

THE GULLIVER SAMPLE RETURN MISSION TO DEIMOS

D. Britt (1) and the Gulliver Team

(1) Dept. of Physics, University of Central Florida, USA, (britt@physics.ucf.edu)

The Martian moon Deimos presents a unique opportunity for a sample return mission. Deimos is spectrally analogous to type D asteroids, which are thought to be composed of highly primitive carbonaceous material that originated in the outer asteroid belt. It also is in orbit around Mars and has been accumulating material ejected from the Martian surface ever since the earliest periods of Martian history, over 4.4 Gyrs ago. There are a number of factors that make sample return from Deimos extremely attractive.

It is Better: Deimos is a repository for two kinds of extremely significant and scientifically exciting ancient samples: (1) Primitive spectral D-type material that may have accreted in the outer asteroid belt and Trojan swarm. This material samples the composition of solar nebula well outside the zone of terrestrial planets and provides a direct sample of primitive material so common past 3 AU but so uncommon in the meteorite collection. (2) Ancient Mars, which could include the full range of Martian crustal and upper mantle material from the early differentiation and crustal-forming epoch as well as samples from the era of high volatile flux, thick atmosphere, and possible surface water. The Martian material on Deimos would be dominated by ejecta from the ancient crust of Mars, delivered during the Noachian Period of basin-forming impacts and heavy bombardment.

It is Closer: Compared to other primitive D-type asteroids, Deimos is by far the most accessible. Because of its orbit around Mars, Deimos is far closer than any other D asteroid.

It is Safer: Deimos is also by far the safest small body for sample return yet imaged. It is an order of magnitude less rocky than Eros and the NEAR-Shoemaker mission succeeded in landing on Eros with a spacecraft not designed for landing and proximity maneuvering. Because of Viking imagery we already know a great deal about the surface roughness of Deimos. It is known to be very smooth and have moderate topography and gravitational slopes.

It is Easier: Deimos is farther from Mars and smaller than Phobos. This location minimizes the delta-V penalties from entering the Martian gravity well; minimizes the energy requirements for sampling maneuvers; and minimizes Martian tidal effects on S/C operations.

After initial processing these samples will be made available as soon as possible to

the international cosmochemistry community for detailed analysis. The mission management team includes Lockheed Martin Astronautics (flight system, I&T) and JPL (payload, mission ops, and mission management).