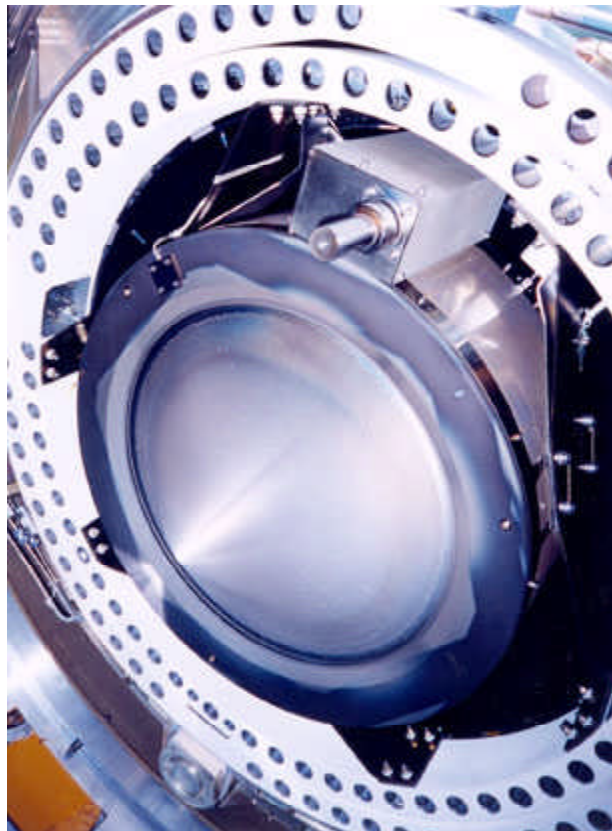


Ion Thruster Used to Propel the Deep Space 1 Spacecraft to Comet Encounters

The NASA Solar Electric Propulsion Technology Applications Readiness (NSTAR) Project provided a xenon ion propulsion system to the Deep Space 1 (DS1) spacecraft to validate the propulsion system as well as perform primary propulsion for asteroid and comet encounters. The On-Board Propulsion Branch of the NASA Glenn Research Center at Lewis Field developed engineering model versions of the 30-cm-diameter ion thruster and the 2.5-kW power processor unit (PPU). Glenn then transferred the thruster and PPU technologies to Hughes Electron Dynamics and managed the contract, which supplied two flight sets of thrusters and PPU's to the Deep Space 1 spacecraft and to a ground-based life verification test at the Jet Propulsion Laboratory (JPL). In addition to managing the DS1 spacecraft development, JPL was responsible for the NSTAR Project management, thruster life tests, the feed system, diagnostics, and propulsion subsystem integration. The ion propulsion development team included NASA Glenn, JPL, Hughes Electronics, Moog Inc., and Spectrum Astro Inc.

The overall NSTAR subsystem dry mass, including thruster, PPU, controller, cables, and the xenon storage and feed system, is 48 kg. The mass of the xenon stored onboard DS1 was about 81 kg, and the spacecraft wet mass was approximately 500 kg.



Flight ion thruster mounted to the Deep Space 1 spacecraft gimbal assembly.

The DS1 spacecraft was launched on October 24, 1998, and on July 29, 1999, it flew within 16 miles of the small asteroid Braille (formerly 1992KD) at a relative speed of 35,000 mph. As of November 1999, the ion propulsion system had performed flawlessly for nearly 149 days of thrusting. NASA has approved an extension to the mission, which will allow DS1 to continue thrusting to encounters with two comets in 2001. The DS1 optical and plasma diagnostic instruments will be used to investigate the comet and space environments. The spacecraft is scheduled to fly past the dormant comet Wilson-Harrington in January 2001 and the very active comet Borrelly in September 2001, at which time approximately 500 days of ion engine thrusting will have been completed.

Bibliography

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