

DIGITAL IMAGE MODELS OF PLANETARY SURFACES; R. M. Batson, U. S. Geological Survey, 2255 North Gemini Drive, Flagstaff, AZ 86001

Controlled photomosaics, or "Digital Image Models" (DIM's), of planetary surfaces are being made in the computer in accordance with standards designed to allow widespread use of the mosaics as digital records, in addition to their more traditional function as photographic or lithographic reproductions. The long-range goal is to compile systematic and comprehensive spacecraft image files for each of the solid-surface planets. Picture-element (pixel) locations are encoded so that map users can register images with similarly encoded data sets, such as the Planetary Consortia databases (1). Until high resolution planetwide DIM's become available in a standard format, any attempt to register one spacecraft image to another, or a dataset to an image, and to utilize the full dynamic range of each image or dataset, will be a research project unto itself, entailing considerable specialized expertise and computer resources.

Each DIM is encoded in Sinusoidal Equal-Area coordinates; that is, each image line is a parallel of latitude with its length compressed by the cosine of the latitude. A database with this geometry covers an entire planet or satellite with a contiguous cartographic zone that can be represented by a single image (figure 1). Although planetwide maps in the Sinusoidal projection have few useful applications, their digital representations in computer files have many. All map projections are easily derived from the Sinusoidal file because it is unnecessary to invoke the mathematically complex inverse-projection computations normally required. Pixel coordinates are already specified by latitude and longitude in the DIM. Segments of a DIM can be written for human viewing by simply shearing or sliding image lines with respect to each other (figures 2 and 3). The procedure is fast because it involves no resampling of pixels.

Digital Image Models are compiled in the following stages:

1. Application to each frame of newly developed radiometric (instrument) calibration data (L. A. Soderblom and E. M. Eliason, written commun. 1985).
2. Geometric correction of each frame to produce a set of projected image files (Frame DIM's, or FDIM's). The full resolution of each frame is preserved by oversampling in the output array. The FDIM thus consists of a collection of map fragments at resolutions commensurate with those of the original spacecraft images.
3. Application of photometric (planetary-surface) corrections throughout each FDIM, based on known illuminations, viewing geometry, and surface reflectance properties.
4. Making of a controlled digital mosaic (MDIM) of the entire surface of the planet, formatted for convenient digital storage, access, and use on small interactive image-processing work stations.

A parallel effort by S. S. C. Wu is underway to compile Digital Terrain Models (DTMs) of Mars in registry with the DIM's, based on ongoing topographic mapping (2,3).

REFERENCES

- (1) Kieffer, H. H., Davis, P. A., and Soderblom, L. A., 1981, Mars' global properties: Maps and applications: Lunar and Planetary Science Conference, 12th, Proceedings, Houston, Texas, March 16-20, 1981, p. 1395-1417.
- (2) Wu, S. S. C., Jordan, Raymond, and Schafer, F. J., 1985, Compilation of the Mars 1:2,000,000-scale topographic map series: Reports of the Planetary Geology and Geophysics Program--1984, National Aeronautics and Space Administration Technical Memorandum 87563, p. 612.
- (3) Wu, S.S.C., and Howington, Annie-Elpis, Digital data base and its application of Mars topography: Reports of the Planetary Geology and Geophysics Program--1985, National Aeronautics and Space Administration Technical Memorandum, in press.

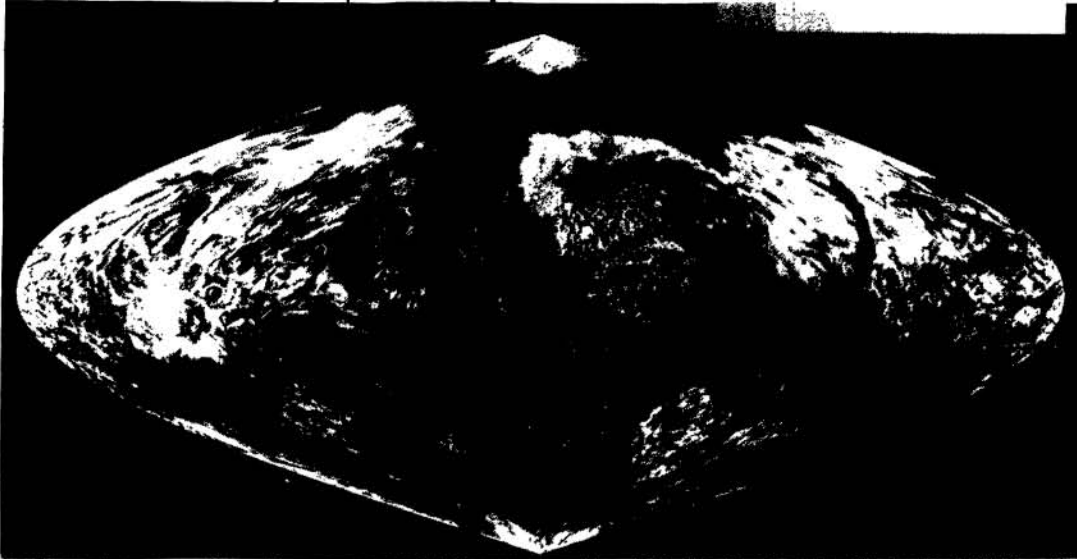


Figure 1. Image of a low-resolution synoptic Digital Image Model (DIM) of Mars, with central meridian at long  $0^{\circ}$ .



Figure 2. Enlarged segment of the Mars synoptic DIM outlined in figure 1.



Figure 3. Area of figure 2, still in the Sinusoidal projection, but with the central meridian shifted to long  $195^{\circ}$  W. to remove foreshortening.