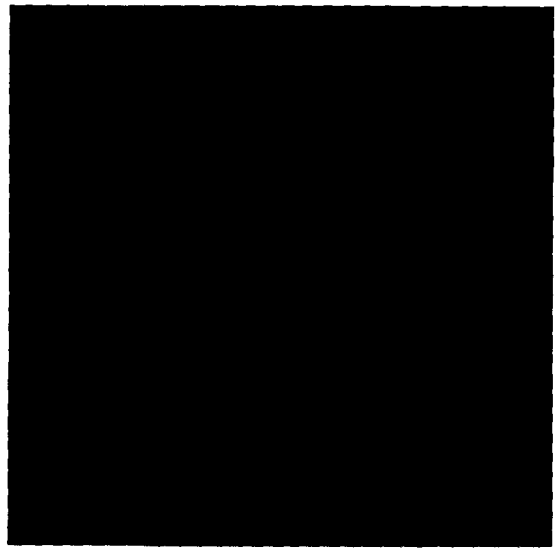
DETAILED SHAPE AND TOPOGRAPHY OF PHOBOS. R.W. Gaskell, JPL/Caltech, MS 301/150, 4800 Oak Grove Drive, Pasadena, CA 91109, (818) 354-2116, rwg@piglet.jpl.nasa.gov.

Introduction: Viking Orbiter and Phobos88 images have been used to construct a model of Phobos at hundred meter resolution with rms radial uncertainties of about 20 meters. Over 100 individual topographic maps have been combined to produce the final model.



The topographic maps are actually extended landmark templates, designed to be alignable with a variety of data types including images, limb data, laser altimetry, and other overlapping landmark templates.

Template Construction The landmark templates are constructed as part of a three-step cyclical iteration with each step supplying refined inputs for the next:

1. Images are registered (aligned), the central landmark vectors determined, and possibly the spacecraft vectors found, by minimizing the weighted mean square residuals between nominal and observed landmark locations, limbs, and overlapping landmark templates.
2. The surface gradient and albedo at each pixelized location within the landmark are determined by minimizing the mean square residuals between the re-illuminated model and imaging data extracted from a number of pictures.
3. The gradients are integrated to produce the height distribution in the landmark, with limb points and sparsely sampled heights from overlapping maps included to provide an absolute height scale, and to prevent errors in the gradient solutions from propagating too far.

Phobos Model One hundred forty six overlapping maps, each containing 10,000 surface vectors, were averaged to produce a low resolution shape model. The volume of Phobos determined from this model is about 5755 km^3, while the principal moments per unit mass are 43.8 km^2, 51.4 km^2, and 60.2 km^2. A more detailed model was then constructed by integrating the original slopes relative to the low resolution model.

References

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