

NORTH POLAR REGION

SCALE 1:15 339 305 (1 mm = 15.3 km) AT 90° LATITUDE
POLAR STEREOGRAPHIC PROJECTION



NOTES ON BASE

This map shows combined shaded relief, surface markings, and topographic contours of the entire surface of Mars. Shaded relief was taken from published maps (U.S. Geological Survey, 1980a). Surface markings (albedo) are also those of existing maps (U.S. Geological Survey, 1980a). Surface markings have been added in the polar regions and in areas not covered by the original set of Viking images used to compile the published maps. Contours were taken from published topographic maps of Mars (U.S. Geological Survey, 1980a).

PROJECTIONS

The figure of Mars used for computing the map projection is an oblate spheroid (flattening of 1/192) with an equatorial radius of 3,393.4 km and a polar radius of 3,373.7 km. The contour lines between the 230° parallels were transferred from the 1:250,000 scale topographic maps originally compiled from Viking Orbiter images on analytical stereoplotters (Wu and others, 1982). Contour lines for polar regions north and south of lat. 330° were compiled from measurements made by both Viking and Mariner 9 experiments, which employed the ultraviolet spectrometer (Conrad and others, 1973), and from elevation data of both the Mars primary control network (Davies and others, 1978) and the Mars plane-side control network (Wu and Schaler, 1986).

CONTROL

Horizontal and vertical control were established by analytical photogrammetric aerotriangulation (Wu and Schaler, 1986), by using the General Integral Analytical Triangulation (GIANT) program of the U.S. Geological Survey. Primary control used in the control network include the Viking Orbiter Secondary Elevation Data Record, radio-occultation measurements from both Mariner 9 and Viking Missions (Lorell and others, 1972; Klose and others, 1973; Lindal and others, 1979). Earth-based radar observations (Pettengill and others, 1971; Downs and others, 1975), and the Mars primary control network of the Rand Corporation (Davies and others, 1978).

ALBEDO

Original maps of the surface albedo (U.S. Geological Survey, 1990) were compiled at a scale of 1:15,000,000 from Viking Orbiter 1 images, Mariner 9 images (Bates and Inge, 1976), maps made with the Viking Infrared Thermal Mapper (Pleske and Miner, 1981) and a map compiled from Earth-based pictures (Inge and others, 1976). Coverage of the entire planet could not be obtained during any specific seasonal period from only one of these sources. Most of the equatorial region has been portrayed by using images taken when the solar plane-side center longitude (L₀) was 65° to 89° with respect to Mars. (The vernal equinox occurs at L₀ 360° and the summer solstice at 90°.) Data from other sources are not necessarily consistent with the seasonal constraints of this primary dataset. The overall albedo balance was maintained by reference to the low-resolution, solar albedo map and to the Earth-based source. The original compilations were photographically reduced to the 1:25,000,000 scale.

PLANIMETRY

Shaded relief was portrayed by using mapping bases assembled from 1:5,000,000 scale maps (Bates and others, 1979), reduced and digitally transformed to the Mercator and Polar Stereographic projections. These bases were used to position details taken from Viking Orbiter pictures during shaded relief portrayal. Shaded relief is shown as if illuminated from the west. Airbrush portrayals of both the relief and albedo were done according to interpretive techniques described by Inge and Bridges (1976). Shaded relief analysis and portrayal were made by Barbara J. Hall and Jay L. Inge (north polar region).

CONTOURS

Because Mars has no surface water and hence no sea level, the datum (the 0-km contour line) for elevations is defined by a gravity field described by spherical harmonics of fourth order and fourth degree (Jordan and Lorell, 1973), combined with a

8.1-millibar atmospheric pressure surface derived from radio occultation data (Klose and others, 1973; Christensen, 1975). This datum can be approximated by a triaxial ellipsoid with semi-major axes of 3,393.4 km and 3,373.7 km and a semi-minor axis of 3,376.3 km. Semi-major axis A intersects the Martian surface at long 105° (Wu, 1978, 1981).

Contour lines between the 230° parallels were transferred from the 1:250,000 scale topographic maps originally compiled from Viking Orbiter images on analytical stereoplotters (Wu and others, 1982). Contour lines for polar regions north and south of lat. 330° were compiled from measurements made by both Viking and Mariner 9 experiments, which employed the ultraviolet spectrometer (Conrad and others, 1973), and from elevation data of both the Mars primary control network (Davies and others, 1978) and the Mars plane-side control network (Wu and Schaler, 1986).

COLOR

No attempt was made on the map to precisely duplicate the color of the Martian surface, although the color used may approximate it.

NOMENCLATURE

Names on this sheet are approved by the International Astronomical Union (IAU), 1974, 1977, 1980, 1983, 1986, and 1989. The positions of named features are taken from published maps of Mars.

M 25M 4AT

Abbreviation for Mars, 1:25,000,000 series, 4th edition; shaded relief with albedo markings (A), topographic contours, and nomenclature (T).

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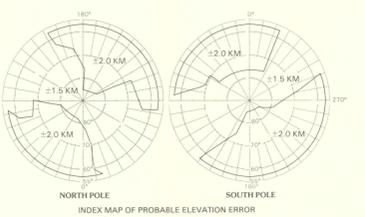
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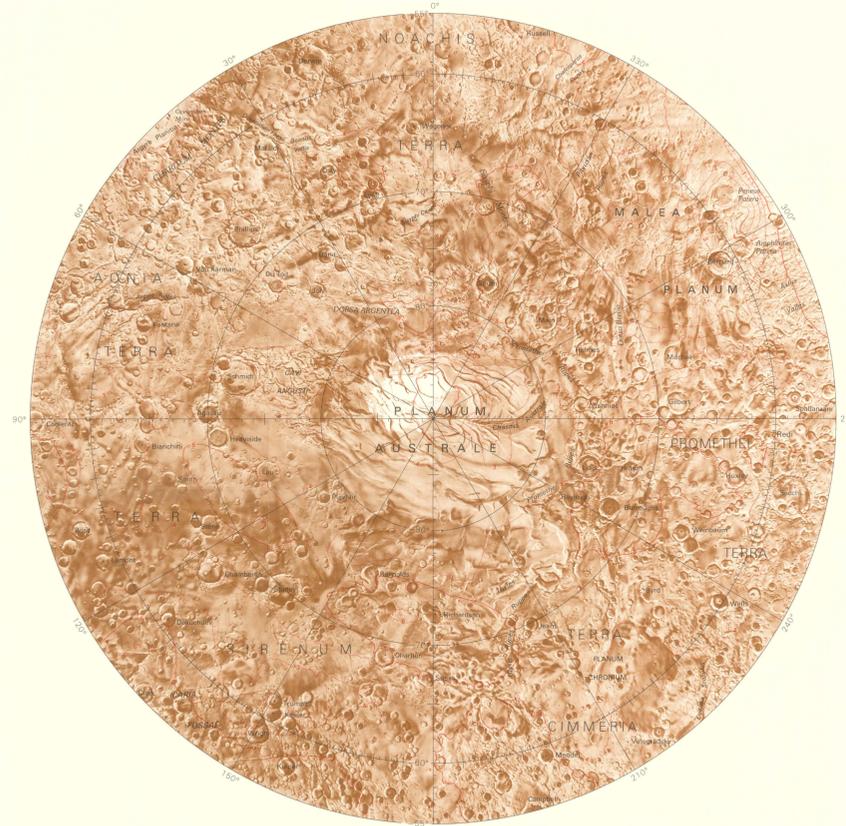
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INDEX MAP OF PROBABLE ELEVATION ERROR

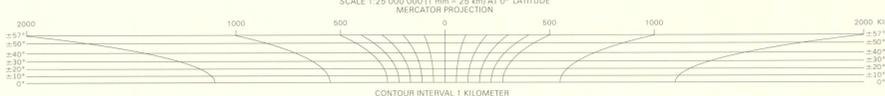


SOUTH POLAR REGION

SCALE 1:15 339 305 (1 mm = 15.3 km) AT -90° LATITUDE
POLAR STEREOGRAPHIC PROJECTION



**SCALE 1:25 000 000 (1 mm = 25 km) AT 0° LATITUDE
MERCATOR PROJECTION**



NOTE TO USERS
Users noting errors or omissions are urged to indicate them on the map and to forward it to U.S. Geological Survey, Building 4, Room 454, 2255 North Gemini Drive, Flagstaff, Arizona 86001. A replacement copy will be returned.

TOPOGRAPHIC MAP OF MARS

1991

Prepared on behalf of the Planetary Geology Program, Solar System Exploration Division, Office of Space Science, National Aeronautics and Space Administration, under contract No. 15-114.
Because the appearance of Mars' albedo markings changes significantly over time, this map does not reproduce 1981, the third edition of this series. Both sheets provide relevant surface markings information.
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For sale by U.S. Geological Survey Map Distribution, Box 25198, Federal Center Denver, CO 80225.