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THE CONTROL NETWORK OF MARS: APRIL 1991

Merton E. Davies and Patricia G. Rogers
 RAND, Santa Monica CA 90406-2138

The modern geodetic control network of Mars was first established based on Mariner 9 images with 1-2 km/pixel resolutions and covered almost the entire martian surface. The introduction of higher resolution (10-200 meter/pixel) Viking Orbiter images greatly improved the accuracy and density of points in the control network (Davies and Katayama, 1982).

Analysis of the Viking lander radio tracking data led to more accurate measurements of Mars' rotational period, spin axis direction, and the lander coordinates relative to the inertial reference frame (Mayo et al., 1977; Michael, 1979). The prime meridian on Mars has been defined by the Geodesy/Cartography Group of the Mariner 9 Television Team as the crater Airy-0, located about 5° south of the equator (de Vaucouleurs et al., 1873). The Viking 1 lander site was identified on a high resolution Viking frame (Morris and Jones, 1980).

The control point measurements form the basis of a least squares solution determined by analytical triangulation after the pixel measurements are corrected for geometric distortions and converted to millimeter coordinates in the camera focal plane.

Photogrammetric strips encircling Mars at the equator and at 60° north and south have been used to strengthen the overall net and improve the accuracy of the coordinates of points. In addition, photogrammetric strips along 0°, 90°, 180°, and 270° longitude from the equator to 60° north and south latitudes and a strip from 60° latitude, 90° longitude to the Viking 1 lander site have all significantly strengthened the control network. Most recently, photogrammetric strips have been added to the net along 30° north latitude between 0° and 180°, and along 30° between 180° and 360°.

The Viking 1 lander site and Airy-0 are linked through photogrammetric strips occurring along the 0° meridian from Airy-0 to 65° north, from that point through the Viking 1 lander site to the equator, and along the equator to 180° longitude. The Viking 1 lander site is thus a well calibrated area with coordinates of points accurate to approximately 200 meters relative to the J2000 inertial coordinate system. This will be a useful calibration region for upcoming missions.

The following represents the current status of the control network calculations:

Points	9380
Mariner 9 Images	1054
Viking Images	1468
Observation Equations	62,650
Normal Equations	26,326
Overdetermination	2.38
Standard Error (μm)	14.12

References

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