SCIENTIFIC PAYLOAD DESCRIPTION

Fast Plasma (ISEE-A and B)

Dr. S. J. Bame, Los Alamos Laboratories, Los Alamos, N.M., (ISEE-A) and Dr. G. Paschmann, Max Planck Institute, West Germany (ISEE-B).

Los Alamos Scientific Laboratories supplies the sensor portion of the ISEE-A and B instruments and Max Planck Institute supplies the electronics for both instruments.

Determinations of electron and ion velocity distributions in one-, two- and three-dimensional form will be obtained from both ISEE-A and B spacecraft. These determinations are made using identical 90 degree spherical section electrostatic two-dimensional and three-dimensional analyzers. The A experiment will also include a solar wind ion 150 degree spherical section analyzer.

Low-Energy Protons and Electrons (ISEE-A and B)

L. A. Frank, University of Iowa, Iowa City.

An improved low energy proton and electron differential energy analyzer (LEPEDEA) each on the A and B satellites will be employed. These are in the shape of a quarter sphere and consist of three of these quadrispherical concentric plates. Fourteen channel multipliers are used so that the instrument can measure angular distributions. Seven multipliers are used for protons and seven for electrons. Measurements of both can be made simultaneously.

Fluxgate Magnetometer (ISEE-A and B)

C. T. Russell, University of California, Los Angeles.

Three ring core sensors in an orthogonal triad are enclosed in a flipper mechanism at the end of the magnetometer boom. The electronics unit is on the main body of the spacecraft at the foot of the boom. The magnetometer has two operating ranges of $\pm$ 8192 and $\pm$512 in each vector component. The data are digitized and averaged within the instrument to provide increased resolution and to provide Nyquist filtering.

Plasma Waves (ISEE-A and B)

D. A. Gurnett, University of Iowa.

The frequency range to be investigated is 1 Hz to 200 kHz for electric fields and 1 Hz to 10 kHz for magnetic fields. The basic instrumentation provides a complete set of triaxial magnetic field measurements on the A spacecraft and much simpler single axis electric and magnetic field measurements on the B spacecraft. Measurements on the A spacecraft are intended to cover all wave characteristics, such as wave-normal direction, polarization and Poynting flux. The single axis measurements on the B are intended to provide detailed comparisons of the frequency spectrum and field amplitudes at the two spacecraft.

Plasma Density (ISEE-A and B)

C. C. Harvey, Paris Observatory.

The electron density in the vicinity of the A spacecraft will be measured by means of a radio technique to detect resonances of the ambient plasma. These resonances occur at the plasma frequency, the upper hybrid resonance, the cyclotron frequency and its harmonics and their study permits the determination of several plasma parameters and notably the electron density.

Energetic Electrons and Protons (ISEE-A and B)

D. J. Williams, National Oceanic and Atmospheric Administration, Washington, D.C. (ISEE-A) and E. Keppler, Max Planck Institute (ISEE-B).

The principle of the measurements is to separate electrons and protons by a magnet, deflecting each type of particle into one or more solid state detector telescopes where the pulse heights can be analyzed. This will be accomplished by flying solid state detector systems on both A and B spacecraft to measure detailed energy spectra and angular distributions of protons in the energy range 20 keV to 2 MeV and electrons in the energy range 20 keV to 1 MeV. The NOAA Space Environment Laboratory is responsible for A instrument hardware and integration and the Max Planck Institute for Aeronomy is responsible for B instrument hardware and integration.

Electrons and Protons (ISEE-A and B)

K. A. Anderson, University of California, Berkeley.

Two identical solid state detector telescopes are used, one open, and the other covered with parylene foil. The telescopes have a viewing cone with a half angle of 40 degrees, oriented at an angle of about 20 degrees with the spin axis of the spacecraft. Electrons will be measured in two energy bands, 8 to 200 keV and 30 to 200 keV. Protons will also be measured in these energy ranges and in addition between 200 and 380 keV.

Fast Electrons (ISEE-A)

K. W. Ogilvie, Goddard Space Flight Center, Greenbelt, Md.

Two identical instruments are mounted diametrically opposite one another in the spacecraft, each having three electrostatic analyzers. The axes of each set of analyzers are mutually perpendicular and are oppositely directed to those of the other set. Thus the net flux of electrons in a given direction can be determined, and a good approximation to the three dimensional velocity distribution function obtained. Two channelton electron multipliers are used on each of six analyzers. There are three modes of operation: solar wind 7.4 to 494 eV; magnetosheath 10.5 to 2006 eV and magnetotail and solar 106 to 7077 eV.

Low Energy Cosmic Ray (ISEE-A) and Gamma Ray Burst

D. Hovestadt, Max Planck Institute.

The instrument consists of three sensors and associated electronics:

- An Ultra Low Energy nuclear charge (Z), total energy (E) and ionic charge (Q) assembly (ULEZEQ); this sensor consists of two physically separated units.

- An Ultra Low Energy Wide Angle Telescope designated ULEWAT.

- A Gamma Ray Burst detector.

Quasi-static Electric Field (ISEE-A)

F. S. Mozer, University of California.

Fields are obtained from measurements of the potential difference between a pair of spheres, each of which is mounted on the end of a 50-meter wire boom. The measured potential differences are converted to electric field components in the spacecraft frame of reference by dividing each measurement by the sphere separation distance, after which the resulting fields are converted to Earth-fixed, inertial, or other frames of reference by subtraction of the induced electric field resulting from spacecraft motion through the magnetic field.

DC Electric Field (ISEE-A)

J. P. Heppner, Goddard Space Flight Center.

The electric field in the spin plane of the spacecraft is determined by measuring the difference in the floating potential between the conducting tip sections of two colinear wires extended perpendicular to the spin axis.

Calibration checks and plasma impedance measurements can be conducted either instantaneously or periodically by command functions.

Ion Composition (ISEE-A)

R. D. Sharp, Lockheed Electronics Co., Plainfield, N.J.

The energetic ion mass spectrometer is a high-sensitivity high-resolution analyzer designed to measure the ionic composition over the mass-per-unit-charge region from 1 to 138 AMU in the energy-per-unit-charge range from zero to 17 keV. The instrumentation consists of two complete spectrometers. These are required outside the magnetosphere to provide adequate elevation angle coverage.

VLF Wave Propagation (ISEE-A)

R. A. Helliwell, Stanford University, Palo Alto, Calif.

The main wave injection device is the Stanford VLF transmitter presently in operation at Siple Station in the Antarctic. In recent tests, signals from this transmitter have been successfully injected into the magnetic equatorial plane and have been observed via satellite. For the ISEE mission, the transmitter will be used to inject VLF waves throughout the magnetosphere, producing both VLF emissions and energetic particle pitch angle scattering. In the general case the injected signal, as well as any stimulated VLF emissions will be detected on the A spacecraft broadband VLF receiver provided by Stanford University.

Solar Wind Ions (ISEE-B)

G. Moreno, Laboratorio Plasma Spazio, Frascati, Italy.

This instrument is designed to measure the flow directions and energy spectra of the positive ions in the solar wind. Two modes of operation are provided, one concentrates on high angular resolution and the other on high energy resolution. The main region of interest for this instrument is outward from and including the magnetopause.

DELTA LAUNCH VEHICLE (2914)

The ISEE-A/B spacecraft will be launched by a three stage Delta 2914 launch vehicle. The launch vehicle has an overall length of approximately 35 meters (115 feet) and a maxumum body diameter of 2.4 m (7.8 ft.). A brief description of the vehicle's major characteristics follows:

First Stage

The first stage is a McDonnell Douglas modified Thor booster incorporating nine strap-on Thiokol solid-fuel rocket motors. The booster is powered by a Rocketdyne engine using liquid oxygen and liquid hydrocarbon propellants. The main engine is gimbal-mounted to provide pitch and yaw control from liftoff to main engine cutoff (MECO).

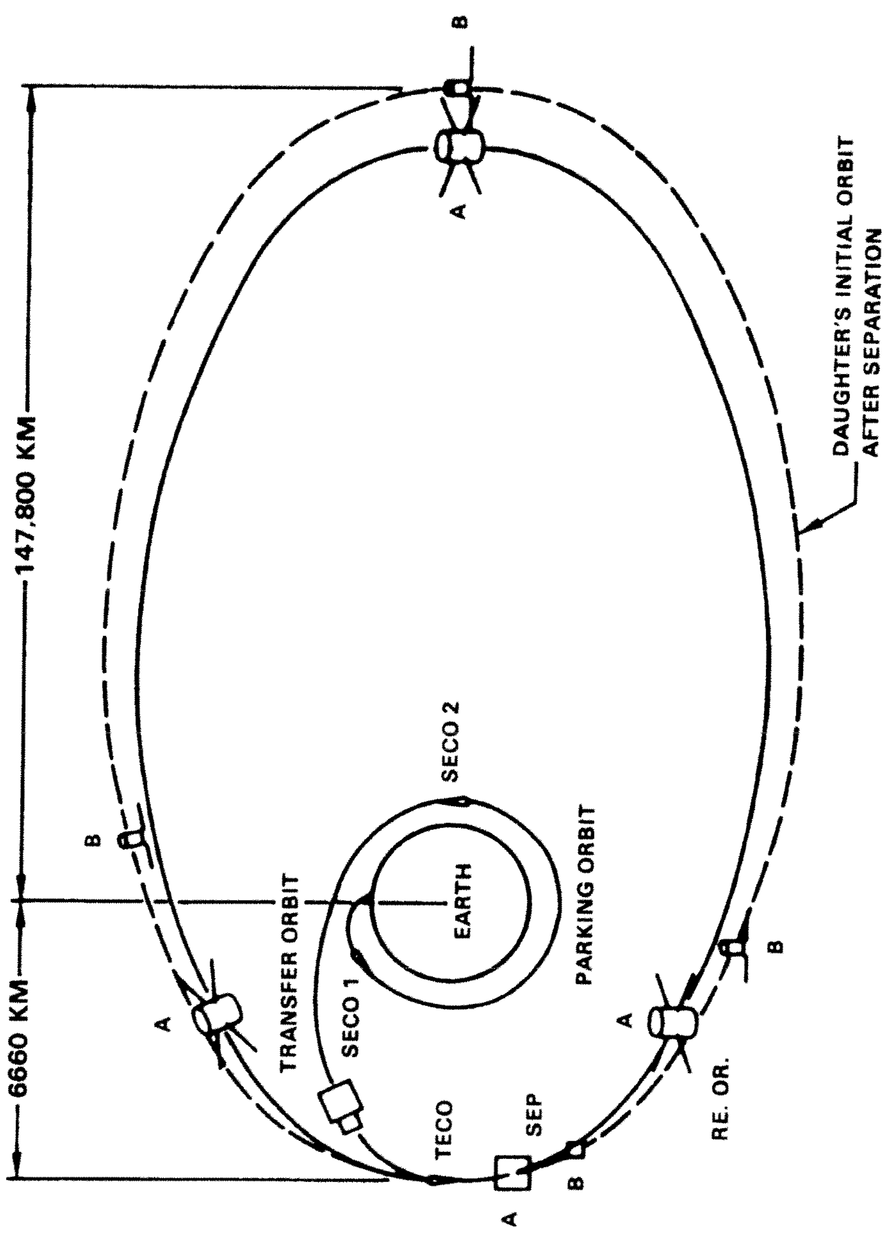
Second Stage

The second stage is powered by a TRW liquid fuel, pressure-fed engine that also is gimbal-mounted to provide pitch and yaw control through the second stage burn. A nitrogen gas system uses eight fixed nozzles for roll control during powered and coast flight, as well as pitch and yaw control during coast and after second stage cutoff (SECO). Two fixed nozzles, fed by the propellant tank helium pressurization system, provide retrothrust after third stage separation.

Third Stage

The third stage is the TE-364-4 spin-stabilized, solid propellant Thiokol motor. It is secured in the spin table mounted to the second stage. The firing of eight solid propellant rockets fixed to the spin table accomplishes spin-up of the third stage spacecraft assembly. The ISEE spacecraft are attached to the third stage motor.

INTERNATIONAL SUN-EARTH EXPLORERS (ISEE-A & B)



INITIAL ORBITS

LAUNCH OPERATIONS

The Kennedy Space Center's Expendable Vehicles Directorate plays a key role in the preparation and launch of the thrust-augmented Delta rocket carrying the ISEE A/B spacecraft.

Delta 135 will be launched from Pad B, southernmost of the two launch pads at Complex 17, Cape Canaveral Air Force Station.

The Delta first stage and interstage were erected on Pad B on August 30. Four Castor 2 solid strap-on rocket motors were mounted in place around the base of the first stage on August 31 and the remaining five were installed on September 1. The second stage was erected on September 6.

The ISEE B spacecraft arrived at KSC on August 31 and the ISEE A spacecraft was received on September 8. After initial checkout in Hangar S, the two spacecraft were moved to the Spin Test Facility in late September for mating with the Delta third stage in early October. Movement of the spacecraft/third stage assembly to the pad for mating with Delta 135 was scheduled for the first week in October.

Based upon an October 19 launch date, the payload fairing which protects the spacecraft on its flight through the atmosphere is to be put in place about October 16.

ISEE-A&B PROGRAM MANAGEMENT

The memorandum of understanding between the European Space Agency and NASA dated March 17, 1975, divides the project responsibilities and provides for an internatinal management organization. NASA is responsible for the A and C spacecraft, Delta launch vehicle, tracking, data acquisition and data processing. ESA is responsible for the ISEE-B spacecraft and its operation.

NASA's Office of Space Science is responsible for overall direction and evaluation of the NASA portion of the program. The Office of Tracking and Data Acquisition has overall tracking and data processing responsibility.

Goddard Space Flight Center has management responsibility for ISEE-A and is directly responsible for tracking and data acquisition and data processing.

ISEE-A is a Goddard-designed spacecraft with all its components supplied by United States industry. Integration and testing was also done at Goddard.

ISEE-B is an ESA-ESTEC spacecraft with Dornier Systems, Frederickshaven, Germany, heading the contractor team which consists of a consortium of industries in 10 European countries called the STAR Consortium.

Goddard directs the Delta rocket program and McDonnell Douglas Astronautics Co., Huntington Beach, Calif., is prime contractor.

LAUNCH SEQUENCE FOR ISEE-A & B

Event	Time	Altitude Kilometers/miles	
Liftoff	0 sec.	0	0
Six Solid Motor Burnout	38 sec.	6	4
Three Solid Motor Ignition	39 sec.	6	4
Three Solid Motor Burnout	1 min. 18 sec.	21	13
Nine Solid Motor Jettison	1 min. 27 sec.	26	16
Main Engine Cutoff (MECO)	3 min. 45 sec.	91	56
First/Second Stage Separation	3 min. 54 sec.	96	60
Second Stage Ignition	3 min. 56 sec.	99	61
Fairing Jettison	4 min. 56 sec.	126	78
Second Stage Cutoff #1 (SECO #1)	8 min. 44 sec.	157	97
Begin Coast Phase Roll (1 rpm)	9 min. 23 sec.	157	97
End Coast Phase Roll	44 min. 23 sec.	275	171
Second Stage Ignition #2	53 min. 31 sec.	285	177
Second Stage Second Cut-Off 2 (SECO 2)	53 min. 52 sec.		
Third Stage/Payload Spin-Up	54 min. 50 sec.		
Jettison Stage II	54 min. 52 sec.		
Third Stage Ignition	55 min. 33 min.		
Third Stage Burnout	56 min. 17 sec.	287	178
Payload Separation, Activate Retro System	57 min. 30 sec.	327	203

ISEE-A and B TEAM

NASA Headquarters

Dr. Noel S. Hinners	Associate Administrator for Space Science
Dr. S. Ichtiaque Rasool	Deputy Associate Administrator for Space Science (Science)
T. Bland Norris	Director, Astrophysics Programs
Dr. Harold Glaser	Director, Solar Terrestrial Programs
Frank Gaetano	ISEE-A Program Manager
Dr. Erwin R. Schmerling	ISEE-A Program Scientist
John F. Yardley	Associate Administrator for Space Flight
Joseph B. Mahon	Director of Expendable Launch Vehicle Programs
Peter T. Eaton	Manager, Delta Program
Gerald M. Truszynski	Associate Administrator for Tracking and Data Acquisition

European Space Agency

Roy Gibson	Director General
Dr. Ernst Trendelenburg	Director of Scientific and Meteorological Programs
Dr. Edgar Page	Head of Space Science Department, European Space Technology Center (ESTEC)
Maurice Delahais	Head, Scientific Projects ESTEC
Derek Eaton	ISEE-B Project Manager
Dr. Alastair C. Durney	ISEE-B Project Scientist

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Goddard Space Flight Center

Dr. Robert S. Cooper	Director
Robert E. Smylie	Deputy Director
Robert Lindley	Director of Projects
Don Fordyce	Associate Director for Projects
Jeremiah J. Madden	Project Manager
Keith W. Ogilvie	Project Scientist
Dr. Stephen Paddack	Deputy Project Manager, Technical
James O. Redding	Financial Manager
John A. Hrastar	Mission Operations Manager
Martin A. Davis	Scientific Instrument Manager
David W. Grimes	Delta Project Manager
William R. Russell	Deputy Delta Project Manager, Technical
Robert Goss	Chief, Mission Analysis and Integration Branch, Delta Project Office
E. Michael Chewning	Delta Mission Integration Manager
Thomas C. Moore	Mission Operations Manager
Kenneth McDonald	Network Support Manager

Kennedy Space Center

Lee R. Scherer	Director
Gerald D. Griffin	Deputy Director
Dr. Walter J. Kapryan	Director, Space Vehicles Operations
George F. Page	Director, Expendable Vehicles

Kennedy (cont'd)

W. C. Thacker	Chief, Delta Operations Division
Wayne McCall	Chief Engineer, Delta Operations
Edmund M. Chaffin	Spacecraft Coordinator

Contractors

Dornier Systems Friedrichshafen, Germany	ISEE-B Spacecraft (prime)
McDonnell Douglas Astronautics Co. Huntington, Beach, Calif.	Delta Launch Vehicle

ISEE-B was designed and constructed by the European STAR Consortium of companies under contract to the European Space Agency. Dornier Systems as prime contractor is responsible for project management, systems engineering, attitude and orbit control, wire harness, assembly integration and test and launch support.

Other STAR consortium team members are:

Structure	Contraves, Switzerland
Telecommunications and data handling	Thomson-CSF, France Montedel Laben SPA, Italy AEG, Germany L.M. Ericsson, Sweden
Attitude and Orbit Control	British Aircraft Corp., United Kingdom SEP, France Fokker, Netherlands
Solar Array	AEG, Germany
Power Supplies	FIAR, Italy Electronikcentralen, Denmark Fokker, Netherlands Dornier Systems, Germany

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