

MARS ORBITER CAMERA GLOBAL MOSAIC. M.A. Caplinger, Malin Space Science Systems, P.O. Box 910148, San Diego, CA 92191.

Introduction: We have recently completed a global 256 pixel/degree image mosaic of Mars built entirely from MOC images, most acquired during the Geodesy Campaign [1] (mapping cycle M01) and some in mapping cycles M00, M02, and M03. South polar coverage was obtained in Science Campaign C (mapping cycle M10-M11). Where possible, nadir-looking images were used; some remaining gaps needed to be filled with off-nadir images.

Processing: Each image was systematically processed by removing pixel-to-pixel variation and matching brightness to a low-resolution base map built by hand from MOC daily global map swaths. It was then map-projected, using the MOLA Digital Terrain Model at 16 pixel/degree [2] for “orthophoto” topographic control. Images with downlink data loss or corruption were processed with and without all corrupted fragments replaced by black pixels, and the versions with errors present added to the mosaic only at the end.

Mosaicking was performed in two steps. In the first step, large barely-overlapping image swaths were mosaicked using linear blending of the overlap regions to reduce the visual impact of the seam. In the second step, smaller fill images were added only in regions without coverage from the first step.

Finally, the small gaps between adjacent swath segments caused by slight timing mismatches between the end of one image and the start of the next on the same orbit were filled by linear interpolation.

All of this processing was performed automatically by software written at MSSS. Once the images were selected, processing required less than 48 hours on a Sun SunBlade 1000 system with dual 750-Mhz UltraSPARC III processors and 4 GB of RAM.

Accuracy: Technically, these mosaics are “uncontrolled” in that the imaging geometry was computed solely from spacecraft position derived from radiometric tracking, and spacecraft orientation extracted from the spacecraft’s attitude control system telemetry, without any further statistical adjustment. In practice, based on error analysis and comparison with the MOLA DTM, the errors relative to the MOLA dataset are typically on the order of 1-2 WA pixels.

To derive the Wide Angle geometry, we started with the WA distortion function and I-kernel offset angles as derived by Kirk et al [3]. We had to suitably modify Kirk’s model to allow it to be implemented by our software, which assumes that the projection of the MOC line array into camera space is a plane (this required the downtrack term to be approximated by an additional pitch, which incurs negligible error near the

center of the array). We then measured about 100 points by hand on images and the MOLA 64 pixel/degree DTM and discovered a systematic offset of about 3 km downtrack and 1 km crosstrack, so the angles were adjusted manually in pitch and roll to null out the offset. After this adjustment, the average one-sigma error of the points with outliers discarded was about 1 WA pixel (~0.25 km) — 0.96 pixels crosstrack and 0.84 pixels downtrack.

While MOC-MOLA offsets of 0.25-0.5 km are arguably present in the mosaics, at least part of the error appears to be due to distortions in the shape of small craters, perhaps caused by the interpolation algorithm used to build the MOLA DTM. Further, there are isolated areas with offsets of 2-3 km, primarily in latitude. The cause of the latter is unknown at this time.

Photometrically, the mosaic is not referenced to absolute albedo units, but no spatial filtering was done, so albedo features remain visible. The mosaic would benefit from MTF restoration filtering, but we have left it in its unfiltered form so that such processing can be applied by individual users.

Availability: The mosaics, in JPEG and PDS standard IMG format with map-projection labels, are available at <http://www.msss.com/mgcvwg/>

References: [1] Caplinger M. and Malin M. (2001) *JGR* **106**, 23,595-23,606. [2] Smith D. et al (2001) *JGR* **106**, 23,689-23,722. [3] Kirk R. et al (2001) *LPSC XXXII*, 1863.

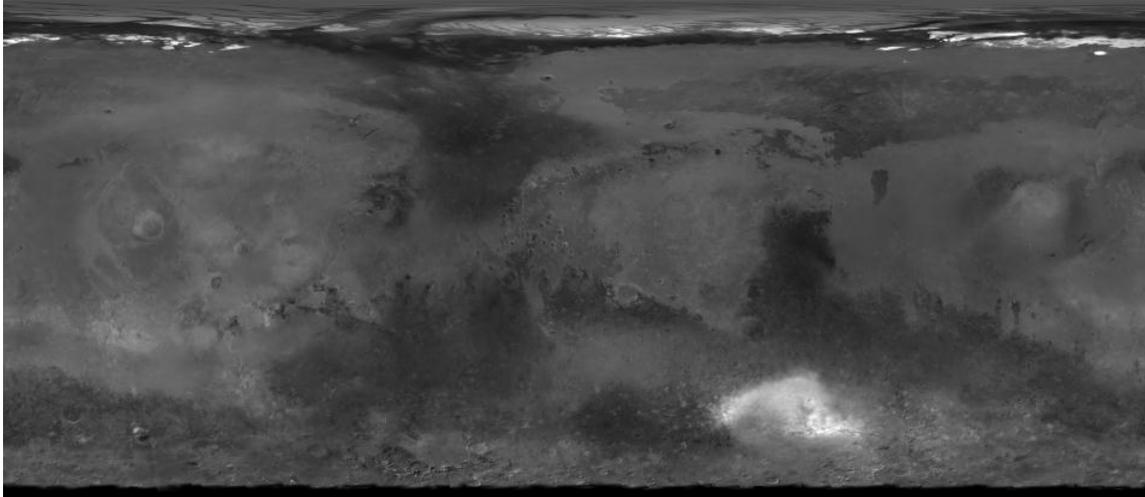


Figure 1: MOC Geodesy Campaign mosaic, 90N to 60S

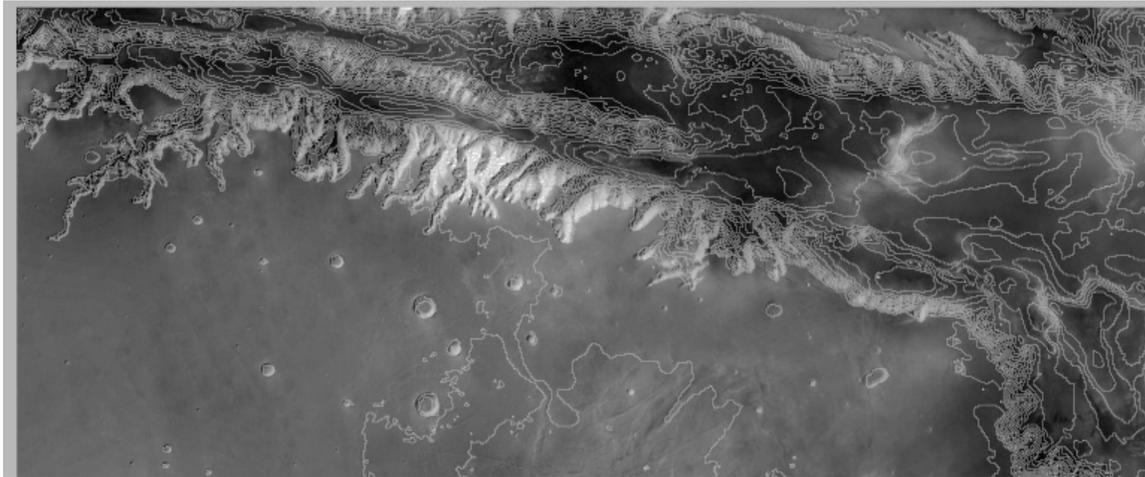


Figure 2: Western Valles Marineris with MOLA 500-meter contour overlay