

**SPONSORING COUNTRY/AGENCY**

**UNITED STATES**

**NASA-CSS**

**INITIAL ORBIT PARAMETERS**

**ORBIT TYPE: AREOCENTRIC**

**EPOCH DATE: 06/21/76**

**ORBIT PERIOD: 375 MIN**

**INCLINATION: 44.6°**

**PERIAPSIS: 1513 KM ALT**

**APOLLEPSIS: 516700 KM ALT**

**PERSONNEL**

PM J. J. Martin NASA-JPL

PS G. A. Moffett NASA-JPL

**BRIEF DESCRIPTION**

The Viking spacecraft consisted of an orbiter and a lander. The lander separated from the orbiter, entered the Martian atmosphere and landed on the surface of Mars after an approximately 7 minutes descent. The orbiter was used for conducting a variety of scientific investigations, including atmospheric and surface mapping, and radio sciences investigations. Scientific analysis instruments had a mass of approximately...
Viking 2 Orbiter

**SPACECRAFT COMMON NAME:** VIKING 2 ORBITER  
**ALTERNATE NAMES:** PL-33A, VIKING-2 ORBITER  
**NSSDC ID:** 75-038A  
**LAUNCH DATE:** 07/09/75  
**WEIGHT:** 509.0 kg  
**SPONSORING COUNTRY/AGENCY:** UNITED STATES  
**ORBIT PARAMETERS:**  
- **ORBIT TYPE:** AREOCENTRIC  
- **PERIOD:** 128.96 days  
- **INCLINATION:** 65.4°  
- **APOLLA:** 21,451 km  
- **PERILLA:** 110,743 km  
**PERSONNEL:**  
- **PI:** J.O. MARTIN(NASA)  
- **PS:** G.A. SOFFEN(NASA)  
**BRIEF DESCRIPTION:**  
The Viking spacecraft consisted of an orbiter and a lander. The lander separated from the orbiter, entered the Martian atmosphere, and soft-landed on September 3, 1976. Scientific investigations were conducted from the lander before, after, and after it was abandoned. The orbiter was a solar-cell-powered satellite stabilized in three axes with inertial control. It had a 598-watt power capacity for the orbiter. It carried instruments for measuring atmospheric, solar, and ionospheric plasma and magnetic, radiometric, and radio science investigations. The orbiter had an excellent remote sensing capability for scientific investigations. The orbiter yielded a high-resolution scientific result. The orbiter also carried instruments for conducting a wide range of experiments and experiments on the lander. The orbiter also carried instruments for conducting a wide range of experiments and experiments on the lander. The orbiter had a 267-kilogram mass and was approximately 1.4 meters wide. For a detailed description of the Viking mission and experiments, see "Scientific Results of the Viking Project," J. Geophys. Res., v. 82 n. 28, 1977.

**SPACECRAFT COMMON NAME:** VIKING 2 LANDER  
**ALTERNATE NAMES:** VIKING-2 LANDER  
**NSSDC ID:** 75-038C  
**LAUNCH DATE:** 07/09/75  
**WEIGHT:** 598.0 kg  
**SPONSORING COUNTRY/AGENCY:** UNITED STATES  
**INITIAL ORBIT PARAMETERS:**  
- **ORBIT TYPE:** MARS LANDER  
- **PI:** J.O. MARTIN(NASA)  
- **PS:** G.A. SOFFEN(NASA)  
**BRIEF DESCRIPTION:**  
The Viking Lander was the landing vehicle for the twopart spacecraft mission. It soft-landed on September 3, 1976, in the Utopia region of Mars at 4.67 degrees south latitude and 285.7 degrees east longitude. The lander carried instruments to study the biology, chemistry, composition, geology, magnetic properties, surface appearance, and physical properties of the Martian surface and atmosphere. The lander had a 76-kilogram mass and was approximately 2.5 meters wide. The Viking Lander 2 ceased operating on April 15, 1980. For a detailed description of the Viking mission and experiments, see "Scientific Results of the Viking Project," J. Geophys. Res., v. 82 n. 28, 1977.

**INVESTIGATIONS**

---

**INVESTIGATIONAL NAME:** VIKING TV CAMERA  
**INVESTIGATIONAL PROGRAM:** CODE 01-4 SCIENCE  
**INVESTIGATION DISCIPLINES:** PLANETOLOGY  
**PERSONNEL:**  
- **PI:** R.E. LEIGHTON  
- **PS:** CALIF INST OF TECH  
**BRIEF DESCRIPTION:**  
The Mars television experiment was designed to obtain photographs of the Martian surface and telecast them to Earth. The TV subsystem consisted of (1) a Cassegrain-type 14.1-meter reflecting telescope with a 36.6-meter effective treat length and a 1.6° field of view; (2) a shutter and filter assembly that had 9.0° and 22.0° exposure times and used red and green filters; (3) a slow scan vidicon tube with a 0.7°- by 0.7° field of view; and (4) related electronics including a TV data encoder. On July 14, 1965, at 0140 UT, the picture recording sequence commenced. Vidicon output underwent analog-to-digital conversion and data were stored at 244,000 bits per image on a 2-track, 1/4-in. 330-ft-long magnetic tape loop on the spacecraft. Two of every three pictures taken were recorded on the tape resulting in a chain of gaps of overlapping, alternately filtered pictures extending across the disk of Mars. Data were transmitted after acquisition of the spacecraft by Mars by the radio subsystem from July 15 to 24, 1965, and were processed in real time by a 2048/2048 system to format magnetic tape of the image data for processing by the larger television processing system and for conversion to a film record. Conversion from electrical signals to an optical image was performed by the vidicon-to-film recorder using 64 shades. The experiment yielded 36 pictures plus 21 times of picture 21. This performance included a normal recording sequence, computer processing programs yielded photographs with greater contrast than the raw image data. A detailed description of the television experiment, data processing, and the various versions of the photographs can be found in the JPL "Mariner Mars 68 Project Reports. Television Experiments Part 1. Investigation Report," of the Mariner TV Pictures of Mars, 12-32-04n-4, 1967.
Two television cameras, one of medium resolution (wide angle) and the other of high resolution (narrow angle), were part of the Mariner 6 scientific instrumentation. The wide-angle camera, which had a field of view of 11 deg by 14 deg and a focal length of 50 mm encompassed 100 times more surface area than the narrow-angle camera and was used only for near-encounter pictures. The narrow-angle camera, which was used for both near- and far-encounter pictures, had a focal length of 508 mm and provided 10 times the linear resolution of the wide-angle camera. Camera shutters were alternated and timed to provide overlapping of the wide-angle and narrow-angle pictures, providing 75 pictures from the two systems (25 near-encounter and 50 far-encounter). The near-encounter pictures were taken between 12 min 59 sec before encounter and 2 min 55 sec after encounter along a track that crossed the equatorial zone of the planet and included many known light and dark features of the Martian surface. The camera system spent 25% of its time on the far-near-encounter operations. In the first series, 35 pictures were obtained normal to the planet, and 29 were oblique views. In the second series, 17 pictures were obtained between 22 h and 7 h from closest approach. TV pictures data were encoded and recorded on the onboard television and data storage subsystems. For each picture, produced by the camera, three separate encoded versions were transmitted to earth—a composite analog video (CAV) picture, a digital video (DV) picture, and an every twenty-eight (28E) digital picture. Video reconstruction consisted of combining the three data streams (CAV, DV, and 28E). This generated video data as they existed coming out of the camera. The high-resolution video magnetic tapes were decoded on a TV and photographed on 70-mm film to produce the final image. They were also digitally processed by an IOM 360/75 computer for enhancement and by an IBM 360/75 for noise reduction. The noise-reduction versions contained in data set 6IC through 9IC. Detailed information on the digital processing procedures can be found in "Digital Processing of the Mariner 6 and 7 pictures" by T. C. Windtish et al., J. Geophys., V. 43, p. 7964/75, January 1971. Accurate trajectory and related geometrical data can be found in Mariner Mars 1969 Simulated TV Pictures (finals), J. C. Campbell, 1970, which was issued by JPL.
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**BRIEF DESCRIPTION**

The Viking imaging experiment viewed the scene surrounding the lander, the surface sampler, and other parts of the lander with high-resolution television framing. The experiment was able to resolve features of the Martian surface with a high degree of accuracy.

**INVESTIGATION NAME**

**LANDER IMAGING**

**INVESTIGATIVE PROGRAM**

**CODE**

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| TM - J.H. Anderson | NASA HEADQUARTERS | NASA HEADQUARTERS | NASA HEADQUARTERS |
A brief description of the experiment is as follows:

The Mariner V ultraviolet spectrometer (UVS) experiment was designed to receive UV radiation (1200 to 3520 A) from the surface of and atmosphere of Mars, and to separate and detect the various components of the radiation. The objectives of this experiment fell into two broad categories: UV spectroscopy and UV radiosity. The UV spectroscopy measurements were carried out in the UV region of the Earth's atmosphere. The UV radiosity measurements were carried out in the same region of the Earth's atmosphere. The Mariner V UV spectrometer was a small, lightweight, high-resolution spectrometer that was used to obtain spectral data on the UV radiation emitted by the Sun. The spectrometer was mounted on the spacecraft and was used to measure the spectrum of the UV radiation from the Sun. The data obtained were used to study the composition of the Sun's atmosphere and to determine the temperature and density of the Sun's atmosphere. The UV radiosity measurements were carried out in the same region of the Earth's atmosphere. The data obtained were used to study the injection of UV radiation into the Earth's atmosphere, the effect of the Earth's atmosphere on the UV radiation, and the effect of the Earth's atmosphere on the UV radiation emitted by the Sun. The data obtained were also used to study the effect of the Earth's atmosphere on the UV radiation emitted by the Sun, and the effect of the Earth's atmosphere on the UV radiation emitted by the Sun.
Spectral measurements of the thermal (18) emission by the Martian surface and atmosphere were obtained to determine (1) the atmospheric composition, including polyatomic life-related molecules; (2) the surface temperature along the track of view; (3) the surface composition; (4) the surface topography; (5) the atmospheric properties and the atmospheric structure; and (6) the bright line in the emission characteristics. The experiments, mounted on the bottom of the occultation scan platform of the spacecrafts, used an IR spectrometer that consisted of a telescope, optical focusing lenses, and a variable edge interference filter that selected the wavelengths reaching the detectors, and a spectrophotometer that covered the wavelength region of 1.9 to 14.3 micrometers and were provided by NASA GSFC. The specrophotometer operated on reflected light from the planet and continued to obtain measurements on the dark side of the planet and channel 1 (1.9 to 6.0 micrometers), which reflected solar radiation. The instrument telescope had a field of view of 2 degrees and, thus, at closest approach (about 3.100 km) the geographical resolution was about 125 km by 3 km and during a single scan, about 125 km by 12 km. The spectral resolution obtained was 0.5 to 1.5. About 25 min of data were obtained during the Mariner 6 near-encounter occultation scan on July 31, 1969. However, due to the failure of the channel 1 expostopy, only channel 2 measurements were obtained. The quality of the data is excellent.

---

MARINER 7, PIMENTEL

INVESTIGATION NAME - IR SPECTROMETER

NSSDC 10-203 - E2

INVESTIGATIONAL PROGRAM

CODE 61-A SCIENCE

INVESTIGATION DISCIPLINE(S)

PLANETARY ATMOSPHERES, PLANETOLOGY

PERSONNEL

PI - G.C. PIMENTEL

U OF CALIF, BERKELEY

01 - G.J. HEIR

U OF CALIF, BERKELEY

BRIEF DESCRIPTION

Spectral measurements of the thermal (18) emission from the Martian surface and atmosphere were obtained to determine (1) the atmospheric composition, including polyatomic life-related molecules; (2) the surface temperature along the track of view; (3) the surface composition; (4) the surface topography; (5) the atmospheric properties and the atmospheric structure; and (6) the bright line in the emission characteristics. The experiments, mounted on the bottom of the occultation scan platform of the spacecrafts, used an IR spectrometer consisting of a telescope, optical focusing lenses and mirrors, a variable edge interference filter that selected the wavelengths reaching the detectors, and cooled IR detectors. The spectra observed covered a wavelength region of 1.9 to 14.3 micrometers and were provided by NASA GSFC. The spectrophotometer operated on reflected solar radiation. The instrument telescope had a field of view of 2 degrees and, thus, at closest approach (about 3.100 km) the geographical resolution was about 125 km by 3 km and during a single scan, about 125 km by 12 km. The spectral resolution obtained was 0.5 to 1.5. About 25 min of data were obtained during the Mariner 7 near-encounter occultation scan on October 23, 1969. During the occultation scan, the equivalent blackbody temperature of the Martian surface was determined by means of the two-channel infrared radiometer, which measured the infrared energy emitted in the 8- to 12-micrometer and 12- to 20-micrometer bands, and had a dynamic range of 125 to 200 deg K. The two channels, located in the atmospheric windows, emphasized the upper atmospheric temperatures of this range, respectively. The experiment package was located on the bottom of the occultation scan platform of the spacecrafts. The radiometer consisted of two reflecting telescopes each equipped with an uncooled antimony-bismuth thermocouple detector. The experiment used an optical device that included a rotatable plate which reflected the incident energy into the detector telescopes. The mirrors had three spherical polished facets, which could be viewed empty space and obtained a zero energy reference. The second viewed the planet and recorded the energy emitted by a temperature calibration plate. After space was viewed for one frame, the two mirrors of the plate were moved at 2-3° intervals in each wavelength channel. Then, following a short time with the reference plate, 14 successive planetary observations were made. The cycle, which lasted 3 to 3.5 frames, started again with a view of space. About 25 min of data were
obtained on July 21, 1974 during near encounter across and beyond the terminator over midlatitudes. The data were used to determine the thermal inertia of the surface material as a function of local time, thus allowing the mapping of the varying ground structure. The quality of the data is good. The data have been corrected for the greater than expected response to off-axis radiation.

--- MARINER 7 GEODERVAUER

INVESTIGATION NAME: Infrared Radiometer Mars Surface Temperture

NSSDC 1D- 05-7155D-11 INVESTIGATIVE PROGRAM CODE ESL-4, SCIENCE INVESTIGATION DISCIPLINE(s) PLANETOLOGY

PERSONNEL
PI: G. G. GEODERVAUER CALIF INST OF TECH
OI: R. M. KIEFFER NASA-JPL
OI: M. PALLAVONI NASA-JPL
OI: S. C. CHASE, JR. SANTA BARBARA RES CTR
OI: S. M. MATEWS NASA-JPL

ABSTRACT

The equivalent blackbody temperature of the Martian surface was determined as an average of 24-channel infrared radiometers. The data were acquired by five infrared emitters described below. The 12-channel radiometer and 25- to 25-micrometer bands had a 0.5 deg. by 0.5 deg. resolution at 1.25 to 2.25 deg. The two-channel radiometer located in an atmospheric window, emphasized the upper and lower temperatures of the planet, respectively. The effective temperature of the planet was less than 300 K.

75.0 deg. to 75.7 deg. The planet was centered in the field of view of the detector telescopes. The mirror had three orthogonal positions. The first position was used to detect the planet, and the second measured the thermal energy radiated by the unobstructed planet. The third measured the thermal energy radiated by the planet. The effective temperature of the planet was more than 300 K.

The sensitivity of the IRTM was basically the same as that in the Mariner 10 IRTM. It was placed in the field of view of the detector telescopes. The sensitivity of the IRTM was less than 250 K.

The experiments began collecting high-quality data soon after the sol. The experiment began collecting high-quality data soon after the sol. The data were obtained from the orbit. The data were obtained from the orbit. The experiments were continued to operate normally until 1972, and the experiment was shut off to conserve spacecraft power during solar occultation. The experiment was shut off to conserve spacecraft power during solar occultation. The experiment was shut off to conserve spacecraft power during solar occultation. The experiment was shut off to conserve spacecraft power during solar occultation.
RADIO SCIENCE AND CELESTIAL MECHANICS

--------- MARINER 4, ANDERSON

INVESTIGATION NAME: CELESTIAL MECHANICS

NSSDC ID: 69-004A-05 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S) CELESTIAL MECHANICS

PERSONNEL
P.I. - J.O. ANDERSON NASA-JPL

BRIEF DESCRIPTION

In this experiment, the spacecraft range and range-rate data were obtained using an onboard transponder (round trip delay time yielding spacecraft range from Earth) and the spacecraft telemetry signal Doppler shift yielding the range rate. The data were used to provide an accurate determination of a variety of astronomical quantities such as the mass of Mars, ephemerides of Mars and Earth and the symmetry of the gravity field of Mars.

--------- MARINER 7, ANDERSON

INVESTIGATION NAME: CELESTIAL MECHANICS

NSSDC ID: 69-004A-05 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S) CELESTIAL MECHANICS

PERSONNEL
P.I. - J.O. ANDERSON NASA-JPL

BRIEF DESCRIPTION

In this experiment, the spacecraft range and range-rate data were obtained using an onboard transponder (round trip delay time yielding spacecraft range from Earth) and the spacecraft telemetry signal Doppler shift yielding the range rate. The data were used to provide an accurate determination of a variety of astronomical quantities such as the mass of Mars, ephemerides of Mars and Earth and the symmetry of the gravity field of Mars.

--------- MARINER 9, KLIORE

INVESTIGATION NAME: S-BAND OCCULTATION

NSSDC ID: 71-051A-08 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S) PLANETARY ATMOSPHERES

PERSONNEL
P.I. - A.J. KLIORE NASA-JPL

BRIEF DESCRIPTION

The occultation of the S-band telemetry signal during occultation of the spacecraft by Mars provided the vertical distribution of the index of refraction of the Martian atmosphere. These data yield the vertical distribution of neutral and ionized species.

--------- VIKING 2 ORBITER, MICHAEL Jr.

INVESTIGATION NAME: ORBITER RADIO SCIENCE

NSSDC ID: 75-075A-04 INVESTIGATIVE PROGRAM CODE EL-4/D-04P, SCIENCE

INVESTIGATION DISCIPLINE(S) PLANETARY ATMOSPHERES

PERSONNEL
P.I. - E.H. MICHAEL Jr. NASA-LARC
T.M. - T.M. SHAPIRO MASS INST OF TECH
T.M. - C.F. LINDAHL NASA-JPL
T.M. - J.G. BRADLEY U OF MANCHESTER
T.M. - D.L. CALN NASA-JPL
T.M. - R.O. CROSS NASA-JPL
T.M. - G.L. TAYLOR BATTENHE COOP
T.M. - D.J. BRENNER NASA-JPL
T.M. - S.M. TOLSON NASA-JPL
T.M. - C.T. STEPHENSON NASA-LARC
T.M. - G. WEST NASA-JPL
T.M. - E. REINECKE MASS INST OF TECH

BRIEF DESCRIPTION

There are four distinct sets of Viking radio science data, three using orbiter data and one primarily using lander data with a few calibration with orbiter data. The orbiter tracking data, obtained from the two-way orbiter-earth S-band and X-band radio links, consist of Doppler frequency and delay-time range measurements. These determine the position and motion of the orbiter, and can be used to study the Mars gravitational field. The planets in interplanetary space, and their interaction with the interplanetary solar corona. The data were obtained from these new radio links by analog recording of the signal when a spacecraft was passing into or out of occultation with Mars. The data can be used to produce altitude profiles (including the ionosphere) and to measure the radius of the planet. The S-band large number of signal points of the surface-properties aspect of this investigation utilized the X-band (10 cm) signals for the ionosphere, and the X-band data for the surface. The data are used to study the interaction of the radio waves with the Martian surface, which information about the physical properties of the surface near the landers. The orbiter tracking data from the two-way direct orbiter-earth S-band links permit determination of the location of the landers and studies of the motion of the planet. Operation of this experiment was terminated on August 7, 1980.
There are four distinct sets of Viking radio science data, obtained simultaneously using orbital data with calibrations from orbiter data. The orbiter tracking data were recorded in the three-way-vigileter: S-band and X-band radio links consist of Doppler frequencies and time-of-flight range measurements. These data determine the position and motion of the orbiters and can be used to study the Mars system including its rotation and stability in an interplanetary space. The structure and the polar region were used to determine the planet's axis orientation and precession. The orbital data were used to determine the location of the lander on the planet's surface. The data were used to provide more precise information about the orbital rotation, and precessional motion of Mars than had previously been available. The two principal differences between orbiter and lander tracking data are (1) lander tracking periods are never longer than 1 h and are sometimes much shorter because of thermal constraints on the duration of lander transmission operation, and (2) lander tracking has no S-band signals to provide the corrections to range data for the interplanetary plasma effects. Consequently, lander ranging sessions were scheduled to be nearly simultaneous with orbiter ranging whenever possible, so that the orbiter S- and X-band data could supply these corrections.

**BRIEF DESCRIPTION**

This experiment used the S-band radio transmitter to acquire Doppler and range data for the landers utilizing the same Deep Space Network facilities that were used by the orbiters. The resulting data were used to determine the location of the lander on the planet's surface. The data were used to provide more precise information about the orbital rotation, and precessional motion of Mars than had previously been available. The two principal differences between orbiter and lander tracking data are (1) lander tracking periods are never longer than 1 h and are sometimes much shorter because of thermal constraints on the duration of lander transmission operation, and (2) lander tracking has no S-band signals to provide the corrections to range data for the interplanetary plasma effects. Consequently, lander ranging sessions were scheduled to be nearly simultaneous with orbiter ranging whenever possible, so that the orbiter S- and X-band data could supply these corrections.

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BRIEF DESCRIPTION

The Viking used an infrared grating spectrometer mounted on the orbiter scan platform that was boresighted with the television cameras and the IRM. The instrument measured solar infrared radiation reflected from the surface through the atmosphere to the spacecraft. Spectral intervals were selected coincident with the wavelength of water vapor absorption lines in the 1.4-μm wavelength band. The quantity of water vapor along the line of sight was measured from 1 to 1000 micrometers of precipitable water with an accuracy of 5% better. The instantaneous field of view of the instrument was 2.37 milliradians, and a stepping mirror rotated the line of sight through 15 positions to provide a roughly rectangular field of view at 17 x 2.3 milliradians.

--- VIKING 1 LANDER, NIER ---

INVESTIGATION NAME: ENTRY SCIENCE ATMOSPHERIC STRUCTURE

NSSDC ID: 75-075C-02

INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

PERSONNEL
TL = A.O.C. NIER
TH = W.B. HANSON
TM = N.W. SPENCER
U OF MINNESOTA
NASA-GSFC

BRIEF DESCRIPTION

The Viking entry science atmospheric structure experiment (one of three that were part of the entry science investigation) studied the Martian atmosphere below an altitude of 350 km. A variety of instruments (Laserscanner, radar altimeters, thermometers, pressure sensors) collected data to provide altitude profiles of pressure and temperature of the atmosphere and the lander, ranging from 1 to 1000 km. From these data, atmospheric density and mean atomic mass can be calculated.

--- VIKING 2 LANDER, NIER ---

INVESTIGATION NAME: ENTRY SCIENCE ATMOSPHERIC STRUCTURE

NSSDC ID: 75-075C-06

INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

PERSONNEL
TL = A.O.C. NIER
TH = W.B. HANSON
TM = N.W. SPENCER
U OF MINNESOTA
NASA-GSFC

BRIEF DESCRIPTION

The entry science atmospheric structure experiment (one of three that were part of the entry science investigation) studied the Martian atmosphere below an altitude of 127 km. A variety of instruments (Laserscanner, radar altimeters, thermometers, pressure sensors) collected data to provide altitude profiles of pressure and temperature of the atmosphere and the lander ranging from 1 to 1000 km. From these data, atmospheric density and mean atomic mass can be calculated.

--- VIKING 1 LANDER, NIER ---

INVESTIGATION NAME: ENTRY SCIENCE NEUTRAL ATMOSPHERIC COMPOSITION

NSSDC ID: 75-075C-52

INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

PERSONNEL
TL = A.O.C. NIER
TH = W.B. HANSON
TM = N.W. SPENCER
U OF MINNESOTA
NASA-GSFC

BRIEF DESCRIPTION

The Viking entry science neutral atmospheric composition experiment (one of three that were part of the entry science investigation) was designed to provide the composition data for the various neutral species that were needed to define the present physical and chemical state of the Martian atmosphere. Mounted in an armstrong in the aeroshell's head, the electron-impact open ion source retracted below the surface of the aeroshell, a double-focusing (electrostatic and magnetic) mass spectrometer was used to measure the concentrations of the atmospheric species that have mass-to-charge ratios from 1 to 100. Two collectors were used, one covering the mass range from 1 to 7 u, and the other simultaneously sweeping the range 7 to 49 u. Mass spectra were obtained by sweeping the ion acceleration voltage and the deflection voltage across all the electrostatic plates. The sweep period was approximately 5 s, and a dynamic range of 1.25 was provided within each spectrum.

--- VIKING 2 LANDER, NIER ---

INVESTIGATION NAME: ENTRY SCIENCE NEUTRAL ATMOSPHERIC COMPOSITION

NSSDC ID: 75-085C-12

INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S)
INTERPLANETARY PHYSICS

PERSONNEL
TL = A.O.C. NIER
TH = W.B. HANSON
TM = N.W. SPENCER
U OF MINNESOTA
NASA-GSFC

BRIEF DESCRIPTION

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--- VIKING 1 LANDER, NIER ---

INVESTIGATION NAME: ENTRY SCIENCE NEUTRAL ATMOSPHERIC COMPOSITION

NSSDC ID: 75-085C-14

INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S)
PLANETARY ATMOSPHERES

PERSONNEL
TL = A.O.C. NIER
TH = W.B. HANSON
TM = N.W. SPENCER
U OF MINNESOTA
NASA-GSFC

BRIEF DESCRIPTION

The Viking entry science neutral atmospheric composition experiment (one of three that were part of the entry science investigation) was designed to provide the composition data for the various neutral species that were needed to define the present physical and chemical state of the Martian atmosphere. Mounted in an armstrong in the aeroshell's head, the electron-impact open ion source retracted below the surface of the aeroshell, a double-focusing (electrostatic and magnetic) mass spectrometer was used to measure the concentrations of the atmospheric species that have mass-to-charge ratios from 1 to 100. Two collectors were used, one covering the mass range from 1 to 7 u, and the other simultaneously sweeping the range 7 to 49 u. Mass spectra were obtained by sweeping the ion acceleration voltage and the deflection voltage across all the electrostatic plates. The sweep period was approximately 5 s, and a dynamic range of 1.25 was provided within each spectrum.

--- VIKING 2 LANDER, NIER ---

INVESTIGATION NAME: ENTRY SCIENCE NEUTRAL ATMOSPHERIC COMPOSITION

NSSDC ID: 75-085C-16

INVESTIGATIVE PROGRAM
CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S)
INTERPLANETARY PHYSICS

PERSONNEL
TL = A.O.C. NIER
TH = W.B. HANSON
TM = N.W. SPENCER
U OF MINNESOTA
NASA-GSFC

BRIEF DESCRIPTION

The Viking entry science neutral atmospheric composition experiment (one of three that were part of the entry science investigation) was designed to provide the composition data for the various neutral species that were needed to define the present physical and chemical state of the Martian atmosphere. Mounted in an armstrong in the aeroshell's head, the electron-impact open ion source retracted below the surface of the aeroshell, a double-focusing (electrostatic and magnetic) mass spectrometer was used to measure the concentrations of the atmospheric species that have mass-to-charge ratios from 1 to 100. Two collectors were used, one covering the mass range from 1 to 7 u, and the other simultaneously sweeping the range 7 to 49 u. Mass spectra were obtained by sweeping the ion acceleration voltage and the deflection voltage across all the electrostatic plates. The sweep period was approximately 5 s, and a dynamic range of 1.25 was provided within each spectrum.

--- VIKING 1 LANDER, NIER ---

INVESTIGATION NAME: ENTRY SCIENCE METEOROLOGY

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heating process while CO (labeled with C-13) swept through. The sample was vaporized into the mass spectrometer (after hydrogen was removed by hydrogen-only-permeable palladium), and a mass spectrum was formed from 12 to 210 amu. The gas chromatogram was measured with H-100 C-125 to C-18 in the gas chromatograph. In some cases, the sample was retained at a higher temperature and analyzed as lost volatile materials. For atmospheric measurements, gases were directly introduced into the mass spectrometer, bypassing the gas chromatograph column.

--- VIKING 2 LANDER: DRIEMANN ---

INVESTIGATION NAME - MOLECULAR ANALYSIS

NSSDC ID: 75-083C-04 INVESTIGATIVE PROGRAM CODE 4-4 SCIENCE INVESTIGATION DISCIPLINE(S) PLANETARY ATMOSPHERES PLANETARY BIOLOGY PLANETOLOGY

PERSONNEL

BRIEF DESCRIPTION

This experiment was designed to investigate the molecular properties of the Martian surface and the environment at the landing site, primarily using engineering measurements and scientific instruments required to meet scientific objectives. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site, primarily using engineering measurements and scientific instruments required to meet scientific objectives. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site, primarily using engineering measurements and scientific instruments required to meet scientific objectives. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site, primarily using engineering measurements and scientific instruments required to meet scientific objectives. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site, primarily using engineering measurements and scientific instruments required to meet scientific objectives. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site, primarily using engineering measurements and scientific instruments required to meet scientific objectives. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site, primarily using engineering measurements and scientific instruments required to meet scientific objectives. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site, primarily using engineering measurements and scientific instruments required to meet scientific objectives.

--- VIKING 2 LANDER: SHORTBILL ---

INVESTIGATION NAME - PHYSICAL PROPERTIES

NSSDC ID: 75-083C-01 INVESTIGATIVE PROGRAM CODE 4-4 SCIENCE INVESTIGATION DISCIPLINE(S) PLANETARY ATMOSPHERES PLANETARY BIOLOGY PLANETOLOGY

PERSONNEL

BRIEF DESCRIPTION

The purpose of the physical properties investigation was to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site. In particular, it is attempted to determine the physical properties of the Martian surface and the environment at the landing site.

--- VIKING 1 LANDER, TOULMIN ---

INVESTIGATION NAME - INORGANIC ANALYSIS

NSSDC ID: 75-083C-13 INVESTIGATIVE PROGRAM CODE 4-4 SCIENCE INVESTIGATION DISCIPLINE(S) PLANETARY ATMOSPHERES PLANETARY BIOLOGY PLANETOLOGY

PERSONNEL

BRIEF DESCRIPTION

The molecular analysis experiment searched for chemical compounds in the upper surface layer of Mars and measured atmospheric composition near the surface. The soil analyses were performed using a gas chromatograph mass spectrometer (GCMS) that has high sensitivity, high structural specificity, and broad applicability to a wide range of compounds. Substances were deposited from the surface material by heating processes while CO (labeled with C-13) swept through. The sample was vaporized into the mass spectrometer (after hydrogen was removed by hydrogen-only-permeable palladium), and a mass spectrum was formed from 12 to 210 amu. The gas chromatogram was measured with H-100 C-125 to C-18 in the gas chromatograph. In some cases, the sample was retained at a higher temperature and analyzed as lost volatile materials for atmospheric measurements. Gases were directly introduced into the mass spectrometer, bypassing the gas chromatograph column.
**PERSONNEL**

TL - H.F. TOUMLIN, 280
TH - A.K. HANG, 280
TM - H.J. ROSE, 280
TM - H.J. CLARE, 280

**US GEOLOGICAL SURVEY**

**BRIEF DESCRIPTION**

This experiment utilized an energy-dispersive X-ray fluorescence spectrometer (EDS) to detect X rays emitted from gas-filled proportional counters located by TRAM radioisotope sources (TRAM and tritium—T2H). The output of the proportional counters was subjected to pulse-height analysis by an onboard step-scaling, single-channel analyzer with adjustable counting periods. The instrument was enclosed in a carbon fiber case to minimize contamination by ambient dust and humidity. Calibration standards were an integral part of the instrument. Reconstructed spectra yielded surface composition data with accuracies ranging from a few tens of parts per million for trace elements to a few percent for major elements.

--- VIKING 2 LANDER, HARGRAVES ---

**INVESTIGATION NAME: INORGANIC ANALYSIS**

**INVESTIGATIVE PROGRAM**

CODE: EL-4, SCIENCE

**INVESTIGATION DISCIPLINE(S)**

PLANETARY SCIENCE

**PERSONNEL**

TL - H.F. TOUMLIN, 280
TH - A.K. HANG, 280
TM - H.J. ROSE, 280
TM - H.J. CLARE, 280

**BRIEF DESCRIPTION**

This experiment utilized an energy-dispersive X-ray fluorescence spectrometer (EDS) in which four scintillation gas-filled proportional counters detected X rays emitted from samples of Martian surface materials illuminated by 5.9 MeV electrons from radioisotope sources (TRAM and T2H). The output of the proportional counters was subjected to pulse-height analysis by an onboard step-scaling, single-channel analyzer with adjustable counting periods. The instrument was enclosed in a carbon fiber case to minimize contamination by ambient dust and humidity. Calibration standards were an integral part of the instrument. Reconstructed spectra yielded surface composition data with accuracies ranging from a few tens of parts per million for trace elements to a few percent for major elements.

--- VIKING 3 LANDER, KLEIN ---

**INVESTIGATION NAME: MAGNETIC PROPERTIES**

**INVESTIGATIVE PROGRAM**

CODE: EL-4, SCIENCE

**INVESTIGATION DISCIPLINE(S)**

PLANETARY SCIENCE

**PERSONNEL**

TL - H.F. TOUMLIN, 280
TH - A.K. HANG, 280
TM - H.J. ROSE, 280
TM - H.J. CLARE, 280

**BRIEF DESCRIPTION**

The magnetic properties experiment detected the presence of magnetic particles in Martian surface material. It used three pairs of spherically-coated magnets mounted on the bottom of the instrument to magnetize the surface samples with a current of 1.5 A for about 10 minutes and to determine the number of magnetic particles in each sample. All three pairs of magnets were independently triggered by the camera system in black and white data. A high-current magneto-optical sensor was used for resolution detection.
The biology experiment sought to detect the photosynthetic or chemical fixation of CO₂ or CO containing C-14. The samples were incubated in an environment consisting of a soil sample once sterilized and purged by HI. After an initial incubation atmosphere, the samples were sealed in an erganic system. Gas chromatograph was operated with a thermal conductivity detector.

INVESTIGATION NAME- MOLECULAR ANALYSIS
INVESTIGATION ID- 75-0574-64
SEE THIS EXPERIMENT UNDER SURFACE CHEMISTRY

INVESTIGATION NAME- MOLECULAR ANALYSIS
INVESTIGATION ID- 75-0821-64
SEE THIS EXPERIMENT UNDER SURFACE CHEMISTRY
Jupiter
JUPITER

Plate 4 is a collection of press release photographs from the Pioneer 11 and Voyagers 1 and 2 missions. (A) P21631 is a Voyager 1 montage of Jupiter and its four Galilean satellites (the four largest of its 16 known moons). (B) 79HC679, a Pioneer 11 photo of Jupiter showing the north polar region as it passed over it, showing the polar region's lack of belts but with many convection cells. This is a view and aspect never seen from earth. The Great Red Spot is at the bottom. (C) P21774, a Voyager 2 photo of the nightside of Jupiter showing the sunlit atmospheric halo and the Jovian ring discovered on Voyager 1. (D) P21195, a composite of Voyager 1 photos of the four Galilean moons illustrating their relative sizes. Io (3632 km diam.) is about 200 km larger than our moon and Europa (3126 km diam.) is about 300 km smaller than our moon (3478 km diam). Callisto (4820 km diam.) is the size of the planet Mercury and Ganymede (the largest moon in the solar system) at about 5150 km is about 350 km larger than Mercury. (E) P21305, Voyager 1 photo of Io showing its completely volcanic surface and an erupting volcano on the limb. Io's volcanic activity was discovered by Voyager 1. Io is the most volcanically active of any solar system body known, and the only one other than the earth known to have current volcanic activity. (F) P21266, Voyager 1 photo of part of the surface of Ganymede showing the mysterious grooved bands with their criss-cross nature and lateral slip fault movement. (G) P21758, Voyager 2 photo of Europa showing the unique linear features which have no relief, and which look as if they were painted on. Europa's icy surface has apparently flowed and filled in the fissures. (H) P21745, Voyager 1 photo of Callisto showing its crater-saturated surface and the strange multi-ringed structure, Valhalla.
INTRODUCTION

Jupiter, next in line from the sun, has been visited by four U.S. spacecraft. These were Pioneers 10 and 11 and Voyagers 1 and 2. There were 41 investigations for which NSSDC has data or knows the sources thereof, and they cover seven categories, which are (1) Imaging, (2) Particles and Fields, (3) Ultraviolet, (4) Infrared, (5) Radio Science and Celestial Mechanics, (6) Atmosphere, and (7) Polarization. Both the categories Atmosphere and Polarization were obtained from photopolarimeters which are presented under Imaging. Tables 1 and 2 and Appendix A show the investigations in more detail.
**SPACECRAFT**

**SPACEnAMES COMMON NAME - PIONEER 10**
**ALTERNATE NAMES - PIONEER 10**
**LAUNCH DATE - 02/05/72**
**WEIGHT - 231 KG**
**LAUNCH SITE - CAYE CANAVARAL - UNITED STATES**
**LAUNCH VEHICLE - ATLAS**

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

**INITIAL ORBIT PARAMETERS**
**ORBIT TYPE - SATURN FLIGHT**

**PERSONNEL**
**PM - C.J. HALL (OLKA)**
**PS = P. BIAL**

**BRIEF DESCRIPTION**
This mission was the first to be sent to the outer solar system, and after encountering the planets Jupiter and Saturn, it continued on to study the heliosphere; neutral hydrogen abundance; the solar wind, including charged particle detector, non-thermal electrons with overlapping fields of view, solar, and velocity of dust particles; jovian aurora; jovian radio waves; atmospheres of Jupiter and Saturn; and their magnetic fields. The spacecraft contained two nuclear electric-power generators, which were designed to provide the necessary energy for the spacecraft's operation. The spacecraft was equipped with a high-gain antenna, which was used to communicate with Earth. The spacecraft was also equipped with a variety of scientific instruments, including a solar wind plasma detector, a charged particle detector, and a magnetic field and radio wave instrument. The spacecraft was designed to fly by Jupiter on December 3, 1973, and subsequent encounters with Jupiter and Saturn. The mission was successful in obtaining data about the jovian aurora, jovian radio waves, atmospheric conditions, and the magnetic fields of Jupiter and Saturn. The mission ended on March 2, 1979, after it had flown by Jupiter on December 3, 1973, and subsequent encounters with Jupiter and Saturn. The spacecraft contained two nuclear electric-power generators, which were designed to provide the necessary energy for the spacecraft's operation.
and radiometer, UV spectrometer, Flautage magnetometers, Faraday cups, a charged-particle analyzer, plasma detector, plasma-wave velocity, radio, microwave radiometer, and a search-frequency radio receiver. Voyager 1 had its closest encounter with Jupiter on March 5, 1979, and with Saturn on November 12, 1980.

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**Investigations**

**INVESTIGATION NAME: Imaging Photopolarimeter (IPP)**

**NSSDC ID: 72-024A-07**

**INVESTIGATIVE PROGRAM**

CORE EL-4 SCIENCE

**INVESTIGATION DISCIPLINE(S)**

ASTROPHYSICS, PLANETARY ATMOSPHERES

**PERSONNEL**

01 - J. GEHRES
01 - D. COHEN
01 - K. KENNEK
01 - M. TOMASKO
02 - R. SHINNELL

**BRIEF DESCRIPTION**

The Imaging Photopolarimeter (IPP) experiment used during Voyager encounters made simultaneous twocolor (blue - 3700 to 4000 A; red - 5000 to 7000 A) polarimetric and radiometric measurements, and moderate-resolution (about 200 km at best) spin-scan images of Jupiter and the Jovian satellites. The polarimetric and radiometric work was performed using an 8- by 8-meter field-stop aperture, while the spin-scan imaging used a 0.5- by 0.5-meter aperture stop. Relative radiometric calibration was derived using an internal tungsten lamp. Long-term absolute calibration of the instrument was accomplished by means of a sunlit diffusor/attenuator placed on the spacecraft. The overall objectives of the IPP investigation were to obtain (1) measurements of the Jovian atmosphere and magnetic field, (2) studies of the nature of the rings of Saturn and Uranus, and (3) study of the Jovian system in a variety of wavebands.
Studies of Saturn's rings included (1) resolution of individual ring components or clumps of material, (2) vertical and radial resolution of material at very high resolution, (3) scintillations of brightness variation, and search for new satellites. The resolution of individual ring components or clumps of material was almost 20 km or 5 km, respectively. The objectives of the experiment were to photograph global motions and cloud distributions on Jupiter, Saturn, Uranus, and Neptune. The focus was on the visible spectrum, polarization, nature of clouds, and its structure and development, and high resolution of the Great Red Spot. The objectives of the satellite encounters included (1) gross characteristics (shape, size, rotation, spin axis), cartography, improved nomenclature methods, polar caps, erosion processes, and low- and high-density satellite comparative studies; detection of atmospheric processes, jets, and limb brightening structures. The objectives of the spacecraft high-gain antenna reflections included (4) coarse polarimetry, (5) occultation - optical depth, (6) distinguishing different types of material in the rings. Other objectives were to search for new comets, asteroids, and targets of opportunity.

PERSONNEL
PI - J.W. WOLFE
01 - L.R. FRANK
01 - R. LUST
01 - H.S. INTEGRATOR
01 - D.O. McKIBBIN
01 - F.L. SCARP
01 - M.G. COLLARD
01 - W.C. FELDMAN
01 - J.J. SMITH
NASA-GRC
U OF IOWA
MPI-HAVERS
U OF SOUTHERN CALIF.
NASA-GRC
TRW SYSTEMS GROUP
NASA
NSSDC
LOS ALAMOS NAT LAB
NASA-SSC

DRAFT DESCRIPTION
The instrument consisted of dual 90°-deg quadrupolar electrostatic analyzers, one with 26 individual particle detectors and the other with 5 current collectors. The system was capable of measuring incident plasma distribution parameters over the energy range 0.1 to 16 keV for protons and approximately 0.5 to 16 keV for electrons. The high-resolution analyzer, with a constant of 9 keV per rad applied to the plates, had a mean plate radius of 14 cm and separation of 0.5 cm. This analyzer, which was used to measure low only, had 26 channeltron current collectors on the opposite side of the entrance phase. The aperture pointed through a wide slit in the back of the spacecraft high-gain antenna reflection along the spin axis toward the earth (and therefore the sun). The edges of the antenna reflector with the reflection point observed at the peak flux roll angle. The high- and medium-resolution analyzers operated independently so that a cross-check between these analyzers was possible. The dynamic range for the particle fluxes was from 1,000 to 3,000 per 1 cm² and the proton temperature could be described down to 0.2 keV. F. Data included the interplanetary region.

PERSONNEL
PI - J.W. WOLFE
01 - L.R. FRANK
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01 - M.G. COLLARD
01 - W.C. FELDMAN
01 - J.J. SMITH
NASA-GRC
U OF IOWA
MPI-HAVERS
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NASA-GRC
TRW SYSTEMS GROUP
NASA
NSSDC
LOS ALAMOS NAT LAB
NASA-SSC

DRAFT DESCRIPTION
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This instrument was designed to study the magnetospheres of Jupiter, Saturn, and Uranus using a low-energy charged particle analyzer. The detector was able to measure particle fluxes in the distant magnetosphere and box shock of Jupiter, (2) in the magnetosheath region of Saturn, and (3) in the interplanetary medium. The energy range of this detector was from 5 keV to 3 MeV. The instrument was able to separate protons and heavier nuclei in the range from 3 keV to 3 MeV using a low-energy particle telescope.

Voyager 2, SCARF

**INVESTIGATION NAME:** PLASMA WAVE (1.05-56 kHz)

**NSSDC ID:** 77-8764-15

**INVESTIGATIVE PROGRAM:** CODE EL-9, SCIENCE

**INVESTIGATION DISCIPLINE(S):** PLANETARY SCIENCE, PARTICLES AND FIELDS

**PERSONNEL:**

- PI: J.L. SCARB
- CI: J.A. OGILVIE, NAT TECH SYSTEMS GROUP
- U: OF IOWA

**BRIEF DESCRIPTION:**

This investigation provided continuous, simultaneous, independent measurements of the plasma density profiles at Jupiter and Saturn. It also gave basic information on local wave-particle interactions required to carry out comparative studies of the physics of the magnetospheres of these planets. The instrument was able to study the planetary radio astronomy.

Voyager 2, RIDE

**INVESTIGATION NAME:** PLASMA SPECTROMETERS

**NSSDC ID:** 77-8764-06

**INVESTIGATIVE PROGRAM:** CODE EL-9, SCIENCE

**INVESTIGATION DISCIPLINE(S):** PLANETARY SCIENCE, PARTICLES AND FIELDS

**PERSONNEL:**

- PI: J.H. BRIDGE
- CI: J.B., DEEGER
- U: OF IOWA

**BRIEF DESCRIPTION:**

This investigation provided continuous, simultaneous, independent measurements of the electron density profiles at Jupiter and Saturn. It also gave basic information on local wave-particle interactions required to carry out comparative studies of the physics of the magnetospheres of these planets. The instrument was able to study the planetary radio astronomy.


**INVESTIGATION NAME: THREE AXIS FLUKE MAGNETOMETERS**

**NASDC ID:** 72-0044-05

**INVESTIGATIVE PROGRAM**

**CODE:** EL-4, SCIENCE

**INVESTIGATION DISCIPLINE(S)**

**PARTICLES AND FIELDS**

**PLANETARY MAGNETIC FIELD**

**MAGNETOSPHERIC PHYSICS**

**PERSONNEL**

PI - R.J. NESS
CI - M.W. ACUNA
CI - M.W. BEHANNON
CI - L.F. BULAGA
CI - W.J. LEPPE
CI - P.J. NEUMANN

**DESCRIPTION**

This experiment was designed to measure the jovian and saturnian magnetic fields, consisting of a single-range three-axis fluxgate magnetometer sensor and associated electronics capable of measuring fields from 1.0 to 1.0 T (20-1600 Gauss) along each orthogonal axis. Use of a 10-bit A/D converter yielded a conversion to 10-bit step size data and a full scale range of 160 nT. Instantaneous vector measurements were made once every 250 ns by comparing the output of the sensor to the ground with no further onboard processing. More instrumental details are found in S. Sc. Inst. J. 15, 1277, 1976. Principal Jovian-scientific results can be found in Smith et al. IEEE Trans. On Magnetics, vol. M-11, no. 2, July 1975.

----- PIONEER 10, SIMPSON -----

**INVESTIGATION NAME: CHARGED PARTICLE COMPOSITION**

**NASDC ID:** 72-0042-02

**INVESTIGATIVE PROGRAM**

**CODE:** EL-4, SCIENCE

**INVESTIGATION DISCIPLINE(S)**

**PARTICLES AND FIELDS**

**COSMIC RAYS**

**PERSONNEL**

PI - R.J. NESS
CI - D.S. COLBURN

**DESCRIPTION**

This experiment was designed to measure the Jovian and Saturnian magnetic fields, consisting of a single-range three-axis fluxgate magnetometer sensor and associated electronics capable of measuring fields from 1.0 to 1.0 T (20-1600 Gauss) along each orthogonal axis. Use of a 10-bit A/D converter yielded a conversion to 10-bit step size data and a full scale range of 160 nT. Instantaneous vector measurements were made once every 250 ns by comparing the output of the sensor to the ground with no further onboard processing. More instrumental details are found in S. Sc. Inst. J. 15, 1277, 1976. Principal Jovian-scientific results can be found in Smith et al. IEEE Trans. On Magnetics, vol. M-11, no. 2, July 1975.
PERSONNEL

PI - J.A. SIMPSON
O1 - J.A. O'CALLAGHER
O2 - A. TUFIZOLINO
U OF CHICAGO

BRIEF DESCRIPTION

This experiment (also carried on Pioneer 10) measured charged-particle composition and spectra using four detector systems: (1) the main telescope, consisting of seven elements and providing energy spectra (approximately 1 to 15 MeV for protons and 10 to 150 MeV for nuclear particles) for protons above 3 MeV; (2) the low-energy telescope, consisting of two elements, and using a very small thin element to extend the high-sensitivity proton measurements (below 3 MeV); (3) the electronic counter detector (ECD), consisting of a beryllium-window silicon detector operated in current mode to measure high fluxes of electrons with energies above 3 MeV; and (4) the thin-cell detector, recording charged particles through the nucleus-induced fission of thoria-232 underwent between two large-area silicon detectors to measure fluxes of particles above 20 MeV in the presence of high fluxes of electrons. The experiment sampled the interplanetary region. Data from this experiment were used to characterize the solar wind and the interplanetary magnetic field. The telescope was mounted on a three-element, low-energy telescope, with the readout of the main and low-energy telescopes into eight fast coincidence counters and 32 slow coincidence counters. Data also included the interplanetary region.

-------- PIONEER 11- SIMPSON ---------

INVESTIGATION NAME - CHARGED PARTICLE COMPOSITION

NSSDC ID - 73-0210-02
INVESTIGATIVE PROGRAM CODE EL-4+ SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS
COSMIC RAYS

PERSONNEL

PI - J.A. SIMPSON
O1 - J.A. O'CALLAGHER
O2 - A. TUFIZOLINO
U OF CHICAGO

BRIEF DESCRIPTION

This experiment used two telescopes to measure the composition (by energy spectrometry of solar energetic particles) and energy spectra above about 0.5 MeV/nucleon. The main telescope consisted of five collinear elements: three solid-state, one Csl, and one sapphire crystal (crystalline). The telescope had a 60-degree, full-angle acceptance cone with its axis approximately normal to the interstellar medium. The spectrometers were sensitive to electrons and protons having energies above 1 MeV. The telescope was mounted on a three-element, low-energy telescope, with the readout of the main telescope into eight fast coincidence counters and 32 slow coincidence counters. Data also included the interplanetary region.

-------- PIONEER 10 - VAN ALLEN ---------

INVESTIGATION NAME - JOVIAN TRAPPED PARTICLES

NSSDC ID - 72-0214-11
INVESTIGATIVE PROGRAM CODE EL-4+ SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS
MAGNETOSPHERIC PHYSICS

PERSONNEL

PI - J.A. VAN ALLEN
U OF IOWA

BRIEF DESCRIPTION

This experiment (also carried on Pioneer 10) used four miniature Geiger tubes in three arrays to measure proton and electron energy spectra. The telescopes sampled the interplanetary region from Jupiter to Saturn. Detector groupings were as follows: (1) a three-element array, with one signal detector (one shielded telescope with tube C shielded omnidirectionally and used for background subtraction) and two electron detectors above 0.1 MeV/nucleon, one Csl and one sapphire crystal (crystalline); (2) a three-element (two Csl and one sapphire) array, each element responding to electrons above 0.1 MeV/nucleon and particles above 10 MeV; and (3) a thin-window tube array of three elements: (a) a gold-plated tube; (b) a silicon detector; and (c) a silicon detector with a gold-plated tube. The aperture which admitted scattered electrons above 0.5 MeV while discriminating strongly against protons. Single element and coincidence rate measurements were obtained from the first two telescopes. The telescope bit rate during the Jupiter encounter permitted directional sampling in interplanetary space. A description of the experiment and the experimental results was published in J. Geophys. Res., v. 79, p. 3589, 1974.
PI - J.J. WEBBER

NASA-GSFC

PERSONNEL

BRIEF DESCRIPTION

This experiment consisted of three 3-element telescopes looking normal to the spacecraft spin axis and a bi-directional telescope measuring 20 to 80 MeV/nucleon particles with 5 to 102 resolution. The first telescope measured 3 to 22 MeV/nucleon particles with 58 resolution. The second telescope measured 50-keV to 1-MeV electrons and 50-keV to 2-MeV protons with 25 resolution. Data include the interplanetary region.

INVESTIGATION NAME - HIGH AND MODERATELY LOW-ENERGY COSMIC-RAY SPECTRA

INVESTIGATION DISCIPLINES(S)

COSMIC RAYS

MAGNETOSPHERIC PHYSICS

PERSONNEL

NASA-GSFC

BRIEF DESCRIPTION

This investigation studied the origin and acceleration process: life histories and dynamic contribution of interstellar cosmic rays, the nucleosynthesis of elements in cosmic-ray sources, the behavior of cosmic rays in the interplanetary medium, and the trapped planetary energetic-particle environment. The instrumentation included a High-Energy Telescope System (HETS) and a Low-Energy Telescope System (LETS). The HETS measured an energy range between 6 and 100 MeV/nucleon for nuclei ranging in atomic numbers from 1 through 80. In addition, electrons in the energy range between 3 and 100 MeV/nucleon were measured by this telescope and an electron telescope (LETS). The LETS measured the energy and detection of electrons for energies between 3 and 100 MeV/nucleon were measured by an electron telescope.
SPECTROSCOPY AND DESCRIPTION

This experiment consisted of a broadband photometer sensitive between 300 and 800 Å. During the cruise phase of the mission, this experiment was used to search for the supercontinuum-to-subcontinuum transition region in the solar wind. During the Jovian encounter, this experiment was used to look for evidence of an auroral oval on the Jovian atmosphere, to find the ratio of hydrogen to helium in the Jovian atmosphere, and to find the temperature of the outer portion of the Jovian atmosphere. Evidences of such a place were found in the Interplanetary region indicating interactions between charged particles and neutral hydrogen.

INVESTIGATION NAME - ULTRAVIOLET SPECTROSCOPY

PERSONNEL
CI - D.L. BROADFOOT
O - R.W. CARLSEN
NASA-JPL

BRIEF DESCRIPTION
This experiment consisted of a broadband photometer sensitive between 300 and 800 Å. During the cruise phase of the mission, this experiment was used to search for the supercontinuum-to-subcontinuum transition region in the solar wind. During the Jovian encounter, this experiment was used to look for evidence of an auroral oval on the Jovian atmosphere, to find the ratio of hydrogen to helium in the Jovian atmosphere, and to find the temperature of the outer portion of the Jovian atmosphere. Evidences of such a place were found in the Interplanetary region indicating interactions between charged particles and neutral hydrogen.

PLANETARY DISCIPLINES
ASTROPHYSICS

PLANETARY ATMOSPHERES

INVESTIGATION NAME - INFRARED SPECTROSCOPY AND RADIOMETRY

PERSONNEL
CI - R.A. HANDEL
O - R.W. CARLSEN
NASA-JPL

BRIEF DESCRIPTION
This investigation was carried out using an infrared radiometer and an interferometer-spectrometer similar in design to the Mariner 9 SIS, combined into a single instrument. The investigation studied both global and local energy balances using infrared spectral measurements in conjunction with broadband measurements of reflected solar energy. Atmospheric composition was also investigated, including determination of the H/He ratio and the abundance of CO and CH₄. Vertical temperature profiles and size of particles in Saturn's rings were conducted. The interferometer had a spectral range of 900 to 1800 Å, while the radiometer range was 80 to 1500 Å. The instrument used a single primary mirror 51 cm in diameter with a field of view of 0.25 deg.

INVESTIGATION NAME - INFRARED SPECTROSCOPY AND RADIOMETRY

PERSONNEL
CI - R.A. HANDEL
O - R.W. CARLSEN
NASA-JPL

BRIEF DESCRIPTION
This investigation was carried out using an infrared radiometer and an interferometer-spectrometer similar in design to the Mariner 9 SIS, combined into a single instrument. The investigation studied both global and local energy balances using infrared spectral measurements in conjunction with broadband measurements of reflected solar energy. Atmospheric composition was also investigated, including determination of the H/He ratio and the abundance of CO and CH₄. Vertical temperature profiles and size of particles in Saturn's rings were conducted. The interferometer had a spectral range of 900 to 1800 Å, while the radiometer range was 80 to 1500 Å. The instrument used a single primary mirror 51 cm in diameter with a field of view of 0.25 deg.

PLANETARY DISCIPLINES
ASTROPHYSICS

PLANETARY ATMOSPHERES
This investigation was carried out using an infrared radiometer and an interferometer spectrometer similar in design to instruments used in previous studies. The investigation studied both global and local energy balances, using a variety of techniques in each. Broad-band measurements of reflected solar energy, atmospheric composition, and also investigated the determination of the ratios and the abundance of (H2 and H2O). Vertical temperature profiles were obtained on the planet and its satellites with atmospheres. Studies of the composition, thermal properties, and size of particles in Saturn's rings were conducted. The interferometer fed a spectral range of 289 to 4400 MHz, while the radiometer range was 2500 to 3500 MHz. The instrument used a single primary mirror 5.1 cm in diameter with a field of view of 8.25 deg.

RADIO SCIENCE AND CELESTIAL MECHANICS

INVESTIGATION NAME: RADIO SCIENCE TEAM

INVESTIGATION NAME: CELESTIAL MECHANICS

The Radio Science Team used the telecommunications system of the Voyager spacecraft to perform its studies. The science objectives of the radio science investigation were to determine the following:

1. To determine the physical properties of planetary and satellite atmospheres by examining the propagation effects on a dual-frequency radio signal, as observed during the encounter period. The science objectives are to determine the amount and size distribution of material in Saturn's rings and the ring dimensions by examining the propagation effects on dual-frequency radio signal that passes through each ring in succession and through the gap between the C ring and Saturn's surface.

2. TO DETERMINE THE PHYSICAL PROPERTIES OF PLANETARY AND SATELLITE ATMOSPHERES BY EXAMINING THE PROPAGATION EFFECTS ON A DUAL-FREQUENCY RADIO SIGNAL DURING OCCULTATION BY THE SUN, JUPITER, AND THE GALILEAN SATELLITES.

INVESTIGATION NAME: CELESTIAL MECHANICS

INVESTIGATION NAME: RADIO SCIENCE TEAM

INVESTIGATION NAME: CELESTIAL MECHANICS

INVESTIGATION NAME: RADIO SCIENCE TEAM

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INVESTIGATION NAME: RADIO SCIENCE TEAM
SPACE FLUIDS

INVESTIGATIVE PROGRAM
CODE 12-AC/OP, SCIENCE
INVESTIGATIVE DISCIPLINE(S)
MAGNETOSPHERIC PHYSICS
SPACE FLUIDS

INVESTIGATION NAME: PLANETARY RADIO ASTRONOMY
NSSDC ID: 77-078A-12

PERSONNEL
PI - J.W. WARWICK - NASA-JPL
CI - W.J. BROWN, JR. - NASA-JPL
CI - S. GULIES - NASA-JPL
CI - C.E. HARRICK - U OF MICHIGAN
CI - Y. LEBLANC - PARIS OBSERVATORY
CI - A. ROUSCH - PARIS OBSERVATORY
CI - T.J. HADDON - U OF FLORIDA
CI - L.J. KRAMER, JR. - NASA-JPL
CI - R.G. PELTZER - NASA-JPL
CI - H.L. KAESER - MEXICO-MEXICO AEROSPACE

BRIEF DESCRIPTION
This experiment consisted of a sweep-frequency radio receiver, operating in both polarization states, between 20 kHz and 40.5 kHz. The signal was received by a pair of orthogonal 18-m monopole antennas. Study of the radio-emission signals from Jupiter and Saturn over this range of frequencies yielded data concerning the physics of magnetospheric plasma resonance and nonthermal radio emissions from these planetary regions.

--- Pioneer 1B, Gehrels ---
INVESTIGATION NAME: IMAGING PHOTOPOLARIMETER (IPP)
NSSDC ID: 72-012A-07
SEE THIS EXPERIMENT UNDER IMAGING

INVESTIGATION NAME: MULTIFILTER PHOTOPOLARIMETER
2200-7300 A
NSSDC ID: 77-078A-11
INVESTIGATIVE PROGRAM
CODE 12-AC/OP, SCIENCE
INVESTIGATIVE DISCIPLINE(S)
INTERPLANETARY DUST
PLANTARY ATMOSPHERES

PERSONNEL
PI - J.W. LANE - NASA-JPL
CI - R.A. PANG - NASA-JPL
CI - J.J. HANSEN - NASA-GSFC
CI - R.A. COHEN - NASA-GSFC
CI - R.E. ESPOSITO - U OF COLORADO
CI - R. SATO - NASA-GSFC
CI - R.A. WEST - U OF COLORADO
CI - J.W. MODD - UOF COLORADO

BRIEF DESCRIPTION
This experiment consisted of an H-line, (2.0 cm) f/1.1 telescope that sent radiation through a polarizer and a filter for one of eight bands in the 2200- to 7300 A spectral region. Study of these emission intensity data, information on surface texture and composition of Jupiter, Saturn, Uranus, and Neptune could be obtained, along with information on the distribution and composition of interplanetary dust in the Uranus-Saturn and Uranus-Saturn rings and information on atmospheric scattering properties and density for all planets. Molecular scale heights for these planets could also be determined from these data.

----- POLARIZATION -----

--- Voyager 1B, LANE ---
SEE THIS EXPERIMENT UNDER ATMOSPHERE

INVESTIGATION NAME: MULTIFILTER PHOTOPOLARIMETER
2200-7300 A
NSSDC ID: 77-078A-11
SEE THIS EXPERIMENT UNDER ATMOSPHERE

--- Pioneer 1B, Gehrels ---
INVESTIGATION NAME: IMAGING PHOTOPOLARIMETER (IPP)
NSSDC ID: 72-012A-07
SEE THIS EXPERIMENT UNDER IMAGING

INVESTIGATION NAME: MULTIFILTER PHOTOPOLARIMETER
2200-7300 A
NSSDC ID: 77-078A-11
SEE THIS EXPERIMENT UNDER ATMOSPHERE

ATMOSPHERE
Saturn
Plate 5. This is a collection of press release photographs from Voyagers 1 and 2 missions. (A) P23400 is a Voyager 1 montage of Saturn and some of its 23 known moons. (B) P23068 is a Voyager 2 photo showing that the rings are composed of myriads of ringlets (over a thousand in number, of which about 100 can be detected in this photo,) making it look like a playing record. (C) P23925 is a Voyager 2 photo of part of Saturn's rings showing many ringlets and the radial bands on the B-ring, discovered on Voyager 1. (D) P23099 is a Voyager 1 photo of the F-ring appearing to consist of twisted or braided rings discovered on this mission. Voyager 2 photos showed a single ring composed of at least 9 ringlets, (but not braided or twisted). (E) P23113 is a Voyager 1 photo of Dione (1120 km diameter) showing a highly cratered surface. (F) P23094 is a Voyager 2 photo of Dione showing an entirely different surface for its other hemisphere from that in (E). Here it is less cratered and splashed with light ray-like material with little relief. (G) P23956 is a Voyager 2 photo of Enceladus (500 km diameter) showing an area of smooth, craterless terrain with ridges bordering it, indicating surface movement in the past to present. (H) P23200 is a Voyager 2 photo of Mimas (390 km diameter) with an enormous deep crater with a high central peak, making its resemblance to the Death Star in Star Wars remarkable. (I) P23915 is a Voyager 2 photo of part of the atmospheric surface of Saturn showing bands, belts and vortices. These features are somewhat similar to Jupiter's though smaller in size and appearing more subdued because of a high-altitude haze on Saturn not present on Jupiter.
The planet farthest from the sun that has been visited and measured by planetary missions is Saturn. It has been visited by three U.S. spacecraft: Pioneer 11 and Voyagers 1 and 2. Voyager 2 is now on its way to Uranus and is expected to arrive at Uranus in January 1986. Although all investigations on these missions that flew by Jupiter obtained data also on Saturn, these data are still being reduced and analyzed and these data are anticipated for deposit in NSSDC. There are nine investigations for which NSSDC has data archived and these data cover the five categories: (1) Imaging, (2) Particles and Fields, (3) Radio Science and Celestial Mechanics, (4) Atmosphere, and (5) Polarization. Again, as in the case of Jupiter, data for the Atmosphere and Polarization categories come from the photopolarimeter investigation and are described under Imaging. Tables 1 and 2 and Appendix A give more detail on these investigations.
**SPACECRAFT**

**SPACECRAFT COMMON NAME: PIONEER 11**

**ALTERNATE NAMES:** PIONEER-G, PL-753C

**NSSC ID:** 73-059A

**LAUNCH DATE:** 09/05/77

**WEIGHT:** 231 kg

**LAUNCH SITE:** CAPE CANAVERAL, UNITED STATES

**LAUNCH VEHICLE:** SATURN

**SPONSORING COUNTRY/AGENCY:** UNITED STATES NASA-GSSA

**INITIAL ORBIT PARAMETERS**

**ORBIT TYPE:** SATURN Flyby

**PERSONNEL**

**PR:** J.W. CASEN (NASA) NASA-JPL

**PS:** E.C. STONE CALIF INST OF TECH

**BRIEF DESCRIPTION**

This was the second mission to investigate Jupiter and the outer solar system. Pioneer 11, like Pioneer 10, was used Jupiter’s gravitational field to alter its trajectory radially. It passed close to Saturn and then it followed an escape trajectory from the solar system. The spacecraft was 2.9 m (9.5 ft) long and contained a 2.26 m (7.46 ft) diameter high-gain antenna of aluminum honeycomb sandwich material whose surface was etched to a high-gain dish. It contained two nuclear electric-power generators, which generated 244 W at Jupiter, but decreased to 100 W at Saturn. There were three reference sensors: a star (cardinal) sensor, and two sun sensors. Attitude position could be calculated from the reference direction to the earth and the sun with the known direction to Canopus as backup. Pioneer 11’s star sensor gain and threshold settings were adjusted based on experience gained from the settings used on Pioneer 10. Three pairs of rocket thrusters provided spin-axis control (± 0.01 rpm) and change of the spacecraft velocity. The thrusters could be either fired stably or pulsed by command. Communications were maintained via the omnidirectional and medium-gain antennas, which operated together, connected to one receiver, while the high-gain antenna was connected to the other receiver. The receivers could be interchanged by command. Two radio transmitters, coupled to two traveling wave tube amplifiers, produced 1.5 W power each. Communication links (Earth to spacecraft) operated at 2139 MHz and downlink transceivers to earth at 200 MHz. At Jupiter’s distance, round-trip communication time took 92 min. Data were received at the Deep Space Network (DSN). The spacecraft temperature was controlled to between 23 and 58° C (73° to 136° F). An additional experiment, a radio-sensitivity test, was planned. The spacecraft was equipped with a pointable magnetometer, a set of dust particles, and a Jupiter aurora. Jovian radio waves, the atmospheres of planets and satellites, solar arrays, and the surfaces of Jupiter, Saturn, and some of their satellites. Instruments carried for these experiments were not completely deployed. For solar winds, a charged-particle detector, ionizing detector, non-imaging telescope, and ion imaging telescope, with views to detect aurorae, reflected from passing meteors, were deployed. The spacecraft was used as a reflector for solar wind. Further scientific information was obtained from celestial occultation sky surveys. This spacecraft, like Pioneer 10, contains a plaque that has a drawing depicting man, woman, and the location of the sun and earth in the galaxy. At Jupiter’s distance, the spacecraft was 36,000 km from Jupiter during its closest approach. December 4, 1979, to within 52,000 km of its cloud tops. It passed by Saturn on August 21, 1979 at a distance of 22,900 km from Saturn’s cloud tops.

**--- VISIONS OF THE FUTURE ---**

**SPACECRAFT COMMON NAME: VOYAGER 2**

**ALTERNATE NAMES:** MARINER-JUPITER/SATURN & OUTER PLANETS B MARINER 77A, 77B

**NSSC ID:** 77-087A

**LAUNCH DATE:** 09/05/77

**WEIGHT:** 760 kg

**LAUNCH SITE:** CANAVERAL, UNITED STATES

**LAUNCH VEHICLE:** SATURN

**SPONSORING COUNTRY/AGENCY:** UNITED STATES NASA-GSSA

**INITIAL ORBIT PARAMETERS**

**ORBIT TYPE:** SATURN Flyby

**PERSONNEL**

**PP:** J.W. CASEN (NASA) NASA-JPL

**PS:** E.C. STONE CALIF INST OF TECH

**BRIEF DESCRIPTION**

The overall objectives of Voyager 2 were to conduct exploratory investigations of the planetary systems of Jupiter and Saturn and of the interplanetary medium en route to Saturn. Voyager 2 contained an array of instruments designed to study these objectives. Voyager 2 carried a comprehensive variety of instruments including: an infrared interferometer and radiometer, a UV spectrometer, a Faraday cup, a charged-particle analyzer, a plasma detector, a space-wave radio receiver, a cosmic-ray telescope, a photopolarimeter, and an ion imaging detector. Voyager 1 had its closest encounter with Jupiter on March 5, 1979, and with Saturn on November 10, 1979. Voyager 2 followed a more exterior trajectory to Saturn. Voyager 2 had its closest encounter with Saturn on August 12, 1981.
BRIEF DESCRIPTION

The Imaging Photopolarimeter (IPP) experiment used during Voyager 1 and Saturn Orbiter encounters was a simultaneous, two-color (blue ~ 4700 to 4920 A; red ~ 5000 to 7000 A) polarimetric and radiometric measurement, and moderate-resolution (about 280 km at best) spin-star images of Jupiter were the jovian satellites and Saturn and some of its satellites. The polarimetric and radiometric work was performed using an 8'-by-8' field-stop aperture, with the spin-star imaging giving a 0.5'-by-0.5' field-stop aperture. Relative radiometric calibration was derived using an internal tungsten lamp, while a long-term absolute calibration of the instrument was accomplished by means of a sunlit diffusor/attenuator element located in the spacecraft antenna structure. Primary radiometric calibration was obtained through the calibration mission by periodically inserting the telescope to view this diffuse backlighted (sunlight) source. The experiment train for the IPP consisted of the following elements: (1) a near-infrared cutoff 2.5'-by-1.0' polished sector of focal ratio (f/8) of a focal-plane wheel containing field-of-view (FOV) apertures, depolarizers, calibration samples, etc. (2) a mastown prism to split the light into two orthogonally polarized beams. (3) a 45-degree dichroic mirror and a dichroic filter to separate the blue and red bands. (4) a blue-beam transmission grating, a red-beam transmission grating, and a narrow-angle long-focal-length camera for each spectral beam. (5) the polarizers were separated, and (6) the bandpass filter and 'blue' box. A 3-4'-by-3-4' photocathode for each spectral beam to register the intensity on each polarization component. Polarization data include the interplanetary region.

---------- VOYAGER 2, SMITH----------

INVESTIGATOR NAME: IMAGING

NSSDC ID: 77-060A-01

INVESTIGATIVE PROGRAM

CODE E-4/COP-O-1, SCIENCE

INVESTIGATIONAL DISCIPLINE

SYSTEMS AND ENVIRONMENTAL PHYSICS

PLANETARY ATMOSPHERES

PLANETOLOGY

ATMOSPHERIC PHYSICS

PERSONNEL

TL - D.A. SMITH
DT - J.A. ROBERSON
TM - G.A. BROOKS
TM - C.R. BENDER
TM - E.E. DANIELSON
TM - F.C. BARR
TM - S.E. BEDENBOURNE
TM - T. O'HARA
TM - G.L. KEMPSTER
TM - V.T. JACOBSON
TM - J. MURPHY

U OF ARIZONA
US GEOLOGICAL SURVEY
NASA HEADQUARTERS
U OF UTAH
CALIF INST OF TECH
BROOKLYN COLLEGE
STATE U OF ILLINOIS
UNIVERSITY OF CALIFORNIA
U OF IOWA
U OF ILLINOIS
GEOSCIENCE LAB

Davies, Danusz, Cook, Hunt, Soderblom, Gallegos, Danesi, Michael, Smith, Zavidentseff, Personne, Massey

BRIEF DESCRIPTION

The photographic experiment used a two-camera system. The polarimetric and radiometric (blue) cameras were of focal ratio (f/8) of a focal-plane wheel containing field-of-view (FOV) apertures, depolarizers, calibration samples, etc. A 45-degree dichroic mirror and a dichroic filter to separate the blue and red bands. A blue-beam transmission grating, a red-beam transmission grating, and a narrow-angle long-focal-length camera for each spectral beam. The polarizers were separated, and the bandpass filter and 'blue' box. A 3-4'-by-3-4' photocathode for each spectral beam to register the intensity on each polarization component. Polarization data include the interplanetary region.

---------- PIONEER 11, SMITH----------

INVESTIGATOR NAME: PLASMA

NSSDC ID: 73-019A-13

INVESTIGATIVE PROGRAM

CODE E-4/COP-O-1, SCIENCE

INVESTIGATIONAL DISCIPLINE

SPACE PLASMAS

PARTICLES AND FIELDS

PERSONNEL

PL - W. WOLFE
PT - L.A. FRANK
PT - R. LUST
PT - J.A. JENKINS
PL - S.L. ZUDENTEFF (NASA)
PT - W.T. SMITH
PT - H.A. SCHEFF
PT - P.R. COBB
PL - W.C. FELDMAN
PL - W.L. NELSON

NASA-ARC
U OF ILLINOIS
U OF SOUTHERN CALIF
NASA-ARC
NASA-ARC
NASA-ARC
NASA-ARC
NASA-ARC

Davies, Danusz, Cook, Hunt, Soderblom, Gallegos, Danesi, Michael, Smith, Zavidentseff, Personne, Massey

BRIEF DESCRIPTION

The experiment consisted of dual Gobierno quadralinear electronic detectors. One of the two quadralinear detectors are the other with 2.5 current collectors. The system is capable of measuring two electron species and parameters over the energy range 0.3 to 10 keV for protons and approximately 1-300 eV for electrons. The high-resolution analyzer with a constant of 9 keV per Ax applied to the plates had a mean plate radius of 9 cm and separation of 0.5 cm. An analyzer was used to measure ions only, and had 9 chambers mounted in a single radial exit to the analyzer. The aperture defined by a wide slit in the back of the spacecraft high-gain antenna reflector and pointed along the
spin axis toward the earth (and therefore the sun). The edges of the antenna reflector limited the viewing of the instrument to 73 deg with respect to the spin axis. The schematics covered a range of plus or minus 51 deg. Each channel near the center covered 3 deg and approximately 6 deg near the edges of the analyzer. The angular width perpendicular to the long angular width was about 2 deg. In half the p.m. the whole cone of half-angle 51 deg centered on the sun was swept out. A medium-energy analyzer with a mean radius of 12 cm and a 5-cm plate spacing was used to perform per-pixel analysis used to detect both ions and electrons. The detectors were five flat-surface current collectors. The three center collectors each covered 15 deg and covered the angular range of plus or minus 22.5 deg from the spin axis. The two outside collectors had an angular width of 47.5 deg and were located at plus or minus 46.0 deg from the center of the analyzer. There was a variety of possible operating modes for the experiment; however the principal mode utilized during the encounter phase was one in which the analyzer plate potential was stepped through its range every one-half revolution of the spacecraft, and all current collectors or channeltrons were read out at the peak a gold-plated shield at the entrance aperture to admit fast events. Interoperating analyzer studied (a cross section between these channeltron was determined) the channeltron current output of electrons at energy thresholds in the range 0.1 to 30 MeV. For these instruments were given in Sp. Sci. Instum. v. 1, p. 177, 1975. Principal Jovian scientific results can be found in J. Geophys. Res. v. 82, p. 1977. 1976.

----- PIONEER 11, ACUNA

INVESTIGATION NAME - JOVIAN MAGNETIC FIELD

NSSDC 10- 73-B9A-14 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S) MAGNETOSPHERIC PHYSICS, PLANETARY MAGNETIC FIELD

PERSONNEL
PI - W.J. ACUNA NASA-GSFC
ASSISTANT PI
A - E. R. MELNICK NASA-GSFC

BRIEF DESCRIPTION
This instrument, designed to measure the Jovian and Saturnian magnetic fields, consisted of a single-range triangular fluxgate magnetometer sensor and associated electronics capable of measuring 0.1 to 1000 G (0.1 to 10 Gauss) along each orthogonal axis. Use of a 10-bit A-to-D converter yielded a quantization error of 1/10th of a bit for fields less than 2.4 G. Instantaneous vector measurements were made every three revolutions of the spacecraft (15 s) and transmitted to the ground with no further onboard processing. More instrument details are given in Sp. Sci. Instum. v. 1, p. 177, 1975. Principal Jovian scientific results can be found in J. Geophys. Res. v. 82, p. 1977. 1976.

----- PIONEER 11, VAN ALLEN

INVESTIGATION NAME - JOVIAN CHARGED PARTICLES

NSSDC 10- 73-B9A-11 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS, MAGNETIC PHYSICS

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

BRIEF DESCRIPTION
This experiment used seven miniature Geiger tubes in three arrays to measure protons and electron fluxes near Jupiter and Saturn. Detector groupings were as follows: (1) a three-element (A, B, and C) differentially shielded telescope; (2) a three-element (A, B, and C) differentially shielded telescope; (3) a two-element(A and B) shielded telescope; and (4) a two-element (A and B) shielded telescope. Background subtraction to provide rates such as 1 J. 10 to 21 MeV electrons and 0.5 to 21 MeV protons; (2) a two-element triangular with a single-windfoil slit aperture for 0.51 MeV protons and 17.5 MeV electrons; and (3) a thick-windfoil slit (9.5 cm in diameter) with a single-windfoil slit aperture for 0.51 MeV protons and 17.5 MeV electrons. The experiment was operated with an average rate of 1000 rate counts per second. Early results are given in J. Geophys. Res. v. 82, p. 1977. 1976. Data include the interplanetary region.

----- PIONEER 11, MCDONALD

INVESTIGATION NAME - COSMIC RAY SPECTRA

NSSDC 10- 73-B9A-12 INVESTIGATIVE PROGRAM CODE EL-4/CO-OP, SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS, COSMIC RAYS

PERSONNEL
PI - F.J. MCDONALD NASA-GSFC
O1 - H.G. MCDONALD ENS
O1 - W.R. WEBBER U OF NEW HAMPSHIRE
O1 - E.C. ROELOF CSIRO
O1 - E.J. TEGARDEN ASPIC LBNL
O1 - J.A. TRARMER NASA-GSFC

BRIEF DESCRIPTION
This experiment consisted of three 3-degree field-of-view all-looking omnidirectional particle detectors. Each omnidirectional telescope measured 0.1- to 500-MeV electron particles with 5 to 350 keV energy resolution. Another telescope measured 3- to 12-keV electron particles with 1 degree resolution. These three telescopes measured protons with energy thresholds of 1 and 10 keV. The third telescope measured 50- to 200-MeV electrons and 50- to 200-MeV protons with 2 degree resolution. Data include the interplanetary region.

----- PIONEER 11, FILLUS

INVESTIGATION NAME - JOVIAN TRAPPED RADIATION

NSSDC 10- 73-B9A-25 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S) MAGNETOPHYSICS, PLANETOPHYSICS

PERSONNEL
PI - R.W. FILLUS U OF CALIF., SAN DIEGO
O1 - C.F. MELNICK U OF CALIF., SAN DIEGO

BRIEF DESCRIPTION
This experiment consisted of an array of five particle detectors with electron thresholds in the range 0.1 to 30 MeV and proton thresholds in the range 0.15 to 80 MeV. A Cerenkov counter (C) had four output channels (C1, C2, and C3) sensitive to electrons having energies above 5, 10, and 1 MeV, respectively. An electron scatter telescope (S) had three output channels: P1 sensitive to electrons having energies greater than 15 MeV; P2 measuring background; and P3 sensitive to protons having energies greater than 15 MeV. The last two sensors were scintillator detectors (S1 and S2) each of which had energy thresholds of 10 keV for electrons and 150 keV for protons. The sensitivity of the S1 detector to protons was about a factor of 10 lower than its sensitivity to electrons. Thus in the Solar wind the S1 channel detected the electron flux which could then be subtracted from the S2C channel response to obtain the proton flux. Several other channels listed above required corrections to obtain the fluxes of the species indicated. The detector channels could be programmed for readout in any one of four patterns at each of the eight spacecraft latitude intervals. During encounters when the spacecraft was operating in the highest bit-rate mode, the entire time to sample one channel was 1.5 s and the time to obtain a complete scan through all channels was 15 s. Since the directional detectors pointed perpendicularly to the spin axis and the spin rate was 5 rpm pitch-angle measurements were obtained. Although this experiment was primarily designed for encounter studies, some data were obtained at low rates in interplanetary space. A description of the investigation and initial Pioneer 10 results was published in J. Geophys. Res. v. 82, p. 1977. 1976.

----- PIONEER 11, ANDERSON

INVESTIGATION NAME - CELESTIAL MECHANICS

NSSDC 10- 73-B9A-0P INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S) ASTRONOMY, ASTRONOMY

PERSONNEL
PI - J.O. ANDERSON NASA-JPL
O1 - G.W. NOLL NASA-JPL

BRIEF DESCRIPTION
In this investigation, two-way Doppler tracking of the spacecraft was used to make more precise determinations of planetary masses, the heliocentric orbits of Jupiter and Saturn, and the gravitational fields of the Sun, Jupiter, Saturn, and the Galilean and Saturnian satellites.
----- PIONEER 11, GEMBELS -----------------------------

INVESTIGATION NAME: IMAGING PHOTOPOlARIMETER (IPP)

NSSDC ID: 73-DSP-07

SEE THIS EXPERIMENT UNDER IMAGING

POLARIZATION

----- PIONEER 11, GEMBELS -----------------------------

INVESTIGATION NAME: IMAGING PHOTOPOlARIMETER (IPP)

NSSDC ID: 73-DSP-07

SEE THIS EXPERIMENT UNDER IMAGING
Interplanetary Investigations by Planetary Probes
Plate 6. This is a collection of press release images of typical planetary spacecraft that conducted investigations in interplanetary space. (A) Mariner 4 was one of the first spacecraft to conduct planetary (Mars) and interplanetary exploration. (B) Pioneer 10 investigated the interplanetary medium, the nature of the asteroid belt, and conducted exploration of Jupiter and its environment. (C) Voyager 1 was designed to conduct investigations of the Jupiter and Saturn systems and to study interplanetary space.
Mariner 4

Pioneer 10

Voyager 1
INTRODUCTION

Six planetary probes carried instruments specifically to make investigations in interplanetary space. These were Mariners 4 and 5, Pioneers 10 and 11, and Voyagers 1 and 2. There were 11 investigations for which NSSDC has data or knows the sources for obtaining data. These cover three categories which are (1) Particles and Fields, (2) Ultraviolet, and (3) Interplanetary Particles. Table 1 and Appendix B show the investigations in more detail.
SPACECRAFT

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SPACECRAFT COMMON NAME- MARINER 4
ALTERNATE NAMES- EDIN.
WEIGHT- 262. KG
LAUNCH VEHICLE- ATMOS.
SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSA
INITIAL ORBIT PARAMETERS
ORBIT TYPE- NASS FLYBY
PERSONNEL
PM - R.W. JAMES
PS - R.A. SLOCUM
NASFA
BRIEF DESCRIPTION
This mission was the first to be sent to the outer solar system and after encountering the planet Jupiter it assumed an escape trajectory from the solar system. The solar array was mounted behind a 2.74-m-diameter parabolic dish antenna that was 46 cm deep. The spacecraft structure was a 36-ft-diameter flat field components the top and bottom being regular hexagons. Its sides were divided into sections, each serving as a smaller compartment that carried the scientific experiments. The high-gain antenna feed was at 12-ft, and the lower section was 14-ft wide. A truss extending about 0.16 m behind the equipment compartment and was bonded by the highgain antenna. Power for the spacecraft was obtained by four SNAP-19 radionuclide thermal generators (RTG), which were held about 5.4 m from the center of the spacecraft by two three-mm tubes 120 deg apart. A third boom extended 0.04 m from the experiment compartment to hold the magnetometer away from the spacecraft. The four RTGs generated about 155 watts at launch and decayed to approximately 140 watts by the time the spacecraft reached Jupiter. On December 3-1973-21 months after launch, there were three reference sensors: a star sensor for Camopus, and two sun sensors. Attitude position could be calculated from the reference direction to the earth and the sun with the known direction to Camopus as a backup. Three pairs of rocket thrusters provided spin-rate control (maintained at 4.0 rpm) and changed the velocity of the spacecraft. These thrusters could be pulsed or fired steadily by command. Communications were maintained by the spacecraft's fixed and its satellites. Instruments carried for these experiments were magnetometer, solar wind analyzer, charged particle detector, ionization detector, non-imaging telescopes with overlapping fields of view to detect sunlight reflected from passing meteoroids, several pressure-measuring units of argon and nitrogen gas for measuring the penetration of meteoroids, UV photometers, spacecraft, and an imaging photometer, which produced photographs and measured polarization. Further scientific information was obtained from the tracking and occultation data. When the spacecraft achieved its closest approach on December 3, 1973, when it reached approximately three times the distance of the earth (about 210,000 km). The spacecraft contains plans that have drawings depictions of a man and woman, and the earth in our galaxy. It is leaving the solar system and passing into interstellar space.

*********************************

SPACECRAFT COMMON NAME- MARINER 5
ALTERNATE NAMES- EDIN.
WEIGHT- 240. KG
LAUNCH VEHICLE- ATMOS.
SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSA
INITIAL ORBIT PARAMETERS
ORBIT TYPE- NASS FLYBY
PERSONNEL
PM - R.W. JAMES
PS - R.A. SLOCUM
NASFA
BRIEF DESCRIPTION
This mission was the fourth in a series of spacecraft used for planetary exploration in a flyby mode. It was designed to conduct close-up scientific observations of the planet Mars and to transmit these observations to earth. Other mission objectives were to perform field and particle measurements in interplanetary space in the vicinity of Mars and to prove capabilities of the engineering capabilities for interplanetary flights of long duration. After 7.5 months of flight, the spacecraft flew by Mars on July 14, 1969, and returned 21 pictures plus 24 times of picture 22. The closest approach was 9,516 km from the Martian surface. The spacecraft performed all programmed activities successfully at the proper times and returned useful data from launch until October 1969, when the distance from earth and its antenna orientation temporarily halted the signal acquisition. Data acquisition resumed in late 1967 and continued until December 20, 1974.

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SPACECRAFT COMMON NAME- MARINER 5
ALTERNATE NAMES- MARINER VENUS 67, 20603
WEIGHT- 240. KG
LAUNCH VEHICLE- ATMOS.
SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSA
INITIAL ORBIT PARAMETERS
ORBIT TYPE- NASS FLYBY
PERSONNEL
PM - R.W. JAMES
PS - R.A. SLOCUM
NASFA
BRIEF DESCRIPTION
The Mariner 5 spacecraft was the first in a series of spacecraft used for planetary exploration in a flyby mode. Mariner 5 was a refurbished backup spacecraft for the Mariner 4 mission and was converted from a Mars mission to a Venus mission. The spacecraft was fully attitude stabilized, using the sun and Venus as references. A central computer and science subsystem was supplied with the capability to perform services for other spacecraft subsystems. The spacecraft passed 3,750 km from Venus on October 19, 1970. The spacecraft's instruments measured both interplanetary and Venusian magnetic fields, charged particles, and plasma as well as the radio reflectivity and UV emissions of the Venusian atmosphere. The mission was a success.

*********************************

SPACECRAFT COMMON NAME- PIONEER 11
ALTERNATE NAMES- PIONEER-PL-73-019A
WEIGHT- 231. KG
LAUNCH VEHICLE- ATMOS.
SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-OSA
INITIAL ORBIT PARAMETERS
ORBIT TYPE- SATURN FLYBY
PERSONNEL
PM - C.F. HALL (NASA)
PS - F. PHIL.
NASA-OSA
BRIEF DESCRIPTION
This was the second mission to investigate Jupiter and the outer solar system. Pioneer 11 was like Pioneer 10 used Jupiter's gravitational field to slingshot from earth to Jupiter. It passed close to Saturn and then it followed an escape trajectory from the solar system to become a member of the Kuiper Belt. It contained two nuclear-electro-power generators, which generated 128 W at Jupiter but decreased to 100 W at Saturn. There were three reference sensors: a star (Camopus) sensor, and two sun sensors. Attitude position could be calculated from the reference direction to the earth and the sun with the

93
The overall objectives of Voyager 2 were to conduct exploratory investigations of the planetary systems of Jupiter, Saturn, Uranus, and Neptune, and of the interplanetary medium. Primary emphasis was placed on comparative studies of these planetary systems by obtaining (1) measurements of the environment, atmosphere, and body characteristics of the planets and one or more of the satellites of each planet, (2) studies of the nature of the rings of Saturn and Uranus, and (3) exploration of the interplanetary (or interstellar) medium at increasing distances from the sun. These objectives were met using a variety of instruments and methods including imaging, a coherent 5- and 6-cm RF receiver, an IR interferometer and radiometer, a UV spectrometer/fluorescence spectrophotometers, a plasma-wave vector receiver, cosmic-ray telescopes, photopolarimeters, and a high-sensitivity ion plasma probe.

PARTICLES AND FIELDS

INVESTIGATION NAME- INTERPLANETARYION PLASMA PROBE FOR EV OF 40 TO 9000 VOLS

INVESTIGATION DISCIPLINE(S)- PARTICLES AND FIELDS

INVESTIGATOR(s)- INTERPLANETARY PHYSICS

PERSONNEL

PI - J.A. SIMPSON
PS - U. OF CHICAGO
PS - U. OF MARYLAND

INSTRUMENT DESCRIPTION

A set of three silicon surface barrier detectors was used in the form of a cone/scope to analyze penetrating charged particles in the energy intervals 23 to 170 MeV and alpha particles in the energy range 15 to 70 MeV/nucleon and above 70 MeV/nucleon, and protons and alpha particles in the energy interval 1.2 to 15 MeV/nucleon. The detector was mounted on the spacecraft so as to point always in the antisolar direction. A 12-channel pulse-height analyzer was used to sample the energy loss in the top detector element of the telescope. It was possible to pulse-height analyze protons and alpha particles from 15 to 170 MeV/nucleon, protons from 70 to 170 MeV and alpha particles with energies above 70 MeV/nucleon. Two count rates and two pulse height analyses were measured. The spacecraft was turned 180° at a later time when the detectors had cooled again. At a later time, the detector did not respond. For further details, see O'Sullivan Ap.J., v. 197, p. 679, 1979.
PHOTOMETRY

This experiment (on both Pioneers 10 and 11) consisted of a broadband photometer sensitive between 200 and 800 A, during the cruise phase of the mission. This experiment was used to search for the superthermal-to-subthermal transition region in the solar wind, during the Jupiter encounter, this experiment was used to look for evidence of an auroral oval on the Jupiter dayside. It was used to find the ratio of hydrogen to helium in the Jupiter atmosphere, and to find the temperature of the outer portion of the Jupiter atmosphere. Evidence of helium was found in the interplanetary region indicating interactions between charged particles and neutral hydrogen.

--- PIONEER 11, SOBERMAN ---

INVESTIGATION NAME: ASTEROID/NEPTUNIAN ASTRODYNAMICS

BRIEF DESCRIPTION

The overall objective of this experiment (also carried on Pioneer 11) was to investigate dust particles and meteoroids in interplanetary space. It was essentially two experiments using two different techniques. One method was to detect particles by the reflection of light from them, and the other method was to detect them by their impact. The objectives were to determine distance, trajectory, velocity, relative size, and flux of particles ranging in size from atom to meteor. The latter detects the reflected light collected by the telescope. An event was recorded when at least three of the four telescopes saw the object. Entry and departure times of the light enabled determination of range and velocity. The equipment for the impact mode consisted of 3 panels each containing 10 sealed cells, pressurized with argon and nitrogen gas, covering 8.3 arc min on a circle of the back of the main antenna dish. Penetration by a particle resulted in loss of gas at a rate proportional to the size of the hole, which would be related to the particle mass and velocity. Penetrations were registered from particles as small as 3.5 km.
The overall objective of this experiment was to investigate dust particles and meteoroids in interplanetary space. It was essentially two experiments: using two different techniques. One method was to detect particles by the reflection of light from them, and the other method was to detect them by their impacts. The objectives were to determine directly the trajectory, velocity, relative size, and flux of particles ranging in size from minute particles a few meters from the telescope to distant asteroids. The equipment for the detection of reflection consisted of four non-imaging Ritchey-Chretien telescopes with primary mirrors of 20-cm (f/5) diameter, 25-cm (f/10) focal length, fields of view (FOV) of 0.2 rad and 15 deg separable optical and a photomultiplier tube. The latter detects the reflected light collected by the telescopes. In an event was recorded when the light from four of the four telescopes saw the object. Entry and departure times of the objects enabled determination of range and velocity.

The equipment for the impact case consisted of 13 panels containing 15 coated steel pellets coated with argon and nitrogen gas, covering 2.64 x 3.07 x 0.39 ft of the back of the main antenna reflector. Penetration by a particle resulted in a loss of gas at a rate proportional to the hole, which would be related to its size and velocity. This experiment is similar to one on Pioneer 10, since the cells on Pioneer 11 were slightly thicker than those on Pioneer 10. The minimum mass particles detected were of slightly greater mass.

--- PIONEER 11: KINARD ---

INVESTIGATION NAME: METEOROID DETECTORS

INVESTIGATIVE PROGRAM: CODE EL-4, SCIENCE
INVESTIGATION DISCIPLINE(S): ASTROBIOLOGY
INTERPLANETARY DUST

PERSONNEL

PI - J. L. KINARD

INVESTIGATION NAME: ZODIAL LIGHT TWO-COLOR PHOTOPOLARIMETER

INVESTIGATION DISCIPLINE(S): ZODIAL LIGHT

INVESTIGATION DISCIPLINE(S): ZODIAL LIGHT

PERSONNEL

PI - J. L. WEINBERG

INVESTIGATION NAME: ZODIAL LIGHT TWO-COLOR PHOTOPOLARIMETER

INVESTIGATION DISCIPLINE(S): ZODIAL LIGHT

INVESTIGATION DISCIPLINE(S): ZODIAL LIGHT

PERSONNEL

PI - J. L. WEINBERG
formatted to produce a sky map, 360 deg in clock angle by 341 deg in cone angle. The experimental train for the IPP package consisted of the following elements: (1) a near-diffraction-limited, 2.5-m-cm, Maksutov-cataodictric telescope (f/3.4); (2) a focal plane wheel containing field-of-view apertures, depolarizers, calibration source, etc.; (3) a collimation prism to split the light into the orthogonally polarized beams; (4) a 45-deg dichromatic mirror that reflected wavelengths less than 5500 A (blue beam) and transmitted all light of greater wavelength (red beam); (5) for each spectral beam (two polarizations) a filtering, coated relay lens and folding mirrors, and (6) for each spectral beam, two photomultiplier channeltron detectors (blue - blaelh 5-15 photomultipliers, red - 5-20 photomultipliers) to register the intensity in each polarization component. (Note: a similar experiment was also aboard Pioneer 10.) Data include the interplanetary region.
Interplanetary Investigations
Plate 7. This is a collection of press release images of typical spacecraft designed solely to conduct investigations in interplanetary space. (A) Pioneer 5 investigated particles and fields in ciscytherean space, including solar flares and the solar wind. (B) Pioneer 6 investigated interplanetary phenomena in ciscytherean space to within about 0.814 AU of the sun. (C) Pioneer 9 collected scientific data on the electromagnetic and plasma properties of the interplanetary medium. (D) Helios-A investigated the properties and processes in interplanetary space in the direction of and close to the sun.
INTERPLANETARY INVESTIGATIONS

INTRODUCTION

There were seven missions which were designed solely to make investigations in interplanetary space. These were Pioneers 5, 6, 7, 8, and 9, and Helios-A and -B. There were 54 investigations for which NSSDC has data or sources for obtaining data. These cover three categories which are (1) Particles and Fields, (2) Radio Science and Celestial Mechanics, and (3) Interplanetary Particles. Table 1 and Appendix C show the investigations in more detail.
PIONEER 5

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PIONEER 6

Pioneer 5 (1960 alpha 23) was a spin-stabilized space
probe intended to investigate interplanetary space between
the orbits of Earth and Venus. The spacecraft measured magnetic
field, solar flare particles, and radiation in the
Interplanetary region. The digital data were transmitted at 1-
32 seven-bit words per day, with occasional increases
during times of special interest. A total of 135.9 h of
collection was transmitted and over 3 million binary bits of
data were received. The major portion of the data was received
at the
and was
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ception. Pioneer 5 performed normally until April
1961, after which
transmission stopped too
infrequent for any significant addition to the data. The
spacecraft established a communications link with the earth
from a record distance of 22.5 million miles on June 26, 1961,
which
was the last day of transmission.

PIONEER 7

Pioneer 7 was the second in a series of solar-orbiting,
spin-stabilized, solar-cell and battery-powered satellites
designed to obtain measurements of interplanetary phenomena
from widely separated points in space. The spacecraft
traveled
at a
several
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propagation experiments,
solar
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rays,
and the
Interplanetary magnetic field. Its main antenna was a high-gain
directional antenna. The spacecraft was spin-stabilized at about
60 rpm and the spin axis was perpendicular to the ecliptic plane
and pointed toward the south ecliptic pole. By ground
command, one of five bit rates could be
selected. The five bit rates were 512, 256, 64, 16,
and 8 bps.

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PIONEER 8

Pioneer 8 was the third in a series of solar-orbiting,
spin-stabilized, solar-cell and battery-powered satellites
designed to obtain measurements of interplanetary phenomena
from widely separated points in space. The spacecraft carried
experiments to study positive ions and electrons in the solar
wind, the Interplanetary electron density, cosmic
propagation experiments, solar and galactic cosmic rays, and the
Interplanetary magnetic field. Its main antenna was a high-gain
directional antenna. The spacecraft was spin-stabilized at about
60 rpm, and the spin axis was perpendicular to the ecliptic plane
and pointed toward the south ecliptic pole. By ground
command, one of five bit rates could be
selected. The five bit rates were 512, 256, 64, 16,
and 8 bps. Three of the four data formats were used primarily
for scientific data and consisted of 32 seven-bit words per frame. One
scientific...
spacecraft was one of a pair of deep space probes developed by the Federal Republic of Germany (FRG) in a cooperative program with NASA. Experiments were provided by scientists from both FRG and the U.S. NASA supplied the Titan/Centaur launch vehicle. The spacecraft was equipped with two boom and a 25º electric dipole. The payload consisted of a fluxgate magnetometer; electric and magnetic wave experiments, which covered various bands in the frequency range 6 Hz to 6 MHz charged-particle experiments, which covered various energy ranges starting with solar wind and extending to 15 MeV; a complement-light experiment and a zodiacal-light experiment. The purpose of the mission was to make pioneering measurements of the interplanetary medium from the vicinity of the earth's orbit to 0.3 AU; the spin axis was normal to the ecliptic, and the nominal spin rate was 1 rpm. The outer spacecraft surface was coated with solar cells and stored at a temperature of 109ºK. Also, sheath-related coupling caused by the spacecraft was to be probed by placing it as close as within 0.3 AU. NASA supplied the high-rate radio system for the spacecraft was capable of being operated at bit rates from 400 to 8 bps, variable by factors of two, while the spacecraft was moving to perihelion. It was generally operated at 64 to 256 bps, and near 0.3 AU it was operated at the highest bit rate. Because of a deployment of the solar panel on one side of the 32ºX32º; the dipole antenna, one axis was shortened causing the antenna to function as a monopole. Another was to increase the effective instrument thresholds, and to introduce additional uncertainties in the antenna length. Instrument descriptions written by the experimenters were published (see in German, some in English) in the Journal #24forschung v. 19, n. 5, 1975.

*************** HELIOS-1 ****************

SPACELCRAFT COMMON NAME- HELIOS-1 ALTERNATE NAMES- HELIOS, PL-75A

NSSDC ID- 68-1DC
LAUNCH DATE- 11/17/68 WEIGHT- 373.2 KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- TITAN
SPONSORING COUNTRY/AGENCY NASA-GSF

ORBIT PARAMETERS

EPOCH DATE- 07/21/76 INCLINATION- 1.206 DEG
PERIAPSIS- 1.289 AU RAD
APOAPSIS- 0.985 AU RAD

PERSONNEL
PM - A. KUTZER
PM - C.W. OUSLEY
PS - H. PORSCHE
PS - J.H. TRAUSCH

BRIEF DESCRIPTION

This spacecraft was one of a pair of deep space probes developed by the Federal Republic of Germany (FRG) in a cooperative program with NASA. Experiments were provided by scientists from both FRG and the U.S. NASA supplied the Titan/Centaur launch vehicle. The spacecraft was equipped with two boom and a 25º electric dipole. The payload consisted of a fluxgate magnetometer; electric and magnetic wave experiments, which covered various bands in the frequency range 6 Hz to 6 MHz charged-particle experiments, which covered various energy ranges starting with solar wind and extending to 15 MeV; a complement-light experiment and a zodiacal-light experiment. The purpose of the mission was to make pioneering measurements of the interplanetary medium from the vicinity of the earth's orbit to 0.3 AU; the spin axis was normal to the ecliptic, and the nominal spin rate was 1 rpm. The outer spacecraft surface was coated with solar cells and stored at a temperature of 109ºK. Also, sheath-related coupling caused by the spacecraft was to be probed by placing it as close as within 0.3 AU. NASA supplied the high-rate radio system for the spacecraft was capable of being operated at bit rates from 400 to 8 bps, variable by factors of two, while the spacecraft was moving to perihelion. It was generally operated at 64 to 256 bps, and near 0.3 AU it was operated at the highest bit rate. Because of a deployment of the solar panel on one side of the 32ºX32º; the dipole antenna, one axis was shortened causing the antenna to function as a monopole. Another was to increase the effective instrument thresholds, and to introduce additional uncertainties in the antenna length. Instrument descriptions written by the experimenters were published (see in German, some in English) in the Journal #24forschung v. 19, n. 5, 1975.

*************** HELIOS-2 ****************

SPACELCRAFT COMMON NAME- HELIOS-2 ALTERNATE NAMES- HELIOS-2, PL-75A

NSSDC ID- 68-1DC
LAUNCH DATE- 11/17/68 WEIGHT- 373.2 KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- TITAN
SPONSORING COUNTRY/AGENCY NASA-GSF

ORBIT PARAMETERS

EPOCH DATE- 07/21/76 INCLINATION- 1.206 DEG
PERIAPSIS- 1.289 AU RAD
APOAPSIS- 0.985 AU RAD

PERSONNEL
PM - A. KUTZER
PM - C.W. OUSLEY
PS - H. PORSCHE
PS - J.H. TRAUSCH

BRIEF DESCRIPTION

This spacecraft was one of a pair of deep space probes developed by the Federal Republic of Germany (FRG) in a cooperative program with NASA. Experiments were provided by scientists from both FRG and the U.S. NASA supplied the Titan/Centaur launch vehicle. The spacecraft was equipped with two boom and a 25º electric dipole. The payload consisted of a fluxgate magnetometer; electric and magnetic wave experiments, which covered various bands in the frequency range 6 Hz to 6 MHz charged-particle experiments, which covered various energy ranges starting with solar wind and extending to 15 MeV; a complement-light experiment and a zodiacal-light experiment. The purpose of the mission was to make pioneering measurements of the interplanetary medium from the vicinity of the earth's orbit to 0.3 AU; the spin axis was normal to the ecliptic, and the nominal spin rate was 1 rpm. The outer spacecraft surface was coated with solar cells and stored at a temperature of 109ºK. Also, sheath-related coupling caused by the spacecraft was to be probed by placing it as close as within 0.3 AU. NASA supplied the high-rate radio system for the spacecraft was capable of being operated at bit rates from 400 to 8 bps, variable by factors of two, while the spacecraft was moving to perihelion. It was generally operated at 64 to 256 bps, and near 0.3 AU it was operated at the highest bit rate. Because of a deployment of the solar panel on one side of the 32ºX32º; the dipole antenna, one axis was shortened causing the antenna to function as a monopole. Another was to increase the effective instrument thresholds, and to introduce additional uncertainties in the antenna length. Instrument descriptions written by the experimenters were published (see in German, some in English) in the Journal #24forschung v. 19, n. 5, 1975.
PARTICLES AND FIELDS

INVESTIGATIONS

PARTICLES AND FIELDS

INVESTIGATION NAME- SOLAR WIND PLASMA FARADAY CUP

NSDC ID- 65-1026-02 INVESTIGATIVE PROGRAM

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS SPACE PLASMAS

PERSONNEL

PI - J.H. WOLFE
OI - J.H. WOLFE
U OF WISCONSIN

BRIEF DESCRIPTION

A truncated hemispherical electrostatic analyzer (120-deg total parallel plate curvature) with three contiguous current collectors was used to study the directional intensity of the electrons and positive ions in the solar wind. The instrument was placed 0.1-0.5 au from the sun and the measured current data were reported to the central collector at each 45 deg step. At the low bit rates (64, 16, and 8 bps) the electron flux was measured at each 45 deg step followed by either (1) for electrons a polar scan and an azimuthal scan at 5 deg/60 sec. In the maximum flux mode, all three collectors were observed, and the peak flux obtained and the azimuthal direction to 2-13/16 deg) of the observation were reported. A complete set of measurements consisted of seven sets of ion measurements at each 45 deg step and one set of electron measurements at each 45 deg step. The high bit rates (152 and 256 bps) one set of ion measurements took 62 sec and one set of electron measurements took 24 sec. For the central collector, a complete set of measurements (seven ions plus one electron) was taken and teletransmitted every 602.5 sec. At 16 bps it took 1610 sec. At 8 bps, it took 3220 sec.

--- PIONEER 6- LEVY

INVESTIGATION NAME- PLASMA DETECTORS

NSDC ID- 74-097A-09 INVESTIGATIVE PROGRAM

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS SPACE PLASMAS

PERSONNEL

PI - J.H. WOLFE
OI - D.O. MCKENZIE
U OF WISCONSIN

BRIEF DESCRIPTION

A truncated hemispherical electrostatic analyzer (120-deg total parallel plate curvature) with three contiguous current collectors was used to study the directional intensity of the electrons and positive ions in the solar wind. The instrument was placed 0.1-0.5 au from the sun and the measured current data were reported to the central collector at each 45 deg step. At the low bit rates (64, 16, and 8 bps) the electron flux was measured at each 45 deg step followed by either (1) for electrons a polar scan and an azimuthal scan at 5 deg/60 sec. In the maximum flux mode, all three collectors were observed, and the peak flux obtained and the azimuthal direction to 2-13/16 deg) of the observation were reported. A complete set of measurements consisted of seven sets of ion measurements at each 45 deg step and one set of electron measurements at each 45 deg step. The high bit rates (152 and 256 bps) one set of ion measurements took 62 sec and one set of electron measurements took 24 sec. For the central collector, a complete set of measurements (seven ions plus one electron) was taken and teletransmitted every 602.5 sec. At 16 bps it took 1610 sec. At 8 bps, it took 3220 sec.

--- HELIODS-A ROSENBAUM

INVESTIGATION NAME- PLASMA DETECTORS

NSDC ID- 74-097A-09 INVESTIGATIVE PROGRAM

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS SPACE PLASMAS

PERSONNEL

PI - J.R. B. MCKENZIE
OI - D.O. MCKENZIE
U OF WISCONSIN

BRIEF DESCRIPTION

A truncated hemispherical electrostatic analyzer (120-deg total parallel plate curvature) with three contiguous current collectors was used to study the directional intensity of the electrons and positive ions in the solar wind. The instrument was placed 0.1-0.5 au from the sun and the measured current data were reported to the central collector at each 45 deg step. At the low bit rates (64, 16, and 8 bps) the electron flux was measured at each 45 deg step followed by either (1) for electrons a polar scan and an azimuthal scan at 5 deg/60 sec. In the maximum flux mode, all three collectors were observed, and the peak flux obtained and the azimuthal direction to 2-13/16 deg) of the observation were reported. A complete set of measurements consisted of seven sets of ion measurements at each 45 deg step and one set of electron measurements at each 45 deg step. The high bit rates (152 and 256 bps) one set of ion measurements took 62 sec and one set of electron measurements took 24 sec. For the central collector, a complete set of measurements (seven ions plus one electron) was taken and teletransmitted every 602.5 sec. At 16 bps it took 1610 sec. At 8 bps, it took 3220 sec.

--- PIONEER 6- LEVY

INVESTIGATION NAME- SOLAR WIND PLASMA FARADAY CUP

NSDC ID- 65-1026-02 INVESTIGATIVE PROGRAM

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS SPACE PLASMAS

PERSONNEL

PI - J.H. WOLFE
OI - J.H. WOLFE
U OF WISCONSIN

BRIEF DESCRIPTION

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--- PIONEER 6- LEVY

INVESTIGATION NAME- SOLAR WIND PLASMA FARADAY CUP

NSDC ID- 65-1026-02 INVESTIGATIVE PROGRAM

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS SPACE PLASMAS

PERSONNEL

PI - J.H. WOLFE
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U OF WISCONSIN

BRIEF DESCRIPTION

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A have a period field, and plasma was coated. This pleasure all counts to a level. The dynamic range of a minute. The 16-channel order of the role of electrons. Because the spacecraft electro-magnetic fields. The present experiment (5a) shared the 32 two-electron, electric antennas with a particle. The instrument consisted of a 16-channel spectrum analyzer with those waveforms. The log compressors, 16 high-resolution plasma data for a period starting before and after the event was recorded into spacecraft memory for a period ending after the triggering signal time. The maximum sampling rate of the spectrum data in this mode was 14,2 samples per s for each channel. One half of the dipole antenna failed to extend properly and was short circuit to the spacecraft ground. The resultant combination of a monopole which was calculated to have an effective length of approximately 3 m. The primary result was the loss of 6 dB in E field sensitivity due to the shorted antenna and the increase in the 176 kHz channel by 25 dB. Failure of the spacecraft formed a series of this particular spacecraft channel, which was band-pass filtered. There were many effects caused in the spacecraft memory. However, a combination of factors including the proper deployment of the monopole and constrictive spacecraft coating resulted in data from this spacecraft being of higher quality than data from other spacecraft. This included the use of a high level of data. The spacecraft was properly and adequately sampled. An event was recorded in the lower electromagnetic range. The resultant configuration failed. For the data, see J. Geophys. Res., v. 82, p. 226 of Raumfahrtforschung, v. 19, n. 5, 1975.

------- HELIOS-B, ROSENBAUER------

INVESTIGATION NAME: SOLAR WIND PLASMA WAVE

INVESTIGATIVE PROGRAM CODE EL-12-250, SCIENCE

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS

INVESTIGATIVE PERSONNEL

Personnel

P J - D.A. GURNEY
01 - H. PELLEGRINO
01 - J. H. WOLFE

BRIEF DESCRIPTION

This experiment (5a) shared the 32 two-electron, electric antennas with a particle. The instrument consisted of a 16-channel spectrum analyzer with approximately logarithmically equispaced center frequencies. 16 log compressors, 16 high-resolution plasma data for a period starting before and after the event was recorded into spacecraft memory for a period ending after the triggering signal time. The maximum sampling rate of the spectrum data in this mode was 14,2 samples per s for each channel. One half of the dipole antenna failed to extend properly and was short circuit to the spacecraft ground. The resultant combination of a monopole which was calculated to have an effective length of approximately 3 m. The primary result was the loss of 6 dB in E field sensitivity due to the shorted antenna and the increase in the 176 kHz channel by 25 dB. Failure of the spacecraft formed a series of this particular spacecraft channel, which was band-pass filtered. There were many effects caused in the spacecraft memory. However, a combination of factors including the proper deployment of the monopole and constrictive spacecraft coating resulted in data from this spacecraft being of higher quality than data from other spacecraft. This included the use of a high level of data. The spacecraft was properly and adequately sampled. An event was recorded in the lower electromagnetic range. The resultant configuration failed. For the data, see J. Geophys. Res., v. 82, p. 226 of Raumfahrtforschung, v. 19, n. 5, 1975.

------- PIONEER 8, SCARF -------

INVESTIGATION NAME: PLASMA WAVE DETECTOR

INVESTIGATIVE PROGRAM CODE EL-12-250, SCIENCE

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS

INVESTIGATIVE PERSONNEL

Personnel

P J - T.L. SCARF
01 - R.H. GREEN

BRIEF DESCRIPTION

Electrostatic and electromagnetic plasma waves were measured in the solar wind near 1 AU using an unbalanced dipole antenna. The dipole was capacitively coupled to the spacecraft's plasma wave antennas. The dipole antenna was constructed in a manner that the dipole antenna failed to extend properly and was short circuit to the spacecraft ground. The resultant combination of a monopole which was calculated to have an effective length of approximately 3 m. The primary result was the loss of 6 dB in E field sensitivity due to the shorted antenna and the increase in the 176 kHz channel by 25 dB. Failure of the spacecraft formed a series of this particular spacecraft channel, which was band-pass filtered. There were many effects caused in the spacecraft memory. However, a combination of factors including the proper deployment of the monopole and constrictive spacecraft coating resulted in data from this spacecraft being of higher quality than data from other spacecraft. This included the use of a high level of data. The spacecraft was properly and adequately sampled. An event was recorded in the lower electromagnetic range. The resultant configuration failed. For the data, see J. Geophys. Res., v. 82, p. 226 of Raumfahrtforschung, v. 19, n. 5, 1975.

------- PIONEER 8, SCARF -------

INVESTIGATION NAME: ELECTRIC FIELD DETECTOR

INVESTIGATIVE PROGRAM CODE EL-12-250, SCIENCE

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS

INVESTIGATIVE PERSONNEL

Personnel

P J - T.L. SCARF
01 - R.H. GREEN

BRIEF DESCRIPTION

Electrostatic and electromagnetic plasma waves were measured in the solar wind near 1 AU using an unbalanced dipole antenna. The dipole was capacitively coupled to the spacecraft's plasma wave antennas. The dipole antenna was constructed in a manner that the dipole antenna failed to extend properly and was short circuit to the spacecraft ground. The resultant combination of a monopole which was calculated to have an effective length of approximately 3 m. The primary result was the loss of 6 dB in E field sensitivity due to the shorted antenna and the increase in the 176 kHz channel by 25 dB. Failure of the spacecraft formed a series of this particular spacecraft channel, which was band-pass filtered. There were many effects caused in the spacecraft memory. However, a combination of factors including the proper deployment of the monopole and constrictive spacecraft coating resulted in data from this spacecraft being of higher quality than data from other spacecraft. This included the use of a high level of data. The spacecraft was properly and adequately sampled. An event was recorded in the lower electromagnetic range. The resultant configuration failed. For the data, see J. Geophys. Res., v. 82, p. 226 of Raumfahrtforschung, v. 19, n. 5, 1975.
A quadrantspherical electrostatic analyzer with eight contiguous current collectors was used to study the directional intensity of the electrons and positive ions in the solar wind. Ions were detected in 16 logarithmically equispaced energy per unit charge (E/Q) steps, ranging from 2 to 503 V. Eight collectors measured particles incident from each of the eight contiguous angular intervals relative to the spacecraft equatorial plane (same as the ecliptic plane). Three different modes of data collection were used. The full scan mode was alternated with the maximum flux mode at each 1/6th step. In the full scan mode, the data were taken in 16 contiguous 20-deg intervals, and the maximum flux mode alone was used. Thus, no pristinal distributions were observed. At the highest bit rate (256 bps), the maximum flux mode alone was used. Such distributions were observed at the lowest bit rate (256 bps). The low bit rate was used to study the directional intensity of the electrons and positive ions in the solar wind. During the short scan mode, the data were taken in 16 contiguous 20-deg intervals, and the maximum flux mode alone was used. Thus, no pristinal distributions were observed. At the highest bit rate (256 bps), the maximum flux mode alone was used. Such distributions were observed at the lowest bit rate (256 bps).
rates (64, 16, and 8 bps), the maximum flux mode was used at each 1/6 step followed by either (3) for ions, a polar scan and an azimuthal scan at that 1/6 step where the peak flux measurement during the maximum flux mode was obtained, or (2) for electrons, a polar scan and an azimuthal scan at 1/6 step. In the maximum flux mode, only the central collector was observed, and the peak flux obtained and the azimuthal direction (to 21/216 deg) of the observation were reported. A complete set of electron measurements was obtained at 1/6 step. At the high bit rates (512 and 256 bps) one set of ion measurements took 62 s and one set of electron measurements 35 s. At the low bit rates (4x, 16, and 8 bps), one set of ion measurements took 37 s and one set of electron measurements 29 s. At 64 bps, a complete set of measurements (seven tons plus one electron) was taken and telemetered every 622.5 s. At 16 bps, it took 1618 s and at 0 bps it took 3220 s.

--- PIONEER 7, NESS ---

INVESTIGATION NAME: energetic electron and proton detector
NSSDC ID: 74-027A-10
INVESTIGATIVE PROGRAM CORE EL-4/COP-SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS
PERSONNEL
PI - C. KEPPLER
01 - H. WILKEN
01 - D.J. WILLIAMS
NSSDC PERSONNEL
BRIEF DESCRIPTION
The objective of the experiment (28) was to study the origin and the distribution mechanism of low-energy electrons and protons. The instrument, a magnetic spectrometer, consisted of six semiconductor detectors with the field of view in the plane of the ecliptic. Species separation was achieved by detecting particles parallel to the field lines and perpendicular to the particle path. Four electron and two proton detectors measured electrons from 0 to 1000 keV and protons from 0 to 1000 keV. The proton measurements were made with a two-detector telescope employing coincidence and anticoincidence logic. Both particle species were measured in 16 energy channels through pulse-height analysis. For further information see pp. 261-263 of Raumfahrtforschung, v. 19, n. 5, 1975.

--- HELIOS-B, KEPPLER ---

INVESTIGATION NAME: energetic electron and proton detector
NSSDC ID: 76-027A-10
INVESTIGATIVE PROGRAM CORE EL-4/COP-SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS
PERSONNEL
PI - C. KEPPLER
01 - H. WILKEN
01 - D.J. WILLIAMS
NSSDC PERSONNEL
BRIEF DESCRIPTION
The objective of the experiment (28) was to study the origin and the distribution mechanism of low-energy electrons and protons. The instrument, a magnetic spectrometer, consisted of six semiconductor detectors with the field of view in the plane of the ecliptic. Species separation was achieved by detecting particles parallel to the field lines and perpendicular to the particle path. Four electron and two proton detectors measured electrons from 0 to 1000 keV and protons from 0 to 1000 keV. The proton measurements were made with a two-detector telescope employing coincidence and anticoincidence logic. Both particle species were measured in 16 energy channels through pulse-height analysis. For further information see pp. 261-263 of Raumfahrtforschung, v. 19, n. 5, 1975.

--- PIONEER 9, SONETT ---

INVESTIGATION NAME: Triaxial magnetometer
NSSDC ID: 68-296A-01
INVESTIGATIVE PROGRAM CORE EL-4/SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS
PERSONNEL
PI - G.B. GLOVER
01 - J.P. COWLE
NSSDC PERSONNEL
BRIEF DESCRIPTION
A simple, single-axis, magnetometer was used to study the interplanetary magnetic field and its fluctuations. The sensors were orthogonally mounted with one axis parallel to the spacecraft spin axis. Upon command, a 3-axis stinger spirals in the plane of the spacecraft. For an appropriate period, the magnetometer is activated, and the signals are transmitted to earth. The magnetic field component, which had ranges of plus or minus 5000 nT, is resolved into 16 telemetry words. Nine magnetic field components, comprising three magnetic field vectors, were transmitted in each spacecraft telemetry frame.
PERSONNEL

PI - F. NESS
01 - F. HABER
01 - L. WALLACE
01 - H. SPANDANO

NASA-GSFC
ENR. SPACE PLASMA LAB

INVESTIGATION NAME - FLUKE MAGNETOMETER FOR AVERAGE FIELDS

NSSDC ID - 74-a040-cd

INVESTIGATIVE PROGRAM

CODE EL-4/C0-OP, SCIENCE

INVESTIGATION DISCIPLINES

PARTICLES AND FIELDS

PERSONNEL

PI - F. NESS
01 - F. HABER
01 - L. WALLACE
01 - H. SPANDANO

NASA-GSFC
U. OF HOME
ENR. SPACE PLASMA LAB

BRIEF DESCRIPTION

The experiment (cd) consisted of a boom-mounted triaxial-fluxgate magnetometer. An automatic infilght range switch system selected the optimum four ranges that were minus plus 16, 9.94, and 432 nT per sensor. These had corresponding digitization resolutions of minus plus 0.55, 0.49, 0.28, and 0.08 nT. A sensor flipper was actuated every 56 h to assist in sensor zero level determination. For telemetry bit rates above 275 kbps, vector measurements were made at rates between 1 and 16 per s depending on bit rates. At lower bit rates averages and variances were computed on board for transmission to earth.

------ HELIOS-B, NESS------

INVESTIGATION NAME - FLUKE MAGNETOMETER FOR FIELD FLUCTUATIONS

NSSDC ID - 74-a073-cd

INVESTIGATIVE PROGRAM

CODE EL-4/C0-OP, SCIENCE

INVESTIGATION DISCIPLINES

PARTICLES AND FIELDS

PERSONNEL

PI - F. NESS, MAIER
01 - A. MAIER

NASA-GSFC
U. OF KÖLN
BRAUNSCHWEIG TECH U

BRIEF DESCRIPTION

The instrument (cd) consisted of a triaxial fluxgate magnetometer mounted on a 2.75-m boom to make magnetic field measurements up to 6 Hz. Data from each axis were first sent through a low-pass filter with the 3 dB attenuation point at 6 Hz, depending on the telemetry format and bit rate. The data were fed either into a time-averaging computer or directly connected to telemetry. A shock identification computer triggered the storage of rapid-rate data in the spacecraft memory when there were discontinuities in the variations of the ambient magnetic field. Two measurement ranges were used: plus or minus 133 or 420 nT with resolutions of plus or minus 0.2 and 0.8 nT, respectively. The instrument was equipped with a flipper mechanism, which reoriented each sensor by 90° periodically, for detailed information, see p. 232 of Raumfahrtorschung v. 19 n. 5, 1975.

------ HELIOS-B, NESS------

INVESTIGATION NAME - FLUKE MAGNETOMETER FOR FIELD FLUCTUATIONS

NSSDC ID - 74-a033-cd

INVESTIGATIVE PROGRAM

CODE EL-4/C0-OP, SCIENCE

INVESTIGATION DISCIPLINES

PARTICLES AND FIELDS

PERSONNEL

PI - F. NESS, MAIER
01 - A. MAIER

NASA-GSFC
U. OF KÖLN
BRAUNSCHWEIG TECH U

BRIEF DESCRIPTION

The instrument (cd) consisted of a triaxial fluxgate magnetometer mounted on a 2.75-m boom to make magnetic field measurements up to 6 Hz. Data from each axis were first sent through a low-pass filter with the 2.5 dB attenuation point at 2.5 Hz, depending on the telemetry format and bit rate. The data were fed either into a time-averaging computer or directly connected to telemetry. A shock identification computer triggered the storage of rapid-rate data in the spacecraft memory when there were discontinuities in the variations of the ambient magnetic field. Two measurement ranges were used: plus or minus 133 or 420 nT with resolutions of plus or minus 0.2 and 0.8 nT, respectively. The instrument was equipped with a flipper mechanism, which reoriented each sensor by 90° periodically, for detailed information, see p. 232 of Raumfahrtorschung v. 19 n. 5, 1975.

------ HELIOS-B, NESS------

INVESTIGATION NAME - SEARCH COIL MAGNETOMETER

NSSDC ID - 74-a074-cd

INVESTIGATIVE PROGRAM

CODE EL-4/C0-OP, SCIENCE

INVESTIGATION DISCIPLINES

PARTICLES AND FIELDS

PERSONNEL

PI - F. NESS, MAIER
01 - A. MAIER

NASA-GSFC
U. OF KÖLN
BRAUNSCHWEIG TECH U

BRIEF DESCRIPTION

The experiment (cd) was designed to investigate the magnetic components of electromagnetic waves in the solar wind from 0.5 to 6 AU. By means of its waveform channel (wfc), the rapid variations of the magnetic field were measured up from plus or minus 0.25 to plus or minus 250 nT in three orthogonal directions from 4 to 60 Hz. A spectrum analyzer observed the field components in the plane perpendicular to 1, to obtain the power spectral density and peak values for eight logarithmically spaced channels in the range from 4 to 256 Hz. Because of the large amount of data produced by this experiment, no detailed information was applied. For interesting time intervals selected by the fluxgate magnetometer (ﰌर्षर्ष-क्ष) or waveform (wfc), waveform data could be read into an onboard memory at a rapid rate. For more detailed information, see p. 241 in Raumfahrtorschung v. 19 n. 5, 1975.

------ HELIOS-B, NESS------

INVESTIGATION NAME - SEARCH COIL MAGNETOMETER

NSSDC ID - 74-a034-cd

INVESTIGATIVE PROGRAM

CODE EL-4/C0-OP, SCIENCE

INVESTIGATION DISCIPLINES

PARTICLES AND FIELDS

PERSONNEL

PI - F. NESS, MAIER
01 - A. MAIER

NASA-GSFC
U. OF KÖLN
BRAUNSCHWEIG TECH U

BRIEF DESCRIPTION

This experiment (cd) was designed to investigate the magnetic components of electromagnetic waves in the solar wind from 0.5 to 6 AU. By means of its waveform channel (wfc), the rapid variations of the magnetic field were measured up from plus or minus 0.25 to plus or minus 250 nT in three orthogonal directions from 4 to 60 Hz. A spectrum analyzer observed the field components in the plane perpendicular to 1, to obtain the power spectral density and peak values for eight logarithmically spaced channels in the range from 4 to 128 Hz. Because of the large amount of data produced by this experiment, no detailed information was applied. For interesting time intervals selected by the fluxgate magnetometer (ڑर्षर्षक्ष) or waveform (wfc), waveform data could be read into an onboard memory at a rapid rate. For more detailed information, see p. 241 in Raumfahrtorschung v. 19 n. 5, 1975.
rate to be transmitted slowly afterwards. For more detailed information see p. 241 in Recherche en Astrophysique et Planetologie, 1975.

-------- PIONEER 5. WINCHELTER

INVESTIGATION NAME: PROPORTIONAL COUNTER TELESCOPE

NSSDC 10-2-321-01 INVESTIGATIVE PROGRAM CODE EL-4: SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS

PERSONNEL
PI - J. A. WINCHELTER
OI - R. W. HOPKIN
OI - U. OF MINNESOTA

BRIEF DESCRIPTION
This experiment consisted of a proportional counter telescope and an anticoincidence shield. The telescope was used to detect and measure the fluxes of energetic charged particles. The experiment used four silicon detectors to study anisotropy and fluctuations of solar protons and alpha particles. The proton energy ranges sampled were 0.1 to 0.4 MeV, 0.5 to 1.0 MeV, 1.1 to 1.6 MeV, and 1.7 to 2.0 MeV. The time resolution ranged from about 0.1 to 0.2 seconds. The experiment was launched on March 15, 1960. Unaccompanied by pulses from the plastic scintillator, the energy resolutions were better than 1% for the two silicon detectors. The detector was mounted on the spacecraft spin axis and the anisotropy was measured for the last event prior to each time resolution event. Further details are given in Ref. 2.3.40.

-------- PIONEER 5. SIMPSON

INVESTIGATION NAME: COSMIC-RAY ANISOTROPY

NSSDC 10-2-324-05 INVESTIGATIVE PROGRAM CODE EL-4: SCIENCE
INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS

PERSONNEL
PI - J. A. SIMPSON
OI - C. Y. FAN
OI - U. OF ARIZONA
OI - J. H. LAMPERT
OI - U. OF CHICAGO

BRIEF DESCRIPTION
This experiment used a charged particle telescope comprising four silicon semiconductor detectors to study the anisotropy and fluctuations of solar protons and alpha particles. The proton energy ranges sampled were 0.1 to 0.4 MeV, 0.5 to 1.0 MeV, 1.1 to 1.6 MeV, and 1.7 to 2.0 MeV. The alpha particle energy ranges sampled were 2.2 to 5.0 MeV between 175 MeV and 2085 MeV. The time resolution ranged from about 0.1 to 0.2 seconds. The detector was mounted on the spacecraft spin axis and the anisotropy was measured for the last event prior to each time resolution event. Further details are given in Ref. 2.3.40.
and for the nondirectional mode varied between 14.1 and 112 s.

The second, spin-integrated sector was used. 31 depending on the telemetry bit rate. See Bartley et al., Rev. Sci. Instrum., v. 38, p. 1964-1967, for a more detailed experiment description.

-------- PIONEER H. MCRAKEN--------

INVESTIGATION NAME: COSMIC-RAY ANISOTROPHY

NSSDC ID: 66-075A-03 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS COSMIC RAYS

PERSONNEL

PI - H. MCRAKEN
OL - W.T. BARTLEY
01 - U.R. RAO

1540 SATELLITE CENTER

BRIEF DESCRIPTION

This experiment was designed primarily to measure the directional characteristics of galactic and solar cosmic-ray fluxes. Primarily each sector was a CsI photomultiplier tube viewed the two scintillators. Pulses from the CsI crystal that were not accompanied by pulses from the plastic scintillator were sorted by a three-window pulse-height analyzer, the windows corresponding to energy deposits in the 0.7 to 6.7, 6.7 to 47.4, and 47.4 to 64.5 and 64.5 to 81.2 MeV. No positive identification was made to either. Part of the counts in each window were usually due to protons with the window energies. For each energy window counter was oriented in a fan arrangement with respect to the four solid-state detector, such that each of the four telescopes was located in a telescope with the fourth detector. Each of the three telescopes thus formed had a geometric factor of 0.155. The telescope acceptance cone was 38.2-deg in width. The telescope acceptance cone was 38.2-deg in width. The direction of the telescopes were in the ecliptic plane and 48 deg above and below that plane, respectively. Two concurrent modes of counting were employed. In the first mode, counts were accumulated in eight separate 45-deg intervals during the spacecraft spin period. In the second spin-integrated counts were accumulated in eight separate 45-deg intervals during the spacecraft spin period. In the first mode, the scintillator separately measured particles with energies in the ranges 7.4 to 21.7 MeV/atom and 26.8 to 64.5 MeV/atom. A third coincidence mode measured the sum of counts due to electrons above 0.6 MeV and nuclides above 14 MeV/atom. A third coincidence mode measured the sum of counts due to electrons above 0.6 MeV and nuclides above 14 MeV/atom. A fourth coincidence mode measured the sum of counts due to electrons above 42 MeV/atom and electrons above 5.7 MeV. A spacecraft spin-integrated directional fluxes were measured in the various modes. The measured intervals between the acceptance cones were dependent on the brightness bit rate and were typically in terms of 90 deg. In all cases, these were longer than the spacecraft spin period.

-------- HELIOS NA TRAVERS--------

INVESTIGATION NAME: GALACTIC AND SOLAR COSMIC RAYS

NSSDC ID: 66-100A-06 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS COSMIC RAYS

PERSONNEL

PI - W.R. WEBER

U OF NEW HAMPSHIRE

BRIEF DESCRIPTION

This experiment utilized a telescope comprised of five solid-state sensors, a Cerenkov detector, and an anticoincidence shield. The spacecraft axis was perpendicular to the spacecraft spin axis. As determined by two coincidence modes and electronic discriminator, particles measured were electrons with energies between 0.9 and 6.3 MeV (one of five count rates was due to the sum of counts in two noncontiguous energy intervals). A third coincidence mode measured the sum of counts due to electrons above 0.6 MeV and nuclides above 14 MeV/atom. A fourth coincidence mode measured the sum of counts due to electrons above 42 MeV/atom and electrons above 5.7 MeV. The spacecraft spin-integrated directional fluxes were measured in the various modes. The measured intervals between the acceptance cones were dependent on the telemetry bit rate and were typically in terms of 90 deg. In all cases, these were longer than the spacecraft spin period.

-------- PIONEER 9. WEBER--------

INVESTIGATION NAME: COSMIC-RAY ANISOTROPHY

NSSDC ID: 66-123A-06 INVESTIGATIVE PROGRAM CODE EL-4, SCIENCE

INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS COSMIC RAYS

PERSONNEL

PI - H. WEBER

U OF NEW HAMPSHIRE

BRIEF DESCRIPTION

This experiment utilized a telescope comprised of five solid-state sensors, a Cerenkov detector, and an anticoincidence shield. The spacecraft axis was perpendicular to the spacecraft spin axis. As determined by two coincidence modes and electronic discriminator, particles measured were electrons with energies between 0.9 and 6.3 MeV (one of five count rates was due to the sum of counts in two noncontiguous energy intervals). A third coincidence mode measured the sum of counts due to electrons above 0.6 MeV and nuclides above 14 MeV/atom. A fourth coincidence mode measured the sum of counts due to electrons above 42 MeV/atom and electrons above 5.7 MeV. The spacecraft spin-integrated directional fluxes were measured in the various modes. The measured intervals between the acceptance cones were dependent on the telemetry bit rate and were typically in terms of 90 deg. In all cases, these were longer than the spacecraft spin period.
ranges 3.6-22.1 and 0-21.2 MeV, and electrons in four ranges between 0.32 and 2 MeV. A neutron telescope with cosmic-ray particles with energies 31.3 MeV/nucleon and electrons 30.3 MeV were measured within interplanetary space over the range 0.3 to 1.0 AU. The instrument, a particle telescope with a 55-degree field of view, was equipped with five scintillation detectors, one magnet, a plastic scintillator, and an anticoincidence cylinder. The telescope was calibrated prior to launch using radioactive sources, particle accelerators, and ground-level muons. It measured protons and alpha particles in six channels (0.3-1.0, 2.0-3.0, 4.0-6.0, 6.0-10.0, and 10.0-30.0 MeV). For more details see pp. 253-256 of 'Raumlufte und Erde' v. 19, n. 5, 1975.

HELIOS-A, TRAENOR

INVESTIGATION NAME: GALACTIC AND SOLAR COSMIC RAYS

NSSDC 10- 65-105A-05 INVESTIGATIVE PROGRAM CODE EL-4/SCIENCE INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS COSMIC RAYS

PERSONNEL
PI: J.H. TRAENOR NASA/GSFC
01: J.C. ROYER APPLIED PHYSICS LAB
01: G.J. REEGROD NASA/GSFC
01: J.A. MCDONALD NASA/GSFC
01: K.-E. MEERCKEN CSIRO

BRIEF DESCRIPTION

The detector complement of this experiment (37) consisted of three separate delta E/delta x vs E telescopes and a proportional counter for monitoring solar x rays in the range 2-50 keV. The high-energy telescope has a geometric factor of 0.20 sq cm and measured electrons in three ranges between 2 and 8 MeV, and protons and alpha particles in three ranges between 21 and 56 MeV. Protons above 253 MeV were also measured. The first low-energy telescope (geometric factor was 0.01 sq cm) measured protons and alpha particles in three ranges between 2 and 21 MeV. The second low-energy telescope (geometric factor was 0.01 sq cm) measured protons in several ranges between 0.12 and 2.1 MeV, alpha particles in the range 0.12-2.1 MeV, and electrons in four ranges between 1.2 and 21 MeV. For a number of coincidences the telescope was placed in a direction of 45 degrees from the spacecraft for a total measured of 2.5 MeV. In this condition electrons were cut-off and the rate data cycle was on the order of 5 min. At the lowest combination of bit rate and format, a complete data cycle required about 2.5 h. For further details see IEEE Trans. on Nuc. Sci., v. 23, p. 576, 1975 and pp. 253-256 of Raumlufte und Erde v. 19, n. 5, 1975.

HELIOS-A, KUNDR

INVESTIGATION NAME: COSMIC-RAY PARTICLES

NSSDC 10- 65-105A-07 INVESTIGATIVE PROGRAM CODE EL-4/SCIENCE INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS COSMIC RAYS

PERSONNEL
PI: H. KUNDR U OF KIEL
01: G.H. WIDDER U OF KIEL
01: G. GREEN U OF KIEL
01: M. MUELLER-MILLER U OF KIEL
01: M. WHITE U OF KIEL
01: H. NEUMANN U OF KIEL

BRIEF DESCRIPTION

The objective of the experiment was to study high-energy charged cosmic-ray particles of solar, planetary, and galactic origin in interplanetary space. Protons and alpha particles with energies 31.3 MeV/nucleon, and electrons 24.4 MeV were measured within interplanetary space over the range from 0.3 to 1.0 AU. The instrument, a particle telescope with a 55-degree field of view, consisted of five semiconductor detectors, one magnet, a plastic scintillator, and one anticoincidence counter, all enclosed by an anticoincidence cylinder. The telescope was calibrated prior to launch using radioactive sources, particle accelerators, and ground-level muons. It measured protons and alpha particles in six channels (0.3-3.3, 3.3-13, 13-27, 27-37, 37-45, and 45 MeV/nucleon) and electrons in five energy channels (0.3-3.3, 3.3-6.0, 6.0-9.0, 9.0-12.0, and 12.0-21.0 MeV). For more details see pp. 253-256 of 'Raumlufte und Erde' v. 19, n. 5, 1975.

HELIOS-A, KUNDR

INVESTIGATION NAME: COSMIC-RAY PARTICLES

NSSDC 10- 65-105A-09 INVESTIGATIVE PROGRAM CODE EL-4/SCIENCE INVESTIGATION DISCIPLINE(S) PARTICLES AND FIELDS COSMIC RAYS

PERSONNEL
PI: V.K. ESHLEMAN STANFORD U
01: T.A. COFFIT SKL INTERNATIONAL
01: W.L. LEAHOAD SKL INTERNATIONAL
01: O.E. GANNSTE NASCAR-JSC
01: A.M. PETERSON STANFORD U

BRIEF DESCRIPTION

The purpose of this experiment was to use the tracking data from the ion spectrometer to obtain primary determinations of the masses of the earth and moon, the astronomical units, and the disturbing moments of the planets of the solar system. This was appropriate because of the absence of interaural orbit corrections and inter-planetary encounters. Also, solar radiation pressure effects could be eliminated. The instrument consisted of onboard receiver and transmitter equipment in conjunction with Deep Space Network spacecraft station equipment to obtain Doppler measurements.

PIONEER 6, ESHLEMAN

INVESTIGATION NAME: RADIO SCIENCE AND CELESTIAL MECHANICS

NSSDC 10- 65-105A-09 INVESTIGATIVE PROGRAM CODE EL-4/SCIENCE INVESTIGATION DISCIPLINE(S) CELESTIAL MECHANICS

PERSONNEL
PI: V.K. ESHLEMAN STANFORD U

BRIEF DESCRIPTION

The objective of the experiment was to study high-energy charged cosmic-ray particles of solar, planetary, and galactic origin in interplanetary space. Protons and alpha particles with energies 31.3 MeV/nucleon, and electrons 24.4 MeV were measured within interplanetary space over the range from 0.3 to 1.0 AU. The instrument, a particle telescope with a 55-degree field of view, consisted of five semiconductor detectors, one magnet, a plastic scintillator, and one anticoincidence counter, all enclosed by an anticoincidence cylinder. The telescope was calibrated prior to launch using radioactive sources, particle accelerators, and ground-level muons. It measured protons and alpha particles in six channels (0.3-3.3, 3.3-13, 13-27, 27-37, 37-45, and 45 MeV/nucleon) and electrons in five energy channels (0.3-3.3, 3.3-6.0, 6.0-9.0, 9.0-12.0, and 12.0-21.0 MeV). For more details see pp. 253-256 of 'Raumlufte und Erde' v. 19, n. 5, 1975.

HELIOS-A, KUNDR

INVESTIGATION NAME: SPACE PHYSICS

NSSDC 10- 65-105A-09 INVESTIGATIVE PROGRAM CODE EL-4/SCIENCE INVESTIGATION DISCIPLINE(S) SPACE PHYSICS

PERSONNEL
PI: R. H. THOMAS STANFORD U
01: R.E. MCNULTY U OF KIEL
01: R.J. UHDE U OF KIEL
01: K.A. MATHIS U OF KIEL
01: M. MUELLER-MILLER U OF KIEL
01: K. SCHWARTZ U OF KIEL

BRIEF DESCRIPTION

The objective of the experiment was to study high-energy charged cosmic-ray particles of solar, planetary, and galactic origin in interplanetary space. Protons and alpha particles with energies 31.3 MeV/nucleon, and electrons 30.3 MeV were measured within interplanetary space over the range from 0.3 to 1.0 AU. The instrument, a particle telescope with a 55-degree field of view, consisted of five semiconductor detectors, one magnet, a plastic scintillator, and one anticoincidence counter, all enclosed by an anticoincidence cylinder. The telescope was calibrated prior to launch using radioactive sources, particle accelerators, and ground-level muons. It measured protons and alpha particles in six channels (0.3-1.0, 2.0-3.0, 4.0-6.0, 6.0-10.0, and 10.0-30.0 MeV). For more details see pp. 253-256 of 'Raumlufte und Erde' v. 19, n. 5, 1975.
Both 423.3-MHz and its 267 subharmonic 49.8-MHz signals were transmitted from a 4.6-m steerable parabolic antenna at Stanford University to the two-frequency radio receiver on the spacecraft. The high-frequency signal served as a reference signal since its propagation time was not appreciably delayed. The low-frequency signal was delayed in proportion to the total electron content in the propagation path. On the spacecraft, a phase-locked receiver counted the beat frequency zero crossings of the received signals to obtain measurements of phase-path differences. Differential delay of the group velocity was also observed; and these values were teleletered to the ground station. From calculated total electron content values, the ionospheric effect (up to a selected altitude obtained from other experimental techniques) was subtracted to produce data describing the interplanetary electron content of the solar wind and its variations. The experiment operated nominally from March to May 20. The two-frequency experiments covering other time periods see 65-1034-03, 67-1130-04, and 67-1154-05. Detailed descriptions of the experiment can be found in J. Geophys., v. 17, p. 3255-3272, 1966, and in Radio Sci., v. 1, p. 55-63, 1966.

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INVESTIGATION NAME: TWO-FREQUENCY BEACON RECEIVER

**NSSDC ID:** 66-0754-04

**INVESTIGATIVE PROGRAM**

CODE EL+4, SCIENCE

**INVESTIGATION DISCIPLINE(S)**

IONOSPHERES AND RADIO PHYSICS

**PERSONNEL**

PI - J. K. ESHLEMAN

01 - T. J. CROFT

SRI INTERNATIONAL

**BRIEF DESCRIPTION**

Both 423.3-MHz and its 267 subharmonic 49.8-MHz signals were transmitted from a 4.6-m steerable parabolic antenna at Stanford University to the two-frequency radio receiver on the spacecraft. The high-frequency signal served as a reference signal since its propagation time was not appreciably delayed. The low-frequency signal was delayed in proportion to the total electron content in the propagation path. On the spacecraft, a phase-locked receiver counted the beat frequency zero crossings of the received signals to obtain measurements of phase-path differences. Differential delay of the group velocity was also observed; and these values were teleletered to the ground station. From calculated total electron content values, the ionospheric contribution (up to a selected altitude obtained from other experimental techniques) was subtracted to produce data describing the interplanetary electron content of the solar wind and its variations. The experiment operated nominally from March to May 20. The two-frequency experiments covering other time periods see 65-1034-03, 67-1130-04, and 67-1154-05. Detailed descriptions of the experiment can be found in J. Geophys., v. 17, p. 3255-3272, 1966, and in Radio Sci., v. 1, p. 55-63, 1966.

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INVESTIGATION NAME: TWO-FREQUENCY BEACON RECEIVER

**NSSDC ID:** 67-1224-05

**INVESTIGATIVE PROGRAM**

CODE EL+4, SCIENCE

**INVESTIGATION DISCIPLINE(S)**

IONOSPHERES AND RADIO PHYSICS

**PERSONNEL**

PI - V.K. ESHLEMAN

01 - C. C. HOWARD

SRI INTERNATIONAL

**BRIEF DESCRIPTION**

Both 423.3-MHz and its 267 subharmonic 49.8-MHz signals were transmitted from a 4.6-m steerable parabolic antenna at Stanford University to the two-frequency radio receiver on the spacecraft. The high-frequency signal served as a reference signal since its propagation time was not appreciably delayed. The low-frequency signal was delayed in proportion to the total electron content in the propagation path. On the spacecraft, a phase-locked receiver counted the beat frequency zero crossings of the received signals to obtain measurements of phase-path differences. Differential delay of the group velocity was also observed; and these values were teleletered to the ground station. From calculated total electron content values, the ionospheric contribution (up to a selected altitude obtained from other experimental techniques) was subtracted to produce data describing the interplanetary electron content of the solar wind and its variations. The experiment operated nominally from March to May 20. The two-frequency experiments covering other time periods see 65-1034-03, 67-1130-04, and 67-1154-05. Detailed descriptions of the experiment can be found in J. Geophys., v. 17, p. 3255-3272, 1966, and in Radio Sci., v. 1, p. 55-63, 1966.

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INVESTIGATION NAME: TWO-FREQUENCY BEACON RECEIVER

**NSSDC ID:** 74-0754-05

**INVESTIGATIVE PROGRAM**

CODE EL+4, SCIENCE

**INVESTIGATION DISCIPLINE(S)**

IONOSPHERES AND RADIO PHYSICS

**PERSONNEL**

PI - J.A. GURNET

01 - F.J. KELLOGG

01 - J.S. BAER

01 - H.S. STONE

NASA-GSFC

**BRIEF DESCRIPTION**

This experiment (5eb) shared the 32 w. tip-to-tip dipole antenna with experiments 40e and 40f. Instrumentation consisted of three tunable plasma wave receivers, a fixed-frequency wideband receiver, and a waveform sampler. The tunable receivers were low-pass filters with corner frequency dependent on the solar wind. Each of the tunable receivers covered a different frequency band in the waveform sampler. The low-frequency receiver had 16 frequency settings separated by about 1 kHz and covered the range 0.48 kHz to 212 kHz. The high-frequency receiver had 16 frequency settings separated by about 1 kHz and covered the range 205 kHz to 212 kHz. The low-frequency receiver had 24 settings with 16% separation and covered the range 205 kHz to 212 kHz. The high-frequency receiver had 24 settings with 16% separation and covered the range 205 kHz to 212 kHz. The high-frequency receiver had 24 settings with 16% separation and covered the range 205 kHz to 212 kHz. The time resolution depended on detail in the spacecraft telemetry format; bit rate, and experiment operational mode. When the shock alarm mode became activated, the waveform receiver was read into spacecraft memory for a period of time before and after the activating event. In this mode, the instantaneous voltage across the antenna was passed through a low-pass filter with corner frequency dependent on the sampling rate, and measured at discrete intervals, the most rapid being 2.6 ms. One half of the electron dipole failed to display properly and became short-circuited to ground. The resulting waveform, and the remaining one, was of an operational effective length of about 8 km. This resulted in a 10% loss in sensitivity; and an increased receiver noise level, particularly at low frequencies. In addition, the high-magnitude telemetry antenna produced polarization effects. For a more detailed discussion, see pp. 249 of Van Allen's book, v. 1, p. 55-63, 1975.

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INVESTIGATION NAME: TWO-FREQUENCY BEACON RECEIVER

**NSSDC ID:** 76-0234-05

**INVESTIGATIVE PROGRAM**

CODE EL+4, SCIENCE

**INVESTIGATION DISCIPLINE(S)**

IONOSPHERES AND RADIO PHYSICS

**PERSONNEL**

PI - R.A. GURNET

01 - P.J. KELLOGG

01 - J.S. BAER

01 - H.S. STONE

NASA-GSFC

**BRIEF DESCRIPTION**

This experiment (6eb) shared the 32 w. tip-to-tip dipole antenna with experiments 40e and 40f. Instrumentation consisted of three tunable plasma wave receivers, a fixed-frequency wideband receiver, and a waveform sampler. The tunable receivers were low-pass filters with corner frequency dependent on the solar wind. Each of the tunable receivers covered a different frequency band in the waveform sampler. The low-frequency receiver had 16 frequency settings separated by about 1 kHz and covered the range 0.48 kHz to 212 kHz. The high-frequency receiver had 16 frequency settings separated by about 1 kHz and covered the range 205 kHz to 212 kHz. The time resolution depended on detail in the spacecraft telemetry format; bit rate, and experiment operational mode. When the shock alarm mode became activated, the waveform receiver was read into spacecraft memory for a period of time before and after the activating event. In this mode, the instantaneous voltage across the antenna was passed through a low-pass filter with corner frequency dependent on the sampling rate, and measured at discrete intervals, the most rapid being 2.6 ms. One half of the electron dipole failed to display properly and became short-circuited to ground. The resulting waveform, and the remaining one, was of an operational effective length of about 8 km. This resulted in a 10% loss in sensitivity; and an increased receiver noise level, particularly at low frequencies. In addition, the high-magnitude telemetry antenna produced polarization effects. For a more detailed discussion, see pp. 249 of Van Allen's book, v. 1, p. 55-63, 1975.
Frequency settings separated by 8 percent and covered the range from 20 kHz to 200 kHz. The receiver was synchronized such that each frequency bin was covered by 16 logarithmically spaced channels, was used to detect type IV radio emissions associated with solar flares. The experiment sampling rate was synchronized such that each spacecraft revolution was divided into 32 sectors, and the spacecraft bit rate. The most rapid sampling possible for a single frequency channel to be sampled for 16 channels was once every 32 s, for a typical sputtering was read into spacecraft memory for a period following the four-sector revolution. In this mode, the instantaneous voltage across the antenna was passed through a low-pass filter with corner frequency dependent on the sampling rates and measured at discrete intervals, the most rapid being 5.2 ms. For a more detailed discussion see p. 268 of Raumfahrtforschung, v. 19, n. 5, 1975.

INVESTIGATION NAME: INTERPLANETARY PARTICLES

NSSDC ID: 74-0374-04

INVESTIGATIVE PROGRAM CODE: EL-14/DQ-0P

INVESTIGATION DISCIPLINE(S):

PARTICLES AND FIelds

SOlar PHYSICS

PERSONNEL

PI - R.A. GURNETT
DI - P.J. KELLOG
DI - J.G. WEIDEN
DI - R.G. STONE

BRIEF DESCRIPTION

The experiment (K5c) shared the 32-m dipole antenna with experiments 48 and 49. A dual channel (16 frequency channels) was used to detect type III radio emissions associated with solar flares. The experiment sampling rate was synchronized such that each spacecraft revolution was divided into 32 sectors, and the spacecraft bit rate. The most rapid sampling possible for a single frequency channel was once every 32 s, for a typical sputtering was read into spacecraft memory for a period following the four-sector revolution. In this mode, the instantaneous voltage across the antenna was passed through a low-pass filter with corner frequency dependent on the sampling rates and measured at discrete intervals, the most rapid being 5.2 ms. For a more detailed discussion see p. 268 of Raumfahrtforschung, v. 19, n. 5, 1975.

INVESTIGATION NAME: INTERPLANETARY PARTICLES

NSSDC ID: 74-0374-05

INVESTIGATIVE PROGRAM CODE: EL-14/DQ-0P

INVESTIGATION DISCIPLINE(S):

PARTICLES AND FIelds

SOlar PHYSICS

PERSONNEL

PI - R.A. GURNETT
DI - P.J. KELLOG
DI - J.G. WEIDEN
DI - R.G. STONE

BRIEF DESCRIPTION

The experiment (K5c) shared the 32-m dipole antenna with experiments 48 and 49. A dual channel (16 frequency channels) was used to detect type III radio emissions associated with solar flares. The experiment sampling rate was synchronized such that each spacecraft revolution was divided into 32 sectors, and the spacecraft bit rate. The most rapid sampling possible for a single frequency channel was once every 32 s, for a typical sputtering was read into spacecraft memory for a period following the four-sector revolution. In this mode, the instantaneous voltage across the antenna was passed through a low-pass filter with corner frequency dependent on the sampling rates and measured at discrete intervals, the most rapid being 5.2 ms. For a more detailed discussion see p. 268 of Raumfahrtforschung, v. 19, n. 5, 1975.

INTERPLANETARY PARTICLES

----- HELIOS-B. FECHSIG -----
Table 3. U.S. Lunar Mission Data

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Legend:
- ● All or partial data at NSSDC
- ○ Experiment failed
- X No data at NSSDC
- Experiment aborted

*Data also available.

Included with telerayed data.
Included with Lunar and Hobson data.
Appendixes
### APPENDIX A

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APPENDIX D - DEFINITIONS

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

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

NLA - No Longer Affiliated. Used in the spacecraft personnel section and occasionally with investigations to indicate that the person had the specified affiliation at the time of his participation in the project, but 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., 72-012A for the spacecraft Pioneer 10) corresponds to the COSPAR international designation. The experiment codes are based on the spacecraft code. For example, the experiments carried aboard the spacecraft 73-019A (Pioneer 11) are numbered 73-019A-01, 73-019A-02, 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 to be carried aboard this spacecraft were coded SME-01, SME-02, etc. Once a spacecraft is launched, its prelaunch designation is changed to a postlaunch one; e.g., Pioneer-G, which was launched April 6, 1973, was given the NSSDC ID code of 73-019A, and the NSSDC spacecraft common name of Pioneer 11.

OI - Other Investigator.

PI - Principal Investigator.

PM - Project Manager.

PS - Project Scientist.

TL - Team Leader.

TM - Team Member.
Technical Reference File. A computerized space-investigation-oriented bibliographic reference list maintained by NSSDC. Journal publications and other documents are cited, and can be retrieved by author name, title, or NSSDC ID of relevant investigation. Used to keep track of descriptive and documentation material, as well as to produce bibliographies of certain spacecraft. The TRF accession number begins with the letter B and contains five digits; for example, B10851.