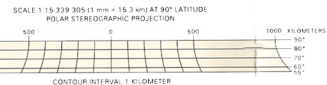


NORTH POLAR REGION
SCALE 1:15,339,306 (1 mm = 15.3 km) AT 90° LATITUDE
POLAR STEREOGRAPHIC PROJECTION



NOTES ON BASE
The 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, 1968). Surface markings (albedo) are also those of existing maps (U.S. Geological Survey, 1968). Surface markings have been added in the polar regions and to areas not covered by the original set of Viking images used to compile the published map. Contours were taken from published topographic maps of Mars (U.S. Geological Survey, 1968).

PROJECTIONS
The figure of Mars used for compiling the map projection is an oblate spheroid with a radius of 3393.3 km and a polar radius of 3393.3 km and a polar radius of 3393.3 km. The figure is less complex than the topographic figure described below in order that the contour lines be based. The Mercator projection is used between 15° and the Polar Stereographic projection is used for the polar regions north and south of the 56° parallels. The projections have a common scale of 1:14,029,968 at lat. 15°. Longitude increases in the east in accordance with astronomical convention for Mars. Latitudes are areographic.

CONTROL
Horizontal and vertical controls were established by analytical photogrammetry, aerod triangulation (Wu and Schuler, 1981), by using the General Geodetic Analytical Triangulation (GGAT) program of the U.S. Geological Survey. Primary controls used in the control network include the Viking Orbiter Secondary Elevation Data Record, radio occultation measurements from both Mariner 9 and Viking Mission (Elliott and others, 1972; Koenig and others, 1973; Lindell and others, 1978). Earth-based radar observations (Pettengill and others, 1971; Evans and others, 1973), 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, 1966) were compiled at a scale of 1:15,000,000 from Viking Orbiter 1 images. Mariner 9 images (Bates and Igoe, 1976) maps made with the Viking Infrared Thermal Mapper (Pisot and others, 1981) and maps compiled from Earth-based pictures (Igoe and others, 1978). Coverage of the entire planet could not be obtained during any specific season per orbit from only one of these sources. Most of the equatorial region has been portrayed by using images taken when the solar planetographic longitude (L₀) was 60° to 80° with respect to Mars. The vertical exposure occurs at L₀ 90° and the summer solstice at 90°. Data from other sources are not necessarily consistent with the seasonal constants of this primary dataset. The overall albedo balance was maintained by reference to the Mars weatherers, solar albedo map and to the Earth-based source. The original conditions were photographically reduced to the 1:25,000,000 scale. Analysis and portrayal of albedo markings were made by Susan L. Davis and Jay L. Igoe.

PLANIMETRY
Shaded relief was portrayed by using mapping bases assembled from 1:5,000,000 scale maps (Bates and others, 1976), reduced and digitized, transferred to the Mercator and Polar Stereographic projections. These bases were used to position details taken from Viking Orbiter pictures using shaded relief portrait. Shaded relief is shown as if illuminated from the west. Actual portrait of north and albedo were done according to perspective techniques described by Igoe and Bates (1976). Shaded relief analysis and portrait were made by Barbara J. Hall and Jay L. Igoe (North polar region).

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

4.1 millibar atmospheric pressure surface derived from radio occultation data (Koenig and others, 1973; Christensen, 1975). The datum can be approximated by a radial ellipsoid with semi-major axes of A=3394.6 km and B=3393.3 km and a semi-minor axis of C=3374 km. Spheroidal axes A intersects the Martian meridian at long 105° (Wu, 1978, 1981). Contour lines between the 130° parallels were transferred from the 1:2,000,000 scale topographic maps originally compiled from Viking Orbiter images on analytical stereoplots (Elliott and others, 1972). Contour lines in the polar regions north and south of lat. 50° were compiled from measurements made by both Mariner 9 and Viking Mission, which were transferred to the contour lines between the 130° parallels and the related stereographic projection (Elliott and others, 1972), and from elevation data of both the Mars primary control network (Evans and others, 1978) and the Mars planetwide control network (Wu and Schuler, 1981).

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, 1982, 1986, and 1989. The nomenclature of named features is taken from published maps of Mars.

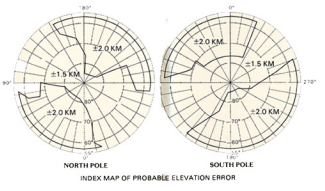
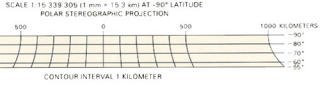
ABBREVIATIONS
Abbreviation for Mars: 1:25,000,000 series, fifth edition, shaded relief with albedo markings (A), topographic contours and nomenclature (T).

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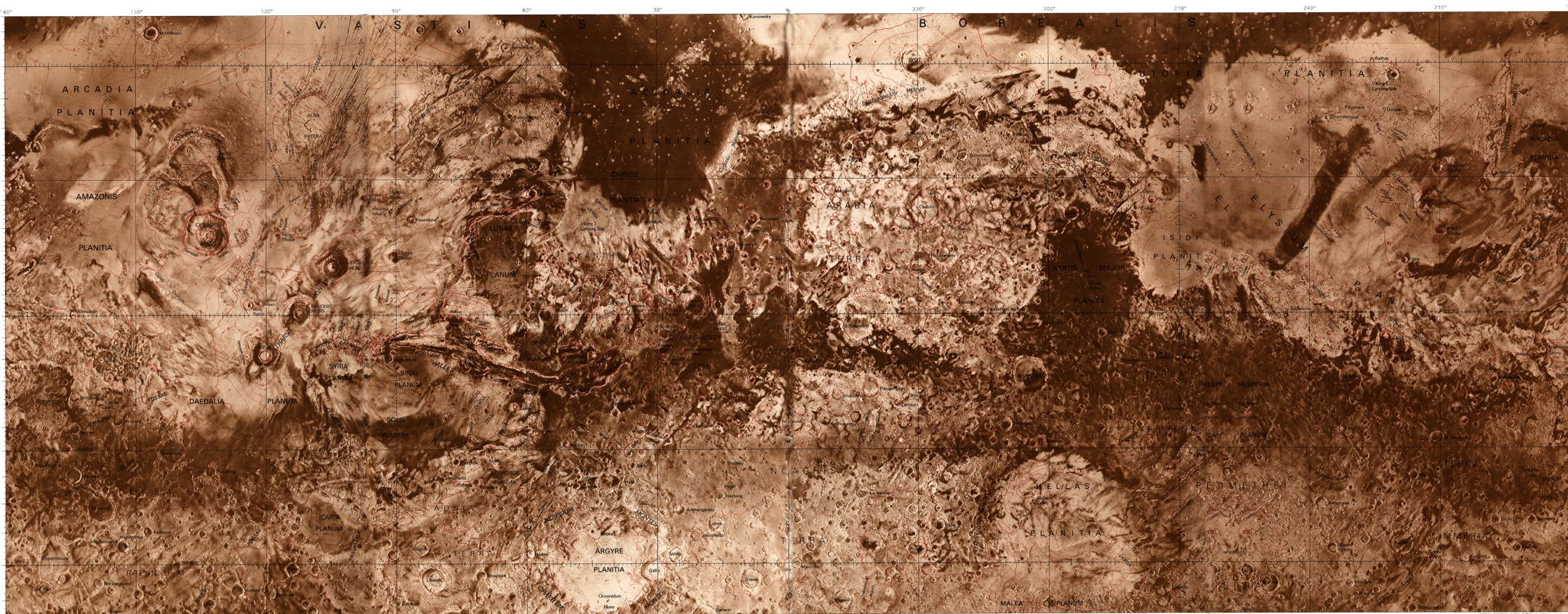
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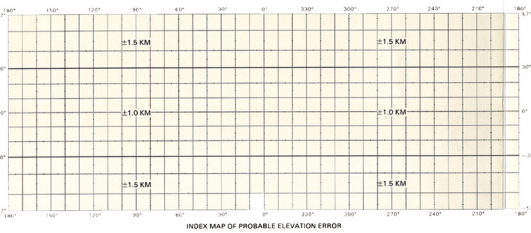
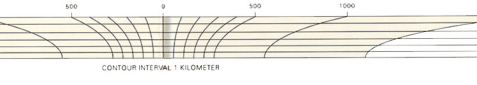
SOUTH POLAR REGION
SCALE 1:15,339,306 (1 mm = 15.3 km) AT 90° LATITUDE
POLAR STEREOGRAPHIC PROJECTION



INDEX MAP OF PROBABLE ELEVATION ERROR



South
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, 1225 North Service Drive, Flagstaff, Arizona 86001. A replacement copy will be returned.

TOPOGRAPHIC MAP OF MARS

Prepared as part of the Planetary Mapping Program, Solar System Exploration Division, Office of Space Science, National Aeronautics and Space Administration, under contract W-15314.
Because the appearance of Mars' albedo markings changes significantly over time, this map does not supersede 1981. The third edition of this series. Both sheets provide relevant surface marking information.
Minoror approved for publication, April 12, 1990.