PUBLIC OUTREACH AND ARCHIVING OF DATA FROM THE HIGH RESOLUTION STEREO CAMERA ONBOARD MARS EXPRESS: 2004 – THE FIRST YEAR. U. Koehler[1], G. Neukum[2], S. v. Gasselt[2], R. Jaumann[1], Th. Roatsch[1], H. Hoffmann[1], J. Zender[3], C. Acton[4], F. Drigani[5] and the HRSC Co-Investigator Team. [1]Institute of Planetary Research, DLR, Rutherfordstrasse 2, D-12489 Berlin, Germany (ulrich.koehler@dlr.de), [2]Freie Universität Berlin, Remote Sensing of the Earth and Planets, Malteserstrasse 74, D-12249 Berlin, [3]ESA RSSD, ESTEC, Noordwijk, The Netherlands, [4]JPL, 4800 Oak Grove Drive, Pasadena, CA 91109-8099, USA, [5]ESA Communication Department, ESRIN, I-00044 Frascati, Italy.

Introduction: During the first year of operation, corresponding to the calendar year 2004, the HRSC imaging experiment onboard ESA's Mars Express mission recorded 23 Gigabyte of 8-bit compressed raw data. After processing, the amount of data increased to more than 344 Gigabyte of decompressed and radiometrically calibrated – scientifically useable – image products. Every six months these HRSC 'Level 2' data are fed into ESA's Planetary Science Archive (PSA) that sends all data also to the Planetary Data System (PDS) to ensure easy availability to the interested user. On their respective web portals, the European Space Agency published in cooperation with the Principal Investigator-Group at Freie Universität Berlin and the German Space Agency (DLR) almost 40 sets of high-level image scenes and movies for PR needs that have been electronically visited many hundred thousand times.

HRSC Experiment and Data Generation. The High Resolution Stereo Camera (HRSC), originally developed for the Russian-led Mars-96 mission, was selected as part of the Orbiter payload for ESA's Mars Express mission [1]. The HRSC is a push-broom-scanning device with nine 5,182 pixels wide CCD line detectors mounted in parallel in the focal plane. Its unique feature is the ability to obtain near-simultaneous imaging data of a specific site at high resolution, with along-track triple stereo, four colors in the visible and near-infrared wavelengths and five different phase angles, thus avoiding the need of revisiting a site again for completing the measurements. An additional Super-Resolution Channel (SRC) – a framing device – yields nested images in the meter-resolution range. The spatial resolution from a periapsis altitude of 250 km is 10 m/pixel, with an image swath of 52 km for the HRSC and 2.3 m/pixel for the SRC. During the mission's nominal operational lifetime of 1 martian year (2 Earth years) and assuming an average HRSC data transfer share of 40%, it will be possible to cover about 50% of the martian surface at a spatial resolution of 10-20 m/pixel. More than 70% of the surface can be observed at a spatial resolution of 40 m/pixel.

Data Handling and Archiving. All HRSC and SRC data are processed systematically in Berlin by DLR's HRSC Experiment Team. The following processing steps are applied once the data is received by ESA's ground station, or NASA's Deep Space Network stations, respectively, and then transferred to the European Space Operation Centre (ESOC) in Darmstadt/Germany: 1 - Transfer of data from ESOC to DLR; 2 – Removing all transmission headers to get the original camera data; 3 – sorting of camera data by sensor and combining them with housekeeping data; 4 – decompression, thus creating 'Level 1' data; 5 – Radiometric calibration ('Level 2' data); 6 – calculation of footprints; 7 – Map projection of all nine complementary image strips, thus creating 'Level 3' data that are calculated on the basis of spacecraft data provided by ESOC converted to SPICE kernels by ESTEC using NAIF software.

Product Generation. Final image products on 'Level 2' that are processed on the basis of bested HRSC image data provided by ESOC are finally converted from the VICAR format used in the Experiment and Science Teams to PDS format [2]. The final products are sent to the PI (G.N.) and the group of individual CoI's who are in charge for the data validation. The data will be sent from DLR's HRSC Experiment Team to PSA after successful validation and PI approval [3], and will be stored in the Mars Express Science Data Archive (MESDA) of PSA. The MESDA is *the* official Mars Express data archive [3]. The disciplinary nodes and the main node of the PDS support the ESA archive team in general and the HRSC Experiment Team in particular. Concerning data structure and format, the PDS standards apply.

The HRSC data will be delivered by the PI through DLR to PSA every six months; every delivery contains the data taken during a time period of six months. Part of the data set is the delivery of appropriate software (xvd) to display the generally very large images, which are $\geq$ 5182 pixels wide and usually several ten- to hundreds of thousands of pixels long in one band. Furthermore, the Experiment Team provides software that enables calculation of map-projected 'Level 3' images.

HRSC on the Web and in the Media: Currently read by more than 1.5 million external visitors per month, the ESA Portal (www.esa.int) is the leading source of European space news and information.

Mars Express brought unprecedented traffic to the ESA portal, with a fourfold increase in visitors [4]. A "flash" of web hits at the ESA portal occurred during the release of the first set of HRSC images on 19 January, and again on 23 January 2004 with 310,000 and 240,000 visitor sessions, respectively. In Germany, the country where the HRSC experiment is based, the portals for HRSC image requests are the web pages of DLR, Germany's Space Research Center (www.dlr.de) and at the Remote Sensing of the Earth and Planets department of FUB (www.geoinf.fu-berlin.de). At all three sites, requests increased strongly after arrival of Mars Express at the planet; during individual release days over one hundred thousand requests have been noticed, with a peak of almost one million requests in January 2004 at the DLR portal.

Press Release Images. HRSC scenes selected for publication by the PI and produced by the PI group in cooperation with DLR will contain several images: Highest resolution is provided with a black and white nadir image; the identical scene is also displayed in color and by an anaglyph image – the latter based on a digital elevation model calculated from the stereo channels; this applies also for one or more perspective views; all images make use of the high resolution of HRSC data, and therefore have considerable dimensions of several thousand pixels per line and column to allow large-format printing; the resolution, though, is slightly reduced for convenience, to allow better online handling. Interpretational text, context images and geographical location of the scene on a Mars globe are also provided. The release sets go online simultaneously at ESA and DLR.

References: [1], Neukum, G. et al. (2004), *ESA Special Publ.* **1240**, 17-35; [2], Planetary Data System Standards Reference, June 1, 1999, Version 3.3, JPL, **D-7669**, Part 1, 531 pp.; [3], J. Zender (2001), Mars Express Archive Generation, Validation and Transfer Plan, **ESA-MEX-TN-4009**, Version 1.0, 42 pp; [4], Drigani, F. and Scholz, J. (2004), ESA Portal Brings Europe's Mars Adventure to Millions. *Esa bulletin*, **119**, 56-62; [5], USGS (2003), Topographic Map of Mars, M 25M RKN.

Figure 1 – Perspective and orthogonal view from a HRSC media-release set. The scene shows Reull Vallis. © ESA/DLR/FU Berlin (G. Neukum)

Figure 2 (below) - HRSC imaging strips, projected on the USGS topographic map [5]. The area covered by the HRSC during its first year of operation, starting at MEX orbit 10 on 8 January 2004 until orbit 1262 on 12 January 2005 corresponds to 18.7 per cent of the martian surface (12.7 per cent in a resolution of ≤ 40 m/pixel).