



Global shape estimates and GIS cartography of Io and Enceladus using new control point network

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We have analyzed a total of 53 Galileo and Voyager images of Io and 54 Cassini images of Enceladus to derive new geodetic control point networks for the two satellites. In order to derive the network for Io we used a subset of 66 images from those used in previous control point network studies [1, 2]. Additionally we have carried out new point measurements. We used recently reconstructed Galileo spacecraft trajectory data, supplied by the spacecraft navigation team of JPL.

A total of 1956 tie point measurements for Io and 4392 ones for Enceladus have been carried out, which were processed by performing photogrammetric bundle block adjustments. Measurements and block adjustments were performed by means of the «PHOTOMOD» software [3] which was especially adapted for this study to accommodate global networks of small bodies, such as Io and Enceladus. As a result, two catalogs with the Cartesian three-dimensional coordinates of 197 and 351 control points were obtained for Io and Enceladus, respectively.

The control points for Io have a mean overall accuracy of 4985.7 m (RMS). The individual accuracy of the control points for Enceladus differ substantially over the surface (the range is from 0.1 to 36.0 km) because images lack coverage and resolutions. We also determine best-fit spheres, spheroids, and tri-axial ellipsoids. The centers of the models were found to be shifted from the coordinate system origin attesting to possible errors in the ephemeris of Io.

Conclusion and Future work: A comparison of our results for Io with the most recent control point network analysis [2] has revealed that we managed to derive the same accuracy of the control points using a smaller number of images and measurements (This study: 1956 measurements, DLR study: 4392). This probably attests to the fact that the now available new navigation data are internally more consistent. At present an analysis of the data is in progress. We report that control point measurements and global network analysis for small planetary bodies by means of the software «PHOTOMOD» is fast and efficient.

Using the new control points and shape models of the satellites we are currently preparing new maps of Io and Enceladus using GIS tools. For parts of the surface for which we have quality stereo-images we will produce DEMs and orthoimages, which will be shown at the conference.

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References: [1] Gaskell et al. (1988) *Geophys. Res. Lett.*, 15(6), 581– 584. [2] Oberst J. and Schuster P. (2004) *JGR*, 109, E04003, doi:10.1029/2003JE002159. [3] <http://www.racurs.ru/?lng=en&page=634>.