IMS/Satellite Situation Center Report

Predicted Orbit Plots for
IMP-H - 1976

REPORT NO. 3

DECEMBER 1975
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National Space Science Data Center/
World Data Center A for Rockets and Satellites
National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771
I. INTRODUCTION

This report contains predicted orbit plots for the IMP-H satellite for the time period January-December 1976. This satellite has been identified as an important possible contributor to the International Magnetospheric Study (IMS) project. The predicted orbit plots are shown in three projections. The time period covered by each set of projections is 12 days 6 hours, corresponding approximately to the period of IMP-H. The three coordinate systems used are the Geocentric Solar Ecliptic system (GSE), the Geocentric Solar Magnetospheric system (GSM), and the Solar Magnetic system (SM).

For the GSE system, the X-axis is along the Earth-Sun line toward the Sun, and the Z-axis is perpendicular to the ecliptic plane such that the Y-axis is toward dusk. The GSE projection at the top left of the set of three plots shows the satellite trajectory rotated into the X-Y plane in order to illustrate the relative positions of the satellite and the bow shock and magnetopause boundaries. Fairfield’s model (1971) for the average position of these boundaries has been used. This model corresponds to a solar wind velocity of 420 km/sec. For positive X values, a spherical rotation of the satellite radius vector has been performed at constant ecliptic longitude. For negative X values, a cylindrical rotation of the Y and Z components of the radius vector has been performed at constant X.

For the GSM system, the X-axis is along the Earth-Sun line toward the Sun, and the X-Z plane contains the geomagnetic dipole such that the Z-axis is positive northward and the Y-axis is toward dusk. The GSM projection at the top right of the set of three plots shows the satellite trajectory projected onto the Y-Z plane in order to show the relative position of the satellite and the neutral sheet. A simple model for the neutral sheet is assumed: the sheet is hinged onto the geomagnetic equator at 10 Earth radii in the antisolar direction and lies in the GSM X-Y plane. The neutral sheet positions are shown as horizontal lines corresponding to six equally spaced times of the first day covered by the plot. The extent of the horizontal lines in Y has no significance. The projected trajectories are shown as solid lines for X < -10 Earth radii and as dashed lines for X > -10 Earth radii. The dashed lines indicate that the satellite is not in the region of the neutral sheet regardless of X values.

For the SM system, the Z-axis contains the north magnetic pole, and the Y-axis is perpendicular to the Earth-Sun line toward dusk. The satellite trajectory is shown at the bottom of the set of three plots as magnetic latitude and magnetic local time. These values of magnetic latitude and magnetic local time use SM latitude and longitude as a basis.

For each of the three projections, time ticks and codes are given on the satellite trajectories. The codes are interpreted in the table at the base of each plot. Time is given in the table as year/day/decimal hour. The total time covered by each plot is shown at the bottom of each table.
An additional variable is given in the table for each time tick. For the
GSM and SM projection this variable is the geocentric distance to the
satellite in Earth radii, and for the GSE projection the variable is
satellite ecliptic latitude in degrees.

For the orbit predictions shown in this report actual spacecraft
elements for epoch April 1975 were used. The predicted elements for
January 1, 1976, are shown in Table 1.

II. IMP-H ORBIT CHARACTERISTICS FOR 1976

The low inclination of the IMP-H satellite precludes encounters with
the direct access (cusp) region, and thus the magnetic latitude/magnetic
local time projections shown in this report are of limited value. How-
ever, IMP-H provides a number of useful bow shock, magnetopause, and
neutral sheet encounters throughout 1976.

The characteristics of the bow shock and magnetopause encounters do
not vary throughout the year. Twice per revolution the satellite en-
counters these boundaries at negative $X_{GSM}$. One encounter per boundary
occurs in the midnight/dusk quadrant and one in the midnight/dawn quad-
rant. The satellite spends approximately 15 percent of each revolution
in the nightside magnetosheath and approximately 65 percent of each
revolution in the interplanetary medium. However, it should be noted
that the triaxial fluxgate magnetometer (see brief descriptions) on IMP-H
is not functioning, and thus the satellite is not an ideal monitor of the
interplanetary medium.

The most useful characteristic of the IMP-H orbit in 1976 is the
neutral sheet encounters. These are summarized in Table 2. There are
14 encounters grouped into three periods. During each period the en-
counters occur on consecutive revolutions and progress from the dawn to
dusk magnetotail. Note, in addition, that the altitudes of the encounters
in each period occur at progressively more remote regions of the magneto-
tail.

III. SPACECRAFT AND EXPERIMENT STATUS

Brief descriptions of the 13 IMP-H experiments are given in pages
5-15. A summary is shown in Table 3. All experiments, except the
fluxgate magnetometer (principal investigator, N. F. Ness), are operat-
ing normally or partially. Four of the IMP-H experimenters appear in
the IMS Directory No. 2. However, only two, F. L. Scarf and
D. J. Williams, have identified the IMP-H experiments under their IMS
Program Summary numbers.
IV. FUTURE OPERATIONS

The Satellite Situation Center (SSC) maintains orbit prediction plots on 16-mm microfilm for HIP-II of the type shown in this document for the time period January 1977 through December 1979. These plots may be obtained upon request.
V. SPACECRAFT/EXPERIMENT CHARACTERISTICS

************************************************************ IMP-H ************************************************************

SPACECRAFT COMMON NAME- IMP-H
ALTERNATE NAMES- PL-713A, EXPLORER 47
IMP 7, 06197
NSSDC ID- 72-073A
LAST REPORTED STATE- LAUNCHED AND OPERATING NORMALLY
AT THE STANDARD DATA ACQUISITION RATE SINCE 09/23/72.

LAUNCH DATE- 09/23/72 SPACECRAFT WEIGHT- 390. KG
LAUNCH SITE- CAPE CANAVERAL, UNITED STATES
LAUNCH VEHICLE- DELTA

SPONSORING COUNTRY/AGENCY
UNITED STATES NASA-GSS

INITIAL ORBIT PARAMETERS

ORBIT TYPE- GEOCENTRIC

ORBIT PERIOD- 17365. MIN
PERIAPSIS- 201599. KM ALT

EPOCH DATE- 09/25/72
INCLINATION- 28.6 DEG
APOAPSIS- 235639. KM ALT

RECENT ORBIT PARAMETERS

ORBIT TYPE- GEOCENTRIC

ORBIT PERIOD- 17482. MIN
PERIAPSIS- 194878. KM ALT

EPOCH DATE- 07/13/74
INCLINATION- 9.215 DEG
APOAPSIS- 243628. KM ALT

SPACECRAFT PERSONNEL (PM=PROJECT MANAGER, PS=PROJECT SCIENTIST)
PM - M. DAVIS ......................NASA-GSFC
GREENBELT, MD
PS - J.H. KING ......................NASA-GSFC
GREENBELT, MD

SPACECRAFT BRIEF DESCRIPTION

IMP-H CONTINUED THE STUDY BEGAN BY EARLIER IMP
SPACECRAFT OF THE INTERPLANETARY AND MAGNETOTAIL REGIONS FROM
A NEARLY CIRCULAR ORBIT, NEAR 37 EARTH RADII. THIS 16-SIDED
DRUM-SHAPED SPACECRAFT WAS 157 CM HIGH AND 135 CM IN DIAM. IT
WAS DESIGNED TO MEASURE ENERGETIC PARTICLES, PLASMA, AND
ELECTRIC AND MAGNETIC FIELDS. THE SPIN AXIS WAS NORMAL TO THE
ECLIPTIC PLANE, AND THE SPIN PERIOD WAS 1.3 SEC. THE
SPACECRAFT WAS POWERED BY SOLAR CELLS AND A CHEMICAL BATTERY.
SCIENTIFIC DATA WERE TELEMETERED TO EARTH AT 1600 BPS (WITH A
SECONDARY 400-BPS RATE AVAILABLE).

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--- IMP-H GAME ---

EXPERIMENT NAME: MEASUREMENT OF SOLAR PLASMA

NSSDC ID: 72-073A-10


EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER, OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)

PI - S.J. BAME .................LOS ALAMOS SCI LAB
LOS ALAMOS, NM

OI - J.R. ASBRIDGE .............LOS ALAMOS SCI LAB
LOS ALAMOS, NM

EXPERIMENT BRIEF DESCRIPTION

A HEMISPHERICAL ELECTROSTATIC ANALYZER WAS USED TO STUDY THE DIRECTIONAL INTENSITY OF POSITIVE IONS AND ELECTRONS IN THE SOLAR WIND, MAGNETOSHEATH, AND MAGNETOTAIL. IONS AS HEAVY AS OXYGEN WERE RESOLVED WHEN THE SOLAR WIND TEMPERATURE WAS LOW. ENERGY ANALYSIS WAS ACCOMPLISHED BY CHARGING THE PLATES TO KNOWN VOLTAGE LEVELS AND ALLOWING THEM TO DISCHARGE WITH KNOWN RC TIME CONSTANTS. IN THE SOLAR WIND, POSITIVE IONS FROM 200 EV TO 5 KEV (15 PERCENT SPACING, 3 PERCENT RESOLUTION) AND ELECTRONS FROM 5 EV TO 1 KEV (30 PERCENT SPACING, 15 PERCENT RESOLUTION) WERE STUDIED. IN THE MAGNETOSHEATH, POSITIVE IONS FROM 200 EV TO 5 KEV (15 PERCENT SPACING, 3 PERCENT RESOLUTION) AND FROM 200 EV TO 2 KEV (30 PERCENT SPACING, 15 PERCENT RESOLUTION) AND ELECTRONS FROM 5 EV TO 1 KEV (30 PERCENT SPACING, 15 PERCENT RESOLUTION) WERE STUDIED. IN THE MAGNETOTAIL, POSITIVE IONS FROM 200 EV TO 20 KEV (30 PERCENT SPACING, 15 PERCENT RESOLUTION) AND ELECTRONS FROM 5 EV TO 1 KEV (30 PERCENT SPACING, 15 PERCENT RESOLUTION) AND FROM 100 EV TO 20 KEV (15 PERCENT RESOLUTION) WERE STUDIED.

--- IMP-H BRIDGE ---

EXPERIMENT NAME: MEASUREMENT OF SOLAR PLASMA

NSSDC ID: 72-073A-02

LAST REPORTED STATE: LAUNCHED AND OPERATING PARTIALLY AT THE STANDARD DATA ACQUISITION RATE SINCE 12/11/73.

EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER, OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)

PI - H.S. BRIDGE .................MASS INST OF TECH
CAMBRIDGE, MA

OI - A.J. LAZARUS .................MASS INST OF TECH
CAMBRIDGE, MA

OI - J.M. BINSACK .................MASS INST OF TECH
CAMBRIDGE, MA

OI - E.F. LYON .................MASS INST OF TECH
CAMBRIDGE, MA
EXPERIMENT BRIEF DESCRIPTION

A MODULATED SPLIT-COLLECTOR FARADAY CUP WHICH WAS PERPENDICULAR TO THE SPACECRAFT SPIN AXIS WAS USED TO STUDY THE DIRECTIONAL INTENSITY OF POSITIVE IONS AND ELECTRONS IN THE SOLAR WIND, TRANSITION REGION, AND MAGNETOTAIL. ELECTRONS WERE STUDIED IN EIGHT LOGARITHMICALLY EQUISPACED CHANNELS BETWEEN 17 EV AND 7 KEV. POSITIVE IONS WERE STUDIED IN EIGHT CHANNELS BETWEEN 50 EV AND 7 KEV. A SPECTRUM WAS OBTAINED EVERY EIGHT SPACECRAFT REVOLUTIONS. ANGULAR INFORMATION WAS OBTAINED IN EITHER 15 EQUALLY SPACED INTERVALS DURING A 360-DEG REVOLUTION OF THE SATELLITE OR IN 15 ANGULAR SEGMENTS CENTERED MORE CLOSELY ABOUT THE SPACECRAFT SUN LINE.

----- IMP-H. CLINE -----------------------------------------------

EXPERIMENT NAME: STUDY OF COSMIC-RAY, SOLAR, AND MAGNETOSPHERIC ELECTRONS

NSSDC ID- 72-073A-13

LAST REPORTED STATE: LAUNCHED AND OPERATING NORMALLY AT THE STANDARD DATA ACQUISITION RATE SINCE 10/13/72.

EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER, DI=OTHER INVESTIGATOR, TM=TEAM MEMBER)

PI - T.L. CLINE ................NASA-GSFC

GREENBELT, MD

EXPERIMENT BRIEF DESCRIPTION

THIS EXPERIMENT STUDIED GALACTIC AND SOLAR ELECTRONS AND POSITRONS IN THE KINETIC ENERGY RANGE 50 KEV TO 2 MEV. INFORMATION ON PROTONS BETWEEN 0.5 AND 1.0 MEV WAS ALSO OBTAINED. A COLLIMATED STILBENE CRYSTAL SCINTILLATION LOOKING PERPENDICULAR TO THE SPACECRAFT SPIN AXIS SERVED AS THE PRINCIPAL DETECTOR. A SIMILAR, FULLY SHIELDED CRYSTAL SERVED TO DETERMINE THE CONTRIBUTION TO THE PRINCIPAL DETECTOR COUNT RATE OF ELECTRONS AND PROTONS GENERATED WITHIN THE PRINCIPAL DETECTOR BY GAMMA RAYS AND NEUTRONS, RESPECTIVELY. A FULLY SHIELDED CSI CRYSTAL SERVED AS A GAMMA-RAY SPECTROMETER AND WAS USED IN COINCIDENCE WITH THE PRINCIPAL DETECTOR TO DISTINGUISH ELECTRONS FROM POSITRONS. COUNT RATES FROM EACH DETECTOR OBTAINED IN EIGHT ANGULAR SECTORS PER REVOLUTION WERE TELEMETERED. IN ADDITION, THE AMPUTATION AND SHAPE OF THE PULSE GENERATED IN THE PRINCIPAL DETECTOR BY THE FIRST STOPPING PARTICLE IN EACH APPROPRIATE TELEMETRY FRAME WILL BE STUDIED. PULSE AMPLITUDE AND SHAPE WERE TO YIELD ENERGY (10 PERCENT RESOLUTION) AND PARTICLE SPECIES INFORMATION.
EXPERIMENT NAME- MEASUREMENT OF LOW-ENERGY PROTONS AND ELECTRONS

NSSDC ID- 72-073A-04

LAST REPORTED STATE- LAUNCHED AND OPERATING NORMALLY AT THE STANDARD DATA ACQUISITION RATE SINCE 09/23/72.

EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER, OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)

PI - L.A. FRANK .................. U OF IOWA
IOWA CITY, IA

EXPERIMENT BRIEF DESCRIPTION

THIS EXPERIMENT MEASURED THE ENERGY SPECTRA OF LOW-ENERGY ELECTRONS AND PROTONS IN THE GEOCENTRIC RANGE 30 TO 40 R(E) TO FURTHER UNDERSTAND GEOMAGNETIC STORMS, AURORA, TAIL AND NEUTRAL SHEET, AND OTHER MAGNETOSPHERIC PHENOMENA. THE DETECTOR WAS A DUAL-CHANNEL CURVED PLATE ELECTROSTATIC ANALYZER (LEPEDEA - LOW-ENERGY PROTON AND ELECTRON DIFFERENTIAL ANALYZER) WITH 16 ENERGY INTERVALS BETWEEN 5 EV AND 50 KEV. IT HAD AN ANGULAR FIELD OF VIEW OF 9 DEG X 25 DEG IN FOUR DIRECTIONS PERPENDICULAR TO THE SPACECRAFT SPIN AXIS. THE DETECTOR WAS OPERATED IN ONE OF TWO MODES (1) ONE PROVIDING GOOD ANGULAR RESOLUTION (16 DIRECTIONS FOR EACH PARTICLE ENERGY BAND) ONCE EACH 272 SEC., AND (2) ONE PROVIDING GOOD TEMPORAL RESOLUTION IN WHICH THE ENTIRE ENERGY RANGE IN FOUR DIRECTIONS WAS MEASURED EVERY 68 SEC.

--------- IMP-H, GLOECKLER ---------------------------

EXPERIMENT NAME- IONS AND ELECTRONS IN THE ENERGY RANGE 0.1 TO 2 MEV

NSSDC ID- 72-073A-03


EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER, OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)

PI - G. GLOECKLER .................. U OF MARYLAND
COLLEGE PARK, MD

OI - C.Y. FAN ..................... U OF ARIZONA
TUCSON, AZ

OI - D.K. MOVESTADT ............. MPI
GARCHING, FED REP OF GERMANY
EXPERIMENT BRIEF DESCRIPTION

THIS EXPERIMENT WAS DESIGNED TO DETERMINE THE COMPOSITION AND ENERGY SPECTRA OF LOW-ENERGY PARTICLES ASSOCIATED WITH SOLAR ACTIVITY AND INTERPLANETARY PROCESSES. THE DETECTORS USED WERE (1) AN ELECTROSTATIC ANALYZER (TO SELECT PARTICLES OF THE DESIGNATED ENERGY PER CHARGE) COMBINED WITH AN ARRAY OF WINDOWLESS SOLID-STATE DETECTORS (TO MEASURE THE ENERGY LOSS) AND SURROUNDED BY AN ANTICOINCIDENCE SHIELDING AND (2) A PARTICLE TELESCOPE CONSISTING OF A SILICON SURFACE BARRIER DETECTOR AND A FLAT TWO-CHAMBER PROPORTIONAL COUNTER ENCLOSED IN AN ANTICOINCIDENCE SCINTILLATOR CUP. THE EXPERIMENT MEASURED PARTICLE ENERGIES FROM 0.1 TO 2 MEV PER CHARGE IN 12 BANDS AND UNIQUELY IDENTIFIED POSITRONS AND ELECTRONS AS WELL AS NUCLEI WITH CHARGES OF Z FROM 1 TO 8 (CHARGE GROUP RESOLUTION FOR Z BETWEEN 9 AND 26). TWO 1000-CHANNEL PULSE HEIGHT ANALYZERS, ONE FOR EACH ELEMENT OF THE TELESCOPE, WERE INCLUDED IN THE EXPERIMENT PAYLOAD. THE TELESCOPE FAILED ON NOVEMBER 25, 1972, WHEN THE WINDOW ON THE PROPORTIONAL COUNTER WEAKENED AND BURST DUE TO EXPOSURE TO UV RADIATION.

-------- IMP-M. KRINIGIS -----------------------------

EXPERIMENT NAME= CHARGED PARTICLE MEASUREMENTS EXPERIMENT

NSSDC ID= 72-073A-08

LAST REPORTED STATE= LAUNCHED AND OPERATING PARTIALLY AT THE STANDARD DATA ACQUISITION RATE SINCE 12/11/73.

EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR; TL=TEAM LEADER; OI=OTHER INVESTIGATOR; TM=TEAM MEMBER)

PI - S.M. KRINIGIS ...............APPLIED PHYSICS LAB
LAUREL, MD

OI - T.P. ARMSTRONG .............U OF KANSAS
LAWRENCE, KS

OI - J.A. VAN ALLEN .............U OF IOWA
IOWA CITY, IA

EXPERIMENT BRIEF DESCRIPTION

THREE SOLID-STATE DETECTORS IN AN ANTICOINCIDENCE PLASTIC SCINTILLATOR OBSERVED ELECTRONS BETWEEN 0.2 AND 2.5 MEV, PROTONS BETWEEN 0.3 AND 500 MEV, ALPHA PARTICLES BETWEEN 2.0 AND 200 MEV, HEAVY PARTICLES WITH ATOMIC NUMBERS RANGING FROM 2 TO 9 WITH ENERGIES GREATER THAN 8 MEV, HEAVY PARTICLES WITH Z VALUES RANGING BETWEEN 6 AND 8 WITH ENERGIES GREATER THAN 32 MEV, AND INTEGRAL PROTONS AND ALPHAS OF ENERGIES GREATER THAN 50 MEV/NUCLEON, ALL WITH DYNAMIC RANGES OF 1 TO ONE MILLION (PER SQUARE CM-SEC-STER). FIVE THIN WINDOW GEIGER-MUeller TUBES OBSERVED ELECTRONS OF ENERGY GREATER THAN
15 Kev. Protons of energy greater than 250 kev, and X rays with wavelengths between 2 and 10 A, all with a dynamic range of 10 to 100 million (per square cm-sfc-stke). Particles and X rays primarily of solar origin were studied. But the dynamic range and resolution of the instrument permitted cosmic rays and magnetotail particles to be observed. Detector E1 (4-10 A X-rays, protons &gt; 250 kev, electrons &gt; 15 kev) failed at about 1230 GMT, December 14, 1972. Detector E2A (1.5-12 A X-rays, protons &gt; 500 kev, electrons &gt; 45 kev) failed on January 13, 1973 at about 1700 GMT. Detectors E2B and E2C (protons &gt; 50 kev, electrons &gt; 45 kev) began degrading in mid-December, 1972 and were useless after January, 1973.

--- IMPeM, MCDONALD -------------------------------

EXPERIMENT NAME - SOLAR AND COSMIC-RAY PARTICLES
NSSDC ID = 72-073A-09
LAST REPORTED STATE - LAUNCHED AND OPERATING NORMALLY
AT THE STANDARD DATA ACQUISITION RATE SINCE 09/26/72.
EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER
OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)
PI - F.B. MCDONALD *************NASA-GSFC
GREENBELT, MD
OI - UNKNOWN ***************NASA-JSC
HOUSTON, TX
OI - B.J. TEEGARDEN ************NASA-GSFC
GREENBELT, MD

EXPERIMENT BRIEF DESCRIPTION
THE GSFC COSMIC-RAY EXPERIMENT MEASURED ENERGY SPECTRA,
COMPOSITION, AND ANGULAR DISTRIBUTION OF SOLAR AND GALACTIC
ELECTRONS, PROTONS, AND HEAVIER NUCLEI UP TO Z = 30. THREE
DISTINCT DETECTOR SYSTEMS WERE USED. THE FIRST SYSTEM
CONSisted OF A PAIR OF SOLID-STATE TELESCOPES WHICH MEASURED
INTEGRAL FLUXES ABOVE 150, 350, AND 700 keV AND OF PROTONS
ABOVE 0.05, 0.15, 0.70, 1.0, 1.2, 2.0, 2.5, 3.0, 15, AND 25
MEV. EXCEPT FOR THE 0.05 MEV PROTON MODE, ALL COUNTING MODES
HAD UNIQUE SPECIES IDENTIFICATION. THE SECOND DETECTOR SYSTEM
WAS A SOLID-STATE DE/DO VS E TELESCOPE THAT LOOKED
PERPENDICULAR TO THE SPIN AXISS THIS TELESCOPE MEASURED NUCLEI
FROM 1 TO 16 AMU WITH ENERGIES BETWEEN 4 AND 20 MEV/NUCLEON.
COUNTS OF PARTICLES IN THE 0.5 TO 4 MEV/NUCLEON RANGE, WITH NO
CHARGE RESOLUTION, WERE OBTAINED AS COUNTS IN THE DE/DO, BUT
NOT IN THE E SENSOR. THE THIRD DETECTOR SYSTEM WAS A
THREE-ELEMENT CSI SCINTILLATOR TELESCOPE WHOSE AXISS MADE AN
ANGLE OF 39 deg WITH RESPECT TO THE SPIN AXISS THE INSTRUMENT
RESPONDED TO ELECTRONS BETWEEN 2 AND 12 MEV AND NUCLEI FROM 1

10
TO 30 AMU IN THE ENERGY RANGE 20 TO 500 MEV/NUCLEON. FOR PARTICLES BELOW 80 MEV, THIS INSTRUMENT ACTED AS A DE/DX DETECTOR. ABOVE 80 MEV, IT ACTED AS A BIDIRECTIONAL TRIPLE DE/DX DETECTOR. FLUX DIRECTIONALITY INFORMATION WAS OBTAINED BY DIVIDING CERTAIN PORTIONS OF THE DATA FROM EACH DETECTOR SYSTEM INTO EIGHT ANGULAR SECTORS.

---- IMP-H, NESS -----------------------------------------------

EXPERIMENT NAME- MAGNETIC FIELDS EXPERIMENT

NSSDC ID= 72-073A-01

LAST REPORTED STATE- INOPERABLE SINCE 04/03/73.

EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER, OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)

PI - N.E. NESS ....................... NASA-GSFC
GREENB.E., MD
OI - C.S. SCARCE .................... NASA-GSFC
GREENB.E., MD
OI - J.B. SEFK ....................... NASA-GSFC
GREENB.E., MD

EXPERIMENT BRIEF DESCRIPTION


---- IMP-H, "GILVIF" ---------------------------------------------

EXPERIMENT NAME- SOLAR WIND ION COMPOSITION

NSSDC ID= 72-073A-12

LAST REPORTED STATE- LAUNCHED AND OPERATING NORMALLY
AT THE STANDARD DATA ACQUISITION RATE SINCE 09/24/72.

EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER, OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)
EXPERIMENT BRIEF DESCRIPTION

An electrostatic analyzer and Wein-type velocity selector were used to gain exploratory data on heavy ion composition in the solar wind. The bulk velocities of 4He++, 4He+, 3He++, and O (isotopes indistinguishable) ions in all ionization states were separately studied. During 30 successive spacecraft spin periods, ions of a given species were studied in 30 logarithmically equispaced bulk velocity channels from 200 to 600 km/sec. A complete set of measurements required about 10 min and consisted of thirty 1-step sequences for 4 He++ ions and five 30-step sequences for each of the other three species.

----- IMP-H. SCARF -----------------------------

EXPERIMENT NAME- PLASMA WAVE EXPERIMENT

NSSDC 10= 72-073A-11

LAST REPORTED STATE- LAUNCHED AND OPERATING NORMALLY AT A SUBSTANDARD DATA ACQUISITION RATE SINCE 09/24/72.

EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER, OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)

PI - F.L. SCARF .................. TRW SYSTEMS GROUP
   REDONDO BEACH, CA

OI - G.M. CROOK .................. GAINES M. CROOK ASSO
   LAGUNA BEACH, CA

OI - I.M. GREEN .................. TRW SYSTEMS GROUP
   REDONDO BEACH, CA

OI - R.J. FREDERICKS ............ TRW SYSTEMS GROUP
   REDONDO BEACH, CA

EXPERIMENT BRIEF DESCRIPTION

Electric field components perpendicular to the spacecraft spin axis and the magnetic field component parallel to that axis were measured by an electric dipole antenna and a search coil magnetometer. Both sensors were mounted on a 3.05-m boom. Data were obtained in eight frequency channels from 10 Hz to 100 kHz, in either the normal mode or the snapshot mode. Two channels, centered at 67 and 600 Hz, had 10-dB fall-off points of 17 and 150 Hz, and 270 and 810 Hz, respectively. The remaining six channels were narrow-bandwidth channels centered at 1.3, 2.3, 5.4, 10.6, 30, and 70 kHz, in the normal mode. The antenna was first sampled in a given frequency channel many times during a given measurement period (comparable to the spacecraft spin period). During the next period, the search coil was sampled many times in the same frequency channel. Next, the antenna was sampled in the next frequency channel, followed by the search coil in that
CHANNEL: THE FREQUENCY CHANNELS WERE INCREMENTED, AND THE
SAMPLED SENSORS WERE ALTERNATED UNTIL A FULL SET OF DATA WAS
OBTAINED IN 16 MEASUREMENT PERIODS (APPROXIMATELY 20 SEC). IN
THE SNAPSHOT MODE, ONLY ELECTRIC FIELD DATA WERE TRANSMITTED.
AS FOLLOWS: THE ANTENNA WAS FIRST SAMPLED IN A GIVEN FREQUENCY
CHANNEL MANY TIMES DURING A GIVEN MEASUREMENT PERIOD. IN THE
NEXT PERIOD, THE ANTENNA WAS SAMPLED IN TWO SEQUENCES OF EIGHT
FREQUENCY CHANNELS. THIS TWO-PERIOD MEASUREMENT WAS EXECUTED
EIGHT TIMES, EACH TIME INCREMENTING THE FREQUENCY CHANNEL
STUDIED IN EVERY OTHER PERIOD BY ONE. THEREFORE, A FULL SET OF DATA
AGAIN REQUIRED 16 MEASUREMENT PERIODS. IN ADDITION, AN ANALOG
MODE, SAMPLING THE ANTENNA AND SEARCH COIL FROM 10 TO 100 HZ,
WAS USED IN CONJUNCTION WITH THE SPECIAL PURPOSE ANALOG
TELEMETRY TEST TO BE CONDUCTED. UNFORTUNATELY THIS NEW
TELEMETRY SYSTEM DID NOT WORK WELL, AND NO USABLE DATA WERE
OBTAINED IN THIS MODE OF OPERATION. FOR THE DIGITAL MODES,
SOME INTERFERENCE WAS EXPERIENCED FROM THE ASYMMETRIC PLASMA
SHEATH ASSOCIATED WITH THE POLAR CELL ARRAYS. THIS
INTERFERENCE LIMITED THE SENSITIVITY OF THE MAGNETIC FIELD
MEASUREMENTS AND INTRODUCED COMPLEXITY INTO ANALYSIS OF THE
ELECTRIC FIELD MEASUREMENTS.

--------- IMP-H. SIMPSON -----------------------------

EXPERIMENT NAME: SOLAR FLARE HIGH-Z/LOW-E AND LOW-Z
ISOTOPE EXPERIMENT

NSSDC ID: 72-073A-07

LAST REPORTED STATE: LAUNCHED AND OPERATING PARTIALLY
AT THE STANDARD DATA ACQUISITION RATE SINCE 12/03/74.
EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER
OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)
PI - J.A. SIMPSON ............... U OF CHICAGO
CHICAGO, IL
OI - M. GARCIA-MUNOZ .......... U OF CHICAGO
CHICAGO, IL

EXPERIMENT BRIEF DESCRIPTION

THIS EXPERIMENT WAS TO INCREASE THE UNDERSTANDING OF
SOLAR FLARE PARTICLE ACCELERATION AND PARTICLE CONTAINMENT IN
MAGNETIC FIELDS IN THE VICINITY OF THE SUN. THE DETECTOR
POINTED ALONG THE SPACECRAFT SPIN AXIS. IT WAS A WINDOWLESS
DE/DO VS E TELESCOPE WITH ANTICOINCIDENCE SHIELDING AND
OPERATED IN EITHER OF TWO MODES -- (1) THE HIGH Z - LOW E MODE
HAVING AN ENERGY RANGE 0.5 TO 50 MEV/NUCLEON AND A CHARGE
RANGE Z=5 TO 50 AND (2) THE LOW Z MODE, HAVING AN ENERGY RANGE
6 TO 1200 MEV/NUCLEON (ISOTOPES = HYDROGEN, DEUTERIUM,
TRITIUM, HELIUM-3, HELIUM-4). THE ENERGY RANGE FOR ELECTRONS
WAS PRIMARILY 0.3 TO 10 MEV. THE ACCEPTANCE ANGLE OF THE
DETECTOR WAS 50-DEG FULL ANGLE.
EXP. NAME- ELECTRONS AND HYDROGEN AND HELIUM ISOTOPES

NSSDC ID- 72-073A-06

LAST REPORTED STATE- LAUNCHED AND OPERATING NORMALLY AT THE STANDARD DATA ACQUISITION RATE SINCE 09/23/72.

EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER, OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)

PI - E.C. STONE ...............CALIF INST OF TECH PASADENA, CA
OI - R.E. VOGT ...............CALIF INST OF TECH PASADENA, CA

EXPERIMENT BRIEF DESCRIPTION

THIS EXPERIMENT WAS DESIGNED TO MEASURE SOLAR AND GALACTIC ELECTRONS, POSITRONS, AND NUCLEI. AND TO SEPARATE ISOTOPES THROUGH OXYGEN. THE ENERGY RANGES COVERED WERE 0.16 TO 5 MEV (ELECTRONS), 0.16 TO 2 MEV (POSITRONS), AND ABOUT 1 TO 40 MEV/N (NUCLEI). THE INSTRUMENT WAS A TELESCOPE CONSISTING OF 11 COLINEAR, FULLY DEPLETED, SILICON SURFACE BARRIER DETECTORS INSIDE A PLASTIC SCINTILLATOR ANTICOINCIDENCE SHIELD. FOUR OF THE TOP FIVE SENSORS WERE ANNULAR WHILE THE REMAINDER WERE SOLID DISCS. THIS ARRANGEMENT GAVE NARROW GEOMETRY (ANTICOINCIDENCE IN ANNULAR SENSORS) AND WIDE GEOMETRY MODES WITH HALF ANGLE ACCEPTANCE CONES OF ABOUT 24 AND 36 DEG. THE TELESCOPE AXIS WAS PERPENDICULAR TO THE SPACECRAFT SPIN AXIS. DATA RETURNED CONSISTED OF 8-SELECTED AND SPIN-INTEGRATED COUNT RATES FOR EIGHT DIFFERENT COINCIDENCE/ANTICOINCIDENCE MODES AND TWO PARAMETER PULSE HEIGHT ANALYSES FOR 32 PARTICLES EVERY 20.48 SEC. THE COINCIDENCE MODE CHosen FOR PULSE HEIGHT ANALYSIS IN ANY 0.64 SEC INTERVAL WAS FIXED BY A FIVE LEVEL PRIORITY SYSTEM. THE PRINCIPAL CONTRIBUTORS TO EACH COINCIDENCE MODE RATE WERE -- (1) 0.16- TO 5-MEV ELECTRONS AND 1- TO 43-MEV/N NUCLEI; (2) 1- TO 5-MEV ELECTRONS AND 13- TO 43-MEV/N NUCLEI; (3) NEUTRALS, SUCH AS GAMMA RAYS; (4) 0.2- TO 1-MEV ELECTRONS; (5) 1- TO 3-MEV ELECTRONS; (6) 1.2- TO 2.4-MEV/N NUCLEI; (7) 4- TO 13-MEV/N NUCLEI; AND (8) ELECTRONS ABOVE 3 MEV AND NUCLEI ABOVE 30 MEV/N. INITIAL EXPERIMENT PERFORMANCE WAS NORMAL.

EXP. NAME- ENERGETIC ELECTRONS AND PROTONS

NSSDC ID- 72-073A-05
LAST REPORTED STATE—LAUNCHED AND OPERATING NORMALLY

AT THE STANDARD DATA ACQUISITION RATE SINCE 09/26/72.

EXPERIMENT PERSONNEL (PI=PRINCIPAL INVESTIGATOR, TL=TEAM LEADER
OI=OTHER INVESTIGATOR, TM=TEAM MEMBER)

PI - D.J. WILLIAMS ...............NOAA-ERL
                 BOULDER, CO
OI - C.O. BOSTROM ...............APPLIED PHYSICS LAB
                 LAUREL, MD
OI - J.C. ARMSTRONG(DECEASED)....APPLIED PHYSICS LAB
                 LAUREL, MD
OI - J.H. TRAINOR ...............NASA-GSFC
                 GREENBELT, MD

EXPERIMENT BRIEF DESCRIPTION

THE PURPOSES OF THIS EXPERIMENT WERE (1) TO STUDY THE
PROPAGATION CHARACTERISTICS OF SOLAR COSMIC RAYS THROUGH THE
INTERPLANETARY MEDIUM OVER THE ENERGY RANGES INDICATED BELOW,
(2) TO STUDY ELECTRON AND PROTON PATCHES THROUGHOUT THE
GEOMAGNETIC TAIL AND NEAR AND THROUGH THE FLANKS OF THE
MAGNETOPAUSE, AND (3) TO STUDY THE ENTRY OF SOLAR COSMIC RAYS
INTO THE GEOMAGNETIC FIELD. THE INSTRUMENTATION CONSISTED OF A
THREE-ELEMENT TELESCOPE CONFIGURATION EMPLOYING SOLID-STATE
DETECTORS AND A MAGNET TO DEFLECT ELECTRONS. TWO SIDE-MOUNTED
DETECTORS WERE USED TO DETECT THE ELECTRONS DEFLECTED BY THE
MAGNET. TWO ADDITIONAL SOLID-STATE DETECTORS WERE USED TO
DETECT VERY LOW-ENERGY (GREATER THAN 15 KEV) PARTICLES, ALPHA
PARTICLES, AND CHARGED PARTICLES OF Z GREATER THAN 2. THE
EXPERIMENT WAS DESIGNED TO MEASURE (1) PROTON FLUXES FROM 30
KEV TO GREATER THAN 8.6 MEV IN SIX RANGES, (2) ELECTRON FLUXES
FROM 30 KEV TO GREATER THAN 450 KEV IN THREE RANGES, (3)
CHARGED PARTICLES GREATER THAN 15 KEV, (4) ALPHA PARTICLES
GREATER THAN 0.5 MEV, GREATER THAN 1.6 MEV, 2.2 TO 8.8 MEV,
AND 8.8 TO 35 MEV, AND (5) CHARGED PARTICLES OF Z GREATER THAN
2 AT E GREATER THAN 5 MEV.
REFERENCE

Table 1. ORBIT PARAMETER SUMMARY TABLE FOR IMP-H

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Table 3. IMP-H EXPERIMENT STATUS SUMMARY

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<th>Experiment</th>
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* These experiments are not identified under these Program Summary numbers.

Op: Operating Normally
Par: Operating Partially
Inop: Inoperative
IMP-N
ROTATED INTO THE GSE X-Y PLANE

IMP-N
PROJECTED ONTO THE GSE Y-Z PLANE

MAGNETIC LATITUDE VS MAGNETIC LOCAL TIME

INTERPRETATION OF TIME CODE-NUMBERS

TIME AS YEAR/ffb/ff
TIME INTERVAL OF PLOT STARTED/ENDED IN HOURS/24 HOURS

LAT IS GEOGRAPHIC LATITUDE IN DEGREES
TIME (HOURS) IN STRIDE 0 TO 24:00 inside each 40 MIN TR"N"AL
R IS GEODETIC DISTANCE IN EARTH RAD
TIME INTERVAL OF PLOT STARTED/ENDED IN HOURS/24 HOURS