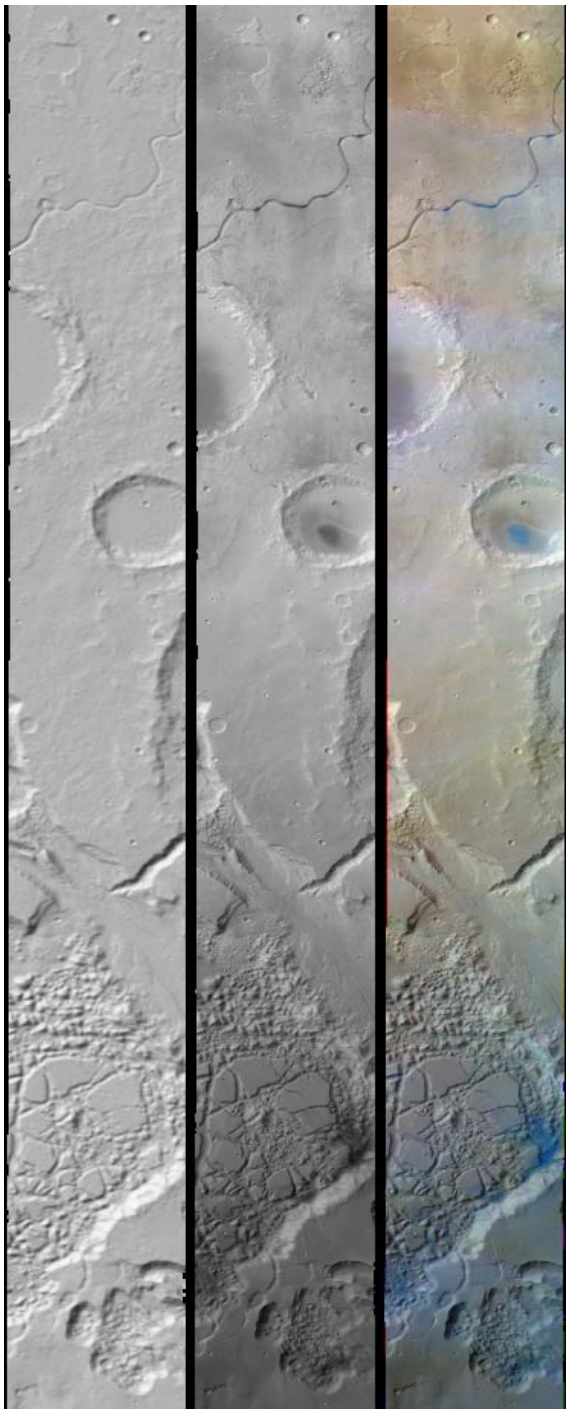
STATUS AND RESULTS FROM MARS EXPRESS HRSC DTM AND ORTHOIMAGE GENERATION

K. Gwinner[a], F. Scholten[a], F. Preusker[a], S. Elgner[a], T. Roatsch[a], R. Schmidt[c], J. Oberst[a], R. Jaumann[a], C. Heipke[c]

[a]Institute of Planetary Research, German Aerospace Center (DLR), Rutherfordstr. 2, 12489 Berlin, Germany (Klaus.Gwinner@dlr.de); [b] Photogrammetry and Remote Sensing, Technische Universität München, Arcisstr. 21, D-80333 München, Germany; [c] Institute of Photogrammetry and GeoInformation, Leibniz Universität Hannover, Nienburger Str. 1, D-30167 Hannover, Germany

Abstract: We report on the results of the Mars Express High-Resolution Stereo Camera (HRSC) experiment pertaining to one of its major aims, mapping the surface of Mars by high-resolution digital terrain models (DTM, up to 50 m grid spacing) and orthoimages (up to 12.5 m resolution). We introduce the specifications and characteristics of these data products and give an overview of the procedures applied for their derivation. We also address the performance characteristics of the mapping project related to different aspects of internal accuracy, accuracy with respect to the global reference system, and regional aspects. Using adaptive processing techniques for terrain reconstruction and a revised approach to the improvement of orientation data, a mean precision of the resulting 3D points of about 12 m is obtained, exceeding the mean ground resolution of the stereo images. Using Mars Orbiter Laser Altimeter (MOLA) data, the HRSC models are firmly tied to the global reference system at the scale of the HRSC DTM grid spacing in the lateral dimension, and to within few meters vertically. HRSC high resolution DTMs are typically generated using a grid size of about 2 times the mean ground resolution, but usually not larger than 3 times the mean ground resolution, and not smaller than 3 times the precision of the integrated 3D points derived from stereo image analysis. Statistically, every grid cell is based on at least one measured 3D point. Thus, horizontal DTM resolution is well established with regard to the precision and density of the derived 3D points, while the concurrent aim of a detailed terrain representation at maximum possible resolution is pursued. Comparison with the DTM derived from MOLA data allows us to identify specific advancements related to this updated view of Martian topography. We also address the mapping performance of HRSC in comparison to MOLA with respect to latitude and to different surface types and morphologies. Finally, comparison with MOLA highlights typical complementarities of the two different approaches for mapping planetary surfaces.



HRSC "Level-4" photogrammetric data products for MEX orbit 1066 (Tiu Vallis and Hydaspis Chaos, Margaritifer Terra). Left to right: shaded relief map of DTM, panchromatic orthoimage (nadir channel); RGB orthoimage.