PROCEDURES FOR MAPPING NON-SPHERICAL WORLDS

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A standardized procedure has been developed for mapping small non-spherical bodies such as asteroids, which will be the targets of numerous spacecraft in coming decades. The first step is to gather all available images from NASA's Planetary Data System website, and image orientation information published by spacecraft camera teams. Next, all images to be used for mapping are processed to remove noise and artifacts and to optimize contrast. The latter step usually involves merging contrast-stretched and high-pass filtered versions of the same image to provide optimum discriminability of features in both bright and dark areas. Where appropriate, images are mosaicked at this stage.

Next, each image is reprojected from perspective geometry to simple cylindrical projection. A latitude-longitude grid is constructed from a shape model prepared by the author or other researchers and is superimposed on each image. Reprojection is handled by the geocorrection routines in a GIS, using grid intersections in the perspective grid and the target projection as tie points. Polynomial reprojection algorithms do not work in this context, so thin plate splines must be used to force tie points to their exact positions. The PCI GCPWorks software is currently used for this purpose as it permits the use of splines. Special care is required at the limbs and edges of the image, as splines behave unpredictably outside the area occupied by tie points.

The reprojected images are mosaicked in conventional photo-editing software, using feathered edges to remove seams. A typical digital scale for global mosaicking is ten pixels per degree, giving a simple cylindrical map of 3600 by 1800 pixels. Where necessary in areas of very high resolution imaging, special mosaics at a larger scale may be compiled separately.

The simple cylindrical projection mosaic represents a standardized cartographic database from which many other maps may be derived. The northern and southern hemispheres may be converted to a polar azimuthal equidistant projection (for a sphere) simply by using the polar coordinates transformation in software such as Adobe Photoshop. Either the polar azimuthal projection or the cylindrical projection can then be projected onto a triaxial ellipsoid or other reference surface such as a 3D convex hull for hemispheric or regional mapping. Numerous examples of current work will be presented.