175)

Hiten/Hagomoro

Nation: Japan (3)
Objective(s): lunar flyby and lunar orbit
Spacecraft: Muses-A and Muses-A subsatellite
Spacecraft Mass: 197.4 kg
Mission Design and Management: ISAS
Launch Vehicle: Mu-3S-II (no. 5)
Launch Date and Time: 24 January 1990 / 11:46 UT
Launch Site: Kagoshima / launch complex M1
Scientific Instruments:

Hiten:

1) cosmic dust detector

Results: This two-module Japanese spacecraft was designed to fly past the Moon and release an orbiter. It was the first Japanese lunar mission and also the first robotic lunar probe since the flight of the Soviet Luna 24 in 1976. Muses-A (for Mu-launched Space Engineering Satellite) was launched into a highly elliptical orbit that intersected the Moon's orbit. After launch, the spacecraft, which was renamed Hiten, returned technical data on trajectory and optical navigation from an onboard computer. The cosmic dust experiment was jointly designed with Germany. On 19 March 1990, the spacecraft approached the Moon to a range of 16,472 kilometers and then released a small 12-kilogram orbiter satellite named Hagomoro into lunar orbit. Initial orbital parameters were 22,000 x 9,000 kilometers. Although the maneuver successfully demonstrated the use of the swingby technique to enter lunar orbit, communication with Hagomoro was lost shortly after release. Hiten, on the other hand, continued on its trajectory, simulating the orbital path of the proposed Geotail spacecraft. On 19 March 1991, Hiten flew by Earth at a range of 126 kilometers during a gravity-assist maneuver that slowed it by 1.7 meters per second—the first aerobraking maneuver by a deep space probe. During its eleventh flyby of the Moon on 15 February 1992, Hiten swung into lunar orbit and eventually impacted on 10 April 1993.

176)

Ulysses

Organization/Nation: ESA and U.S. (1)
Objective(s): heliocentric orbit
Spacecraft: Ulysses
Spacecraft Mass: 371 kg
Mission Design and Management: ESA and NASA JPL
Launch Vehicle: STS-41 *Atlantis*
Launch Date and Time: 6 October 1990 / 11:47:16 UT
Launch Site: ETR / launch complex 39B
Scientific Instruments:

1) BAM solar wind plasma experiment
2) GLG solar wind ion composition experiment
3) HED magnetic fields experiment

This montage of the nine planets and four large moons of Jupiter in our solar system are set against a false-color view of the Rosette Nebula. The light emitted from the Rosette Nebula results from the presence of hydrogen, oxygen, and sulfur. Most of the planetary images in this montage were obtained by NASA's planetary missions, which have dramatically changed our understanding of the solar system.

4) KEP energetic-particle composition/ neutral gas experiment
5) LAN low-energy charged-particle composition/anisotropy experiment
6) SIM cosmic rays and solar particles experiment
7) STO radio/plasma waves experiment
8) HUS solar x-rays and cosmic gamma-ray bursts experiment
9) GRU cosmic dust experiment

Results: The Ulysses mission was an outgrowth of the abandoned International Solar Polar Mission (ISPM) that involved two spacecraft flying over opposite solar poles to investigate the Sun in three dimensions. Eventually, ESA built a single spacecraft for launch on the Space Shuttle. The vehicle was designed to fly a unique trajectory that would use a gravity-assist from Jupiter to take it below the elliptic plane, past the solar south pole, and then above the elliptic to fly over the north pole. Eventually, thirteen years after ESA's science council had originally approved the mission, Ulysses was sent on its way via a Shuttle/PAM-S motor combination. Escape velocity was 15.4 kilometers per second, higher than had been achieved by either of the Voyagers or Pioneers, and the fastest velocity ever achieved by a human-made object. After a midcourse correction on 8 July 1991, Ulysses passed within 378,400 kilometers of Jupiter at 12:02 UT on 8 February 1992. After a seventeen-day period passing through and studying the Jovian system, the spacecraft headed downwards and back to the Sun. From about mid-1993 on, Ulysses was constantly in the region of space dominated by the Sun's southern pole, as indicated by the constant negative polarity measured by the magnetometer. South polar observations extended from 26 June to 6 November 1994, when the vehicle was above 70° solar latitude. It reached a maximum of

80.2° in September 1994. Its instruments found that the solar wind blows faster at the south pole than at the equatorial regions. Flying up above the solar equator on 5 March 1995, Ulysses passed over the north polar regions between 19 June and 30 September 1995 (maximum latitude of 80.2°). The closest approach to the Sun was on 12 March 1995 at a range of 200 million kilometers. ESA officially extended Ulysses's mission on 1 October 1995, renaming this portion as the Second Solar Orbit. The spacecraft made a second pass over the south pole between September 2000 and January 2001, and it made a pass over the northern pole in October 2001. In October 2000, ESA announced that Ulysses had discovered the most distant gamma-ray burst yet recorded, about 11 billion light years from Earth. At that time, the Sun was at the peak of its eleven-year cycle. ESA's Science Programme Committee, during a meeting on 5–6 June 2000, agreed to extend the Ulysses mission from the end of 2001 to 30 September 2004. NASA was expected to approve the plan by mid-2001.