



**NOTES ON BASE**

This map is one of a three-sheet set that shows combined surface markings, shaded relief, and topographic contours of Mars. Shaded relief was taken from published maps (U.S. Geological Survey, 1985b). Surface markings (albedo) in the western and eastern regions are also those of existing maps (U.S. Geological Survey, 1985a); 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 existing maps. Contours were taken from topographic maps of the U.S. Geological Survey (1989).

**PROJECTIONS**

The figure of Mars used for computing the map projections 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. This figure is less complex than the topographic figure (described below) on which the contour lines are based. The Mercator projection is used between lat ±57° and the Polar Stereographic projection is used for the polar regions north and south of the 57° parallels. The projections have a common scale of 1:18,418,000 at lat ±56°. Longitude increases to the west in accordance with astronomical convention for Mars. Latitudes are areographic.

**CONTROL**

Horizontal and vertical controls 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 controls used in the control network include the Viking Orbiter Secondary Experiment Data Record, radio occultation measurements from both Mariner 9 and Viking Missions (Lorell and others, 1972; Kliore and others, 1973; Lind and others, 1979). Earth-based radar observations (Pettengill and others, 1971; Downs and others, 1973), and the Mars primary control network of the Rand Corporation (Davies and others, 1978).

**ALBEDO**

Original maps of the surface albedo were compiled from a selected set of Viking Orbiter 1 images acquired through red or clear filters when the solar plane-centric longitude (Ls) with respect to Mars was 65° to 89° and when the solar zenith angle was small. Coverage of the north and south regions could not be obtained during this period. Therefore, Viking Orbiter images acquired at different times and Mariner 9 images (Batson and Inge, 1976) were used as necessary to complete the mapping. These sources are not necessarily consistent with the seasonal constraints of the first dataset. Details of the albedo markings were drawn on photographic copies of the original shaded relief maps. The overall albedo balance in the polar regions was maintained by reference to the western and eastern regional maps. Analysis and control of albedo markings in the polar regions were made by Jay L. Inge.

**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, 2215 North Gemini Drive, Flagstaff, Arizona 86001. A replacement copy will be returned.

**PLANIMETRY**

The mapping bases used for these three sheets (U.S. Geological Survey, 1985b) were assembled from 1:5,000,000 scale shaded relief maps (Batson and others, 1979), reduced and digitally transformed to the projections described above. These bases were used to position details taken from Viking Orbiter pictures during shaded relief portrayal. Shaded relief is shown as 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 Jay L. Inge (north polar region) and Barbara J. Hall (south 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 6.1 millibar atmospheric pressure surface derived from radio occultation data (Kliore and others, 1973; Christensen, 1975). This datum can be approximated by a triaxial ellipsoid with semi-major axes of A=3,394.6 km and B=3,393.3 km and a semi-minor axis of C=3,376.3 km. Semi-major axis A intersects the Martian surface at long 180° (Wu, 1978, 1981).

Contour lines between the ±30° parallels were transferred from the 1:2,000,000 scale topographic maps originally compiled from Viking Orbiter images on analytical stereopairs (Wu and others, 1982). Contour lines in the polar regions north and south of lat ±30° were compiled from measurements made by both Viking and Mariner 9 experiments, which employed the ultraviolet spectrometer (Hord and others, 1974) and the infrared interferometer spectrometer (Conrath and others, 1973), and from elevation data of both the Mars primary control network (Davies and others, 1978) and the Mars planimetric and surface properties (Karns, 1976, no. 3, p. 273-312).

**COLOR**

No attempt was made to 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 in press. The positions of named features are taken from published maps of Mars.

M 15M ±90/0 1AT: Abbreviation for Mars 1:15,000,000 series; center of maps, lat 90° N and 90° S, long 0°; 1st edition; shaded relief with albedo markings (A), topographic contours and nomenclature (T).

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**INDEX MAPS OF PROBABLE ELEVATION ERROR**

**NORTH POLAR REGION**

**SOUTH POLAR REGION**

**INDEX TO THE 1:15,000,000 MAP SERIES**

## TOPOGRAPHIC MAP OF THE POLAR REGIONS OF MARS

M 15M ±90/0 1AT

1991

For sale to U.S. Geological Survey, Map Distribution, Box 25286, North Gemini Drive, Flagstaff, Arizona 86001.