ISEE-2

Achievements: unprecedented observations, with ISEE-1, of Earth's magnetosphere
Launch date: 22 October 1977
Mission end: reentered 26 September 1987 (design life 3 years)
Launch vehicle/site: US Delta from Cape Canaveral complex 17
Launch mass: 165 kg (27.7 kg science payload)
Orbit: operational 2400x135 830 km, 23.0°
Principal contractors: Dornier-System GmbH, heading the STAR consortium

The International Sun-Earth Explorer (ISEE) was a joint ESA/NASA 3-spacecraft mission designed to study the dynamic properties of the Earth's magnetosphere and the solar wind in front of the magnetosphere. ESA's 'daughter' ISEE-2 was launched in tandem with NASA's 'mother' ISEE-1 and released into almost the same highly-elliptical orbit that provided good coverage of all the magnetosphere features over the period of a year. The separation between the spacecraft could be varied between 50 km and 5000 km, according to the scale of the feature being studied. The pairing allowed differentiation between spatial and temporal phenomena.

ISEE-2 in the Dynamic Test Chamber at ESTEC.

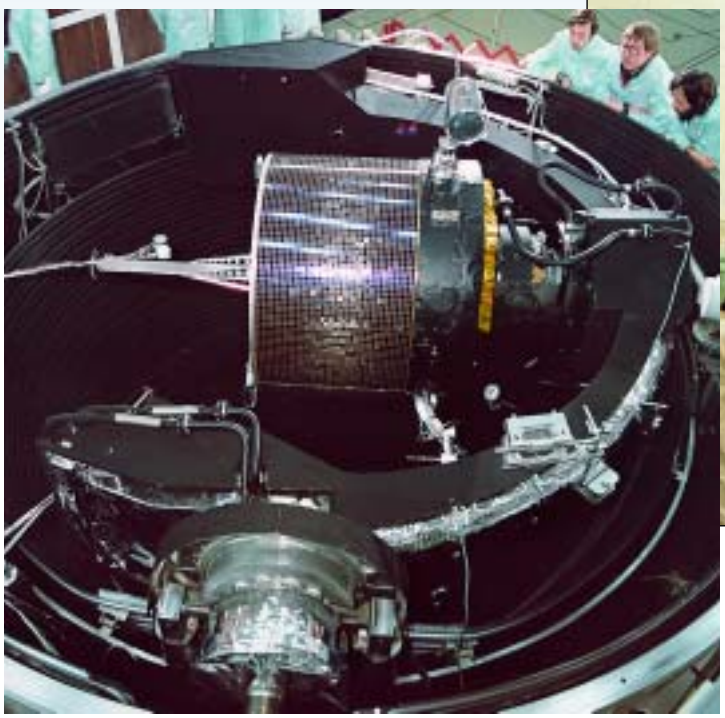
NASA's ISEE-3 was launched in August 1978 to monitor the solar wind, fields and cosmic rays before they arrived at Earth. More than 100 investigators, representing most of the magnetospheric community, from 33 institutes were involved in the ISEE mission and its 28 instruments. The satellites were planned with 3-year lives but the ISEE-1/2 pair both operated for almost 10 years until their reentries in 1987. It is remarkable that no ISEE-2 units failed, apart from the expected loss of its battery.

Mission objectives included quantifying the picture of the magnetosphere known at the time, identifying how the solar wind affects the near-Earth environment, exploiting the plasmasphere and bow shock magnetosheath for plasma and particle physics studies, and measuring the isotopic composition of solar and galactic cosmic rays. For example, the satellites provided the first reliable measurement of the thickness of the magnetopause, the boundary between the Earth's magnetic field and the solar wind.

Satellite configuration: spin-stabilised cylindrical bus with three deployed instrument booms. Strict measures were followed to eliminate interference from the spacecraft to some of the experiments: the entire

Mating ESA's ISEE-2 (top) with NASA's ISEE-1 at Cape Canaveral in preparation for launch.

ISEE-2 installation in the HBF 3 facility at ESTEC for thermal-vacuum testing.



Only two ISEE-2 models were built: the vibration-test version (later converted to engineering/prototype standard) and the flight model.

exterior was made conductive to reduce potential difference to 1 V, the use of non-magnetic materials restricted ISEE's DC field to <0.25-gamma at the magnetometer, and stringent limits were imposed on the electromagnetic radiation emitted by ISEE's interior.

Attitude/orbit control: 20 rpm spin-stabilised about longitudinal axis, perpendicular to ecliptic plane; 4 spin nozzles, 2 precession nozzles, also used for separation manoeuvres from ISEE-1. Cold gas propellant: 10.7 kg Freon-14. Attitude determined by two Earth albedo and solar aspect sensors.

Power system: Si cells on cylindrical panels generated >100 W (65 W after 10 years; 27 W required by science payload), supported by nickel cadmium battery (failed, as predicted, after 2 years).

Communications payload: S-band data returned at 8192 bit/s (high) or 2048 bit/s (low). Controlled from NASA Goddard.

ISEE-2 Scientific Instruments	
AND	8-380 keV protons & 8-200 keV electrons at high time resolution. K.A. Anderson, Univ. California at Berkeley (US)
EGD	0.001-10 keV/N solar wind ions. G. Moreno, CNR Frascati (I)
FRD	0.001-50 keV protons & 0.001-250 keV electrons at high angular resolution. L. Frank, Iowa Univ. (US)
GUD	10 Hz-2 MHz electric waves & 10 Hz-10 kHz magnetic waves. D. Gurnett, Iowa Univ. (US)
HAD	Total electron density between ISEE-1/2. C.C. Harvey, Meudon (F)
KED	0.025-2 MeV protons & 20-250 keV electrons at high angular resolution. D. Williams, NOAA Boulder (US)
PAD	0.005-40 keV protons & 0.005-20 keV electrons at high time resolution. G. Paschmann, MPI Garching (D)
RUD	Magnetometer, range 8192-gamma sensitivity 0.008-gamma. C. Russell, Univ. California at Los Angeles (US)