ABSTRACT

DETERMINATION OF EROS PHYSICAL PARAMETERS FROM NEAR EARTH ASTEROID RENDEZVOUS ORBIT PHASE NAVIGATION DATA

J. K. Miller, P. J. Antreasian, J. Giorgini, W. M. Owen,
B. G. Williams and D. K. Yeomans

Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive, MS301/125J
Pasadena, CA 91109

Navigation of the orbit phase of the Near Earth Asteroid Rendezvous (NEAR) mission will require determination of certain physical parameters describing the size, shape, gravity field, attitude and inertial properties of Eros. Prior to launch, little was known about Eros except for its orbit which could be determined with high precision from ground based telescope observations. Radar bounce and light curve data provided a rough estimate of Eros shape and a fairly good estimate of the pole, prime meridian and spin rate. However, the determination of the NEAR spacecraft orbit requires a high precision model of Eros's physical parameters and the ground based data provides only marginal a priori information. Eros is the principal source of perturbations of the spacecraft's trajectory and the principal source of data for determining the orbit. The initial orbit determination strategy is therefore concerned with developing a precise model of Eros.

The initial attitude and spin rate of Eros, as well as estimates of reference landmark locations, are obtained from images of the asteroid. These initial estimates are used as a priori values for a more precise refinement of these parameters by the orbit determination software which combines optical measurements with Doppler tracking data to obtain solutions for the required parameters. As the spacecraft is maneuvered closer to the asteroid, estimates of spacecraft state, asteroid attitude, solar pressure, landmark locations and Eros physical parameters including mass, moments of inertia and gravity harmonics are determined with increasing precision.

James K. Miller
Jet Propulsion Laboratory
MS 301/125j
4800 Oak Grove Dr.
Pasadena, CA 91109
Tel: (818) 354-4652
Fax: (818) 393-6388
Email: jkm@tube.jpl.nasa.gov