**OVERVIEW OF TECHNIQUES USED FOR THE PRODUCTION OF HIGH QUALITY PUBLIC AND EDUCATIONAL OUTREACH IMAGERY OF MARS EXPRESS' HRSC DATA.** B. P. Schreiner and S. van Gasselt, Planetary Sciences and Remote Sensing Group, Institute of Geological Sciences, Freie Universität Berlin, Germany (bjoern.schreiner@fu-berlin.de).

**Abstract:** At the Planetary Sciences and Remote Sensing Group of Freie Universität Berlin a major part of public outreach imagery of the Mars Express' High Resolution Stereo Camera (HRSC) [1], [2] is produced. Among these are orthorectified high resolution colour images of selected regions on Mars, colour-coded digital terrain models, anaglyph images and context maps. Further we provide perspective colour views and virtual flights over the surface of Mars in plain and stereoscopic high definition video based on HRSC data. These products can be downloaded from our webpage [3].

**Introduction:** For every successful mission funded with a fair amount of public money there should be the obligation, certainly apart from producing valuable science results, to deliver impressive and hopefully easy to understand images to the interested public, especially if a mission has a powerful camera as the Mars Express' HRSC on board. The camera is designed to record it's nine sensor lines (2 stereo channels, 2 photometric channels, 1 nadir channel and 4 colour channels (blue, green, red, IR) simultaneously. At the Institute of Geological Sciences' Planetary Sciences division we accompany this mission since the first image data arrived from Mars in 2004. During that time several methods have been used and developed to provide a range of image products derived from raw data. By now about 90% of Mars' surface has been covered resulting in a wide variety of features encountered on the planet which include impact craters, valleys, volcanic activity, source regions, aeolian phenomena, glacial and icy landforms and tectonism. HRSC delivers a ground resolution of up to 12.5 metres/pixel for the highest resolution nadir channel, due to data limitations the stereo and photometric channels provide half of the nadir resolution while colour resolution is about a fourth as a widely used setting.

**Image products and techniques behind:** In a batch processing of VICAR [4] commands a group of othorectified images are cut out of the orginal level-4 orbit strip and scaled to equal size. These are the high resolution nadir, tree colour channels and a corresponding digital terrain model (DTM). To achieve *high resolution colour images* a composit of the red, green and blue colour channels are pan-sharpened with the nadir channel by IHS transformation. After that, due to slight changes in colour by this transformation nonlinear histogram stretches on each colour are applied to regain initial colour.

For *the colour-coded DTM* (Fig. 3) different heights are coded as different colours following an adjustable colour look-up table allowing to outline decent and also large height changes to give a maximum of height distinction. The result is merged with the corresponding high resolution nadir image, which has been histogram stretched for optimal contrast.

Derived from level-2 data is the *anaglyph image* which is composed of the nadir channel and one of the stereo channels set on either red and green-blue or vice versa depending on orbit properties providing an almost natural 3D-impression due to the fact that these images are derived from two different along-track camera positions. In case of low terrain differences a composit of the two stereo channels can also be used to substantially enhance perceived terrain dynamics.

Draping high resolution colour over the digital terrain model a *virtual oblique view* (Fig. 4) is generated where adjustment of the virtual camera position, height exaggeration and lighting among other settings allow to find interesting scene compositions. This is done with Lightwave Software [5].

For larger scenes several orbits are mosaicked (Fig, 1), which geometrically in most cases works very satisfying due to overall orbit adjustments. But as illumination, viewing angles and atmospheric conditions can vary considerably, a large amount of colour and histogram adjustment is often necessary to find seamless transitions between orbits (Fig. 2). This is done with Photoshop thanks to the software's helpful interactive tools. Also the appropriate choice of orbits available may strongly influence the quality of the resulting *mosaic*. For cutting out colour edges from colour composit orbit stripes and other recurring operations IDL [6] batch programs are used when large quantities of orbits need to be pre-processed for mosaicking.

Finally, when high resolution imagery either from one orbit or from a mosaic of several orbits is available together with a corresponding DTM the virtual view can be extended to a *movie* by programming a virtual camera movement and calculating the camera view frame-by-frame on its track through the scene, which can also be stereoscopic.

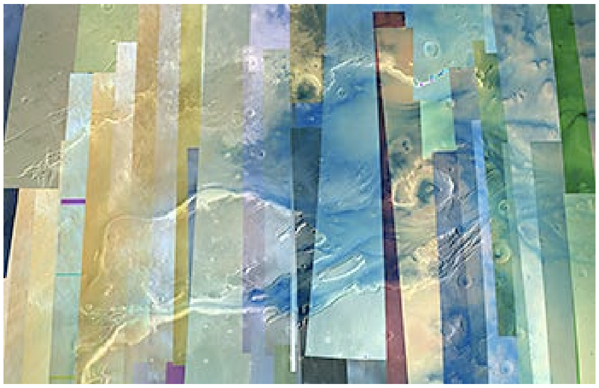

Fig. 1: Mosaic of 32 unprocessed Orbits (Kasei Valles).

Fig. 2: Above mosaic processed.

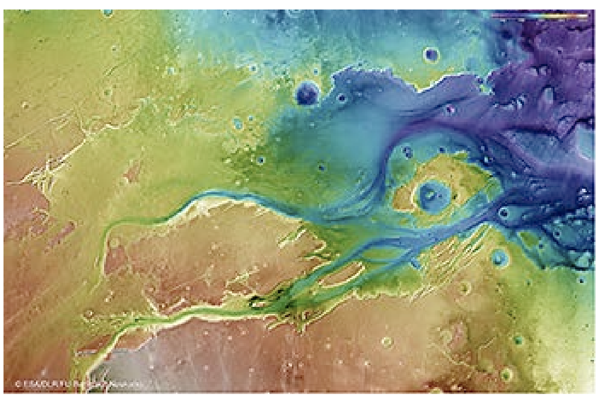

Fig. 3: Colour-coded DTM (same area).

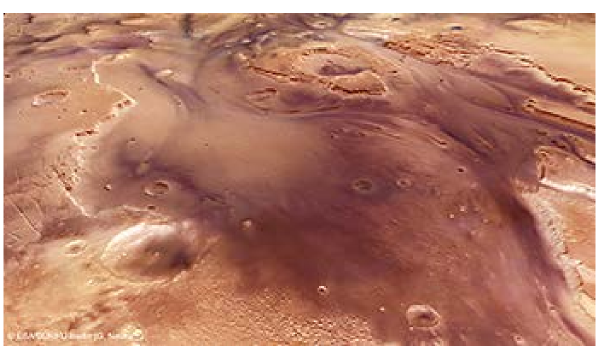

Fig. 4: Perspective view of the mosaik (same area).

**References:** [1] Neukum, G. and Jaumann, R. (2004) ESA SP, 1240, 17-35. [2] Jaumann, R. et al. (2007) PSS, 55, 928-952.
[3] http://www.planet.geo.fu-berlin.de
[4] http://www-mipl.jpl.nasa.gov/vicar.html
[5] https://www.lightwave3d.com
[6] http://www.exelisvis.com

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