THE HERMES MERCURY ORBITER MISSION: Robert M. Nelson (1), Linda J. Horn (2), James R. Weiss (3), and William D. Smythe (4), all at Jet Propulsion Laboratory

Hermes is a Discovery class mission under study which is intended to investigate the feasibility of placing a spacecraft in orbit about the planet Mercury. It is a response to NASA's challenge to the planetary exploration community to develop missions within strict resource limits. The Hermes mission will complete the exploration of Mercury, a body whose surface is 60% unmapped. The planet has been surveyed only once by a spacecraft -- the Mariner 10 flyby mission in the 1970's. The goal of the mission is to understand Mercury's significance in planetary formation by determining the topography, composition, texture and mineralogy of the surface, searching for condensates at Mercury's poles and constraining the planet's interior structure.

The instruments on board the Hermes spacecraft will permit investigations into important scientific questions regarding Mercury including:

(1) The search for expressions of volcanism on the planet's surface.
(2) The search for iron in the crust.
(3) Identification and mapping of hypothesized water ice polar caps.
(4) The role of impact cratering in the evolution of the surface.
(5) The distribution and production and loss rates of the species comprising Mercury's tenuous atmosphere.
(6) The nature of Mercury's magnetic and gravitational fields and their relationship to the planets interior.

Hermes' highly elliptical, near polar orbit will permit mapping of the entire surface at 1 km resolution and a significant fraction (40%) will be mapped at 0.1 km resolution. These data will enable investigators to search for morphological changes that have occurred on Mercury since the Mariner 10 flyby mission. In addition to a multispectral CCD camera, the spacecraft will support a magnetometer, a ultraviolet spectrometer and a lidar.

Recent major advances in mission design, spacecraft and instrument technology, and ground system operations offer the opportunity to complete this mission at modest cost. The mission design concept calls for two flybys of Mercury followed by insertion in a 12-hour 200x15,000 km orbit. This strategy enables Hermes to use a low cost Delta II launch vehicle. The Hermes spacecraft is a TRW Lightsat that is based on spacecraft designs of recent vintage. This modification of current technology is financially attractive compared to developing a new spacecraft. The Hermes data system uses new concepts of centralized design to increase efficiency over recent decentralized data system concepts.

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The temperature extremes of the Hermean environment present a challenge to spacecraft thermal design. To respond to these challenges the Hermes spacecraft will employ a variety of active and passive thermal control technologies including concepts as straightforward as sunshields to more sophisticated concepts such as heat pipes.

Hermes will utilize a ground operations system of previously proven design rather than building a new system from scratch. This will be based on the multi-mission support concept in which one ground system will maintain the personnel and equipment for several missions.

The Hermes study shows that by astute use of recent advances in space technology Discovery class missions can remain within budgetary constraints and not compromise quality science.

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