A NEW DIGITAL ORTHOIMAGE MAP OF THE MARTIAN WESTERN HEMISPHERE USING DATA OBTAINED FROM THE MARS ORBITER CAMERA AT A RESOLUTION OF 256 PIXEL/DEG.


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Introduction: We present a new digital orthoimage map of Mars using data obtained from the Mars Orbiter Camera (MOC) of the Mars Global Surveyor Mission (MGS) [1]. The map covers the Mars surface from 0° to 180° West and from 60° South to 60° North with the MDIM2 resolution of 231.529 m/pixel (256 pixel/degree). Digital image processing methods have been developed and applied for the production of image mosaics. These methods are also applicable for other planetary missions, whenever a CCD line camera is used.

Input Data: The MOC wide angle (WA) camera is a line scanner camera operating in the push-broom mode. In order to map the whole planet, stripes of images (4° longitude range by 17° latitude range) were obtained at the beginning of the MGS mission during the Geodesy Campaign [2]. When the mapping with the near angle camera started, WA- context images (2° by 2°) were obtained. When inspecting the available images of the red WA camera, it was obvious, that the data range of the recently obtained MOC context images is better than the data range of images of the Geodesy Campaign. To take advantage of the 8 bit data range of the MOC camera, we decided to use not only the long strips of the Geodesy Campaign, but all available context images. We found 4,339 context images and 183 Geodesy images of good quality in the investigated area and with a resolution better than 250 m/pixel. Additionally, we had to use 313 images of the Geodesy Campaign with a resolution >250 m/pixel and <435 m/pixel. Approximately 10% of the visually inspected images were sorted out due to their major quality deficits.

Methods: Image data processing has been performed using multiple VICAR1 and IDL programs, developed by the JPL2, DLR3 and the TUB4 [3]. Furthermore, ISIS5 software, developed by the USGS6, was applied. First, each MOC image was corrected for radiometric camera errors. After visual inspection, some images were edited manually to remove image artifacts (stripes of pixel errors, etc.). Images containing too many artifacts, were not included. The correction of images with major differences in brightness was performed using an IDL routines developed at the DLR. After all radiometric and brightness corrections, the images were Mars referenced [4], geometrically corrected [5] and orthoprojected using a global Martian Digital Terrain Model (DTM), developed by the DLR and based on MGS Mars Orbiter Laser Altimeter (MOLA) data [6]: We used all released MOLA binary data. Reading out these files, we got about 588,000,000 measurements of planetographic latitude, east longitude and Mars geoid heights with a flattening of 1/176.875. All longitudes were shifted by a factor of +0.1465 to convert the longitudes from IAU 1991 (the MOLA reference system) to the MDIM2 reference system. Finally, a gridded DTM from all these object points was computed using DLR/TUB software [3]. The DTM has a resolution of 64 pixel/degree and is Mercator projected. So, the images were sinusoidal map projected onto this DTM to get orthoimages. As a reference system the MDIM2 reference system was adopted (A=B=3,396.0 km, C=3,376.8 km, location of the prime meridian in J2000: 176.7215°). For the 0° to 90° W region, the longitude 45° W represents the reference meridian, for the 90° W to 180° W region the
longitude 135° W. To eliminate major differences in brightness between the individual images of the mosaics, high- and low-pass filter processing techniques were applied for each image after map projection. After filtering the images, we mosaicked the images together. No registering or block adjustment techniques were adopted in order to improve the geometric quality. We recognized that the accuracy of the navigation data has such a good quality, that the orthoimages fit very well to each other except some images of the Geodesy Campaign in the North and South of the investigated region. Figure 1 shows a small part of the Valles Marineris in full resolution. Depending on the resolution and data range, we created three layers of MOC mosaics, which were stacked afterwards (see figure 2): The upper layer consists of context images (orbits M00-M18) with a resolution <250 m/pixel, the middle layer consists of images of the Geodesy Campaign (orbit M01) with a resolution <250 m/pixel and the bottom layer consists of images of the Geodesy Campaign (orbit M01) with a resolution >250 m/pixel and <435 m/pixel. A few remaining gaps in the coverage were filled with Mars Digital Image Mosaics (MDIM2), based on 7 bit VIKING-Data.

**Results:** We present a new digital orthoimage map of Mars with a resolution, reference system and map projection parameters according the MDIM2. As the photometric conditions of the MOC and MDIM2 images are very different, it is still important to use both datasets for photogeological interpretations. The good correspondence between MOLA and MOC datasets can be seen by merging the MOC mosaic with the MOLA data using IHS-transformation (see figure 3). It is not difficult to generate contour lines from the DTM and to overlay them onto the MOC-mosaic as it has been done for the Coprates region. We will process the eastern part, of Mars from 180° to 360° and the North and South pole depending on availability of data. To be consistent with the new IAU 2000 reference system and in preparing the Mars Express mission, the data processing will relay in this new defined reference system.