AOGS 2005

High-Resolution Topographic Mapping of Phobos by the HRSC on MARS-EXPRESS

B. GIESE[1], J. OBERST[1], G. NEUKUM[2] and the HRSC CO-INVESTIGATOR TEAM
[1]*DLR-Institute of Planetary Research, Berlin, Germany*
[2]*Department of Earth Sciences, Freie Universität Berlin, Germany*

In August 2004, Mars Express had an exceptionally close encounter (150 km) with the small Martian satellite Phobos (radii: 13x11x9 km). During this flyby, the High-Resolution Stereo Camera (HRSC) on board acquired stereo images at resolutions down to 6 m. High-resolution coverage of Phobos was also obtained by the Viking orbiters and the Mars Global Surveyor spacecraft, but the HRSC data set is unique because of the high-resolution and five-fold stereo coverage, which significantly improves the accuracy of the topographic model.

We used methods of photogrammetry to derive a regional topographic model of Phobos. To get highest point accuracies, offsets in the image pointing angles were estimated by a bundle block adjustment. In lack of a complete data set covering the whole moon, we used one point from the Viking control network to firmly tie our network to the established global shape model. In result of the adjustment we found that Phobos must have advanced by ~6 sec. (corresponding to 12 km along the orbit) beyond what is predicted by its Viking ephemeris.

The obtained terrain model has a horizontal resolution of ~100 m and vertical accuracies in the range of 2-25 m, depending on the HRSC-sensors involved. Although limited in coverage, the resolution is substantially higher than the global shape model from the Viking era (Fig.1). Once data from more flybys become available, we hope to obtain full global coverage at high-resolution.

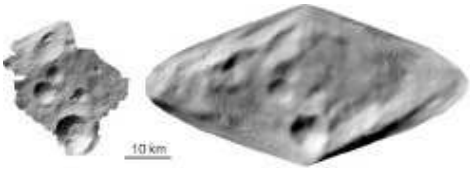

Figure 1: Shaded relief of terrain models. (Left) based on HRSC-stereo images, (Right) from Viking images (P. C. Thomas, 1993).