SMALL BODY MAPPING RESULTS - 1994: Philip J. Stooke, Department of Geography, University of Western Ontario, London, Ontario, Canada N6A 5C2 (stooke@sscl.uwo.ca).

INTRODUCTION. The Small Body Mapping Program is an ongoing effort to produce digital shape models, maps and geological studies of all small bodies for which data are obtained. In 1994 it encompassed the nucleus of Comet Halley, asteroid 4769 Castalia and Phobos. Halley was modelled using the Slow LAM rotation of Belton et al. (1). The new shape will support mapping and studies of jet activity. Castalia was mapped using the harmonic expansion shape of Hudson and Ostro (2) to develop methods for future mapping of high resolution radar data. The Phobos photomosaic of Simonelli et al. (3) was reprojected onto a morphographic projection of their shape model to form a base for relief, topographic and geological mapping. In addition, a simplified version of Cheeseman et al.'s method (4) of combining multiple images to increase effective resolution has been tried with good results on images of Hyperion, and will be used where appropriate in future.

HALLEY. The nucleus was modelled before (5) using the 53.5 hour short axis rotation proposed in 1986 (6). The Slow LAM rotation produces different results, mainly because Vega 1 is now thought to have passed the small end rather than the large end of the tapered nucleus. Working with Alain Abergel of IAS, I have derived a consistent shape model which duplicates the appearance of the entire image set, if my assumptions about limb locations in the very noisy images are accepted (Figure 1). We will use the model to study jet source locations and cometary landforms, and will produce maps of the nucleus.

4769 CASTALIA. Hudson and Ostro used low resolution radar images of Castalia (7) to derive a separate harmonic expansion shape for each of its lobes (2). The data barely warrant mapping but were used to experiment with modelling delay-doppler radar data and to define cartographic options for multi-lobed shapes (8,9). The harmonic expansions were published as rendered images and silhouettes (2), which I used like conventional images, matching 'limbs' and details on the disks with the shape model. The longitudes of (2) were reduced by 60° to place 0° on the long axis. The digital radius model derived in this way was used to create maps (Figure 2). All maps in this program use the Morphographic Conformal Projection applied to the convex hull of the 3-D shape, to reduce distortions in deep depressions (9,10). Usually this just flattens depressions such as Stickney on Phobos, projecting crater floors onto their rim planes. For a multi-lobed object it reduces the visual impression of a multi-component shape, so a novel shape is proposed for mapping such objects: the semiconvex hull, a surface lying between surface and convex hull, with the same technique applied to the convex hull of the 3-D shape, to reduce distortions in deep depressions (9,10).

PHOBOS. The new Phobos shape model of ref. 3, provided by P. Thomas, was used to derive the convex hull which controls the map projection, and projected to the Morphographic Conformal geometry. The cylindrical projection photomosaic (3) was scanned from a print provided by D. Simonelli and reprojected into the new geometry. Shapes of features near the poles, and their relationships to other features, are restored by this projection. Two gaps in coverage in the original mosaic and a distorted crater floor were restored from raw Viking images. The mosaic (Figure 3) will be used to control shaded relief drawing which will serve as a base for contour and geological maps. The same technique will be applied to images of Deimos, Gaspra and Ida in the coming years.

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Figure 1: Preliminary Halley shape model.

Figure 2: 4769 Castalia grids and map of one side (names informal).

Figure 3: Phobos.