

SCALE 1:500,000 (1 mm = 500 m) AT 330° E (30° W) LONGITUDE
TRANSVERSE MERCATOR PROJECTION
KILOMETERS
CONTOUR INTERVAL 250 METERS
Planetocentric latitude and east longitude coordinate system shown in black.
Planetographic latitude and west longitude coordinate system shown in red.

Prepared on behalf of the Planetary Geology and Geophysics Program, Solar System Exploration Division, Office of Space Science, National Aeronautics and Space Administration.
Manuscript approved for publication May 19, 2003

NOTES ON BASE

This map, compiled photogrammetrically from Viking Orbiter stereo image pairs, is part of a series of topographic maps of areas of special scientific interest on Mars.

MTM 500k -10/337E OMKT: Abbreviation for Mars Transverse Mercator; 1:500,000 series; center of sheet latitude 10° S, longitude 337.5° E, in planetocentric coordinate system (this corresponds to -10022; latitude 10° S, longitude 22.5° W, in planetographic coordinate system); orthographic (OM) with color-coded (K) topographic contours and nomenclature (T) [Greeley and Batson, 1990]

ADOPTED FIGURE

The figure of Mars used for the computation of the map projection is an oblate spheroid (flattening of 1/176.875) with an equatorial radius of 3396.0 km and a polar radius of 3376.8 km (Kirk and others, 2000). The datum (the 0-km contour line) for elevations is defined as the equipotential surface (gravitational plus rotational) whose average value at the equator is equal to the mean radius as determined by Mars Orbiter Laser Altimeter (MOLA; Smith and others, 2001).

PROJECTION

The projection is part of a Mars Transverse Mercator (MTM) system with 20° wide zones. For the area covered by this map sheet, the central meridian is at 330° E, (30° W). The scale factor at the central meridian of the zone containing this quadrangle is 0.9960 relative to a nominal scale of 1:500,000.

COORDINATE SYSTEM

Longitude increases to the east and latitude is planetocentric as followed by IAU/IAG standards (Seidelmann and others, 2002) and in accordance with current NASA and USGS standards (Duxbury and others, 2002). A secondary grid (printed in red) has been added to the map as a reference to the west longitude/planetographic latitude system that is also followed by IAU/IAG standards (Seidelmann and others, 2002) and has been used for previous Mars maps.

CONTROL

Horizontal and vertical control was established using the Mosaic Digital Image Model 2.0 (MDIM 2.0; Kirk and others, 2000) and MOLA data. A portion of MDIM 2.0 covering the mapping area was extracted in simple cylindrical projection. This MDIM image was georeferenced to the MOLA data with an affine transformation. The MDIM image and georeferencing information were imported into a digital photogrammetric workstation (Miller and Walker, 1993) and used as an orthophoto to provide horizontal control to stereopairs of Viking imagery. The horizontal information was used to extract vertical control from the MOLA data. Note that the distribution of Viking Orbiter images suitable for mapping at a scale of 1:500,000 is uneven. Areas mapped in this series are chosen, often in blocks of two or more adjacent quadrangles, based on scientific interest as well as on the availability of suitable data for accurate mapping.

CONTOURS

Contours were derived from a digital terrain model (DTM) compiled on a digital photogrammetric workstation using Viking Orbiter stereo image pairs with orientation parameters derived from an analytic aerotriangulation and from a DTM derived using photoinometry (Kirk, 1987; Kirk and others, 2003). Contours were drawn automatically using a commercial geographic information system (GIS) software package (Environmental Systems Research Institute, 1994). For the stereomodels, the local expected vertical precision, based on image resolutions, parallax-to-height ratio (that is, convergence angle), and a matching accuracy of 0.2 pixel ranges from 116 m to 142 m, with a mean of 127 m. Elevation (in meters) is given with respect to the adopted Mars topographic datum (see "Adopted Figure" section). A comparison of the DTM values at the MOLA point locations show that the DTM is on average 39 meters higher than the MOLA points

(n=181,675; $\mu=39$ m; $\sigma=261$ m). Contour lines were generated automatically using GIS software and were not edited. Because the contour lines were not edited, small closed contour lines, contour lines that intersect, and contour lines that do not match features are present. The point spacing for the DTM is 600 m; features that are less than 600 m in size will not be resolved and features that are smaller than 1800 m in size may only have four elevation measurements associated with them. This lack of elevation measurements may result in contour lines that do not adequately represent some features. The purpose of this mapping project is to produce the digital orthophoto and DTM. This map provides a graphical representation of the digital products that are available.

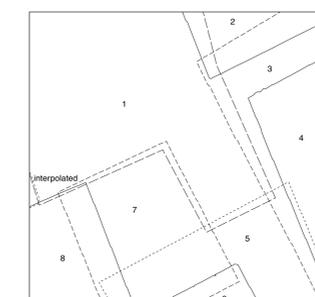
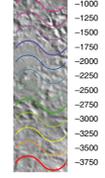
IMAGE BASE

The image base for this map employs Viking Orbiter images from orbit 651. An orthophotomosaic was created on the digital photogrammetric workstation using the DTM compiled from stereo models. Integrated Software for Imagers and Spectrometers (ISIS; Torson and Becker, 1997) provided the software to project the orthophotomosaic into the Transverse Mercator Projection.

REFERENCES

Duxbury, T.C., Kirk, R.L., Archinal, B.A., and Neumann, G.A., 2002, Mars Geodesy/Photogrammetry Working Group Recommendations on Mars Cartographic Constants and Coordinate Systems, in Joint International Symposium on Geospatial Theory, Processing and Applications, Ottawa, Canada, 2002, Commission IV, Working Group 9—Extraterrestrial Mapping, Proceedings: Ottawa, Canada, International Society for Photogrammetry and Remote Sensing [http://www.isprs.org/commission4/proceedings/paper.html].
Environmental Systems Research Institute, 1994, Arc commands: Redlands, Calif., Environmental Systems Research Institute, Inc.
Greeley, Ronald, and Batson, R.M., 1990, Planetary mapping: New York, Cambridge University Press, p. 261-276.
Kirk, R.L., 1987, A fast finite-element algorithm for photoinometry: Pasadena, California Institute of Technology, Ph.D. Dissertation, Part III, p. 165-268.
Kirk, R.L., Lee, E.M., Sucharski, R.M., Richie, J., Greco, A., and Castro, S.K., 2000, MDIM 2.0—A revised global digital image mosaic of Mars, in Lunar and Planetary Science XXXI: Houston, Lunar and Planetary Institute, abstract 2011 (CD-ROM).
Kirk, R.L., Barette, J.M., and Soderblom, L.A., Photoinometry made simple.?, in Advances in Planetary Mapping 2003: Commission IV, Working Group 9—Extraterrestrial Mapping, Proceedings: Houston, March 22, 2003, International Society for Photogrammetry and Remote Sensing [http://www.isprs.org/commission4/proceedings/MTM500k/Houston2003/abstracts/Kirk_1999_mart3.pdf].
Miller, S.B., and Walker, A.S., 1993, Further developments of Leica Digital Photogrammetric Systems by Helava, ACSM/ASPRS Annual Convention and Exposition, Technical Papers, v. 3, p. 256-263.
Seidelmann, P.K. (chair), Abalakin, V.K., Bursa, M., Davies, M.E., De Bergh, C., Lieske, J.H., Oberst, J., Simon, J.L., Standish, E.M., Stooke, P., and Thomas, P.C., 2002, Report of the IAU/IAG Working Group on Cartographic Coordinates and Rotational Elements of the Planets and Satellites: 2000: Celestial Mechanics and Dynamical Astronomy, v. 82, p. 83-110.
Smith, D.E., Zuber, M.T., Frey, H.V., Garvin, J.B., Head, J.W., Muhleman, D.O., Pettengill, G.H., Phillips, R.J., Solomon, S.C., Zwally, H.J., Banerdt, W.B., Duxbury, T.C., Golombek, M.P., Lemoine, F.G., Neumann, G.A., Rowlands, D.D., Aharonson, O., Ford, P.G., Ivanov, A.B., McGovern, P.J., Abshire, J.B., Afzal, R.S., and Sun, X., 2001, Mars Orbiter Laser Altimeter (MOLA)—Experiment summary after the first year of global mapping of Mars: Journal of Geophysical Research, v. 106, p. 23,689-23,722.
Torson, J.M., and Becker, K.J., 1997, ISIS—A software architecture for processing planetary images (abs.), in Lunar and Planetary Science Conference XXVIII: Houston, Lunar and Planetary Institute, p. 1443.

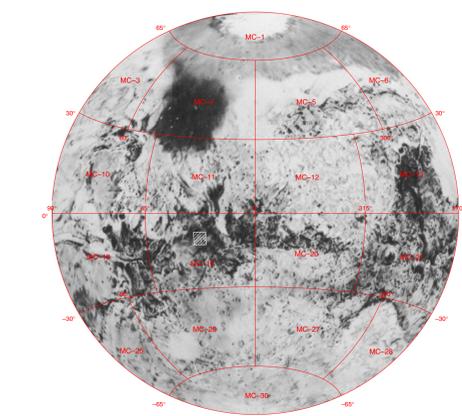
Contour Guide meters



MTM -10/337E QUADRANGLE VIKING STEREOIMAGE COVERAGE

The following is a list of image pairs used to produce the topographic information for this map. Numbers below correspond to the numbers on the diagram above. Some of the topographic information was derived from a single image, 651A86, using photoinometry, as well as interpolated from surrounding contours.

ID	IMAGE PAIR
1	651A86
2	739A96/651A83
3	739A96/651A85
4	615A26/651A85
5	615A24/651A88
6	615A24/651A83
7	615A24/651A61
8	615A22/651A61



QUADRANGLE LOCATION
Photomosaic showing location of map area. An outline of 1:500,000-scale quadrangles is provided for reference.

Topographic Map of the Margaritifer Chaos Region of Mars
MTM 500k -10/337E OMKT
By
U.S. Geological Survey
2003

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.
Dimensional calibration may vary between electronic plotters and between X and Y directions on the same plotter, and paper may change size due to atmospheric conditions; therefore, scale and proportions may not be in use on plots of this map.
Digital files available on World Wide Web at http://geopubs.wr.usgs.gov