20 YEARS OF HIGH-RESOLUTION STEREO CAMERA IMAGE RELEASES OF ESA's MARS EXPRESS MISSION. C. Gross[1], R.R.C. Munteanu[1], S.H.G. Walter[1], L. Patermann[1], B. Schreiner[1], R. Jaumann[1] and the HRSC/Mars Express Teams at DLR and ESA. [1]Freie Universität Berlin, Institute of Geological Sciences, Planetary Sciences and Remote Sensing, Malteserstr. 74-100, 12249 Berlin, Germany (christoph.gross@fu-berlin.de).

Introduction: Mars Express was launched on June 2nd 2003 and entered orbit on December 25th 2003. Besides the "Earth Farewell" and "Mars Approach" releases, created during transit of the spacecraft, the first surface-images were sent to Earth on January 14th 2004. On January 19th these images were released featuring Hydraotes Chaos at the Martian equator.

Today, after 20 years of image press release activity, the main motivation in contributing to the public perception and to the legacy of the mission is to make this work accessible for scientists as well as for the public by dissemination of the High Resolution Stereo Camera data. During the past 20 years, the experiment has collected image data from more than 23.000 orbits, resulting in a steadily increasing set of image, mosaic, and movie releases. We recently developed a new map-interface to facilitate the search of our PR products.

Data Processing: Decompression, calibration and projection of raw image data is performed at the Institute of Planetary Research of the German Aerospace Center in Berlin-Adlershof. This level 2-4 data is then processed to higher -level products by the Planetary Sciences and Remote Sensing Team at Freie Universität Berlin (FUB). Here, the camera data from the different channels (stereo, color, nadir) is combined to produce color images, anaglyphs, digital terrain models, 3D perspectives and movies of the Martian surface and the Martian moons.

PR Releases: Press releases are provided by the Planetary Sciences and Remote Sensing Group at FUB in close collaboration with the European Space Agency (ESA) and the German Aerospace Center (DLR) on a monthly basis.

A typical press release comprises different views of a scene taken from an HRSC image of the Martian surface: Plan view color scenes from the four color channels refined with the higher-resolution nadir channel, a color-coded terrain model also pan-sharpened with the nadir-image, anaglyphs derived from the stereo channels, and perspective color views. The views are provided at the best possible resolution. In addition, a context map is produced to show the footprints of the processed HRSC observation and its position on the Martian surface. Descriptive texts come with the press products and fulfill scientific correctness and popular science requirements. Also, annotated images are provided, to illustrate geological processes and landforms. "Special" press products include animations and simulated flights over the Martian surface, perspective views of stereo data combined with color and high resolution, multi-orbit mosaics, and perspective views of mosaics as well as broom observations. Due to the high effort, these products are published at irregular intervals.

Data Dissemination: The newly developed "HRSC Press Release Map" displays an overview map of all the press products released so far. Three different categories of press releases are distinguished: *Animation* (contains a flyover movie) highlighted by a white movie icon, *Past Years* (press releases of the past years) represented by a white circle, *Current Year* (press releases of the current year) highlighted by a green star or a green movie icon in case of an animation press release. By clicking on a point on the map, the user can display a popup window (see Fig. 1) containing the following information: Title, press release date, short press release description, link to the press release page, table with available product types that are provided by the selected press release (highlighted with blue if the product type is available). By clicking on the available product button, the corresponding product is opened and displayed in higher resolution in a new browser tab.

The meta information for each press release is stored geo-referenced in a PostgreSQL database with PostGIS extension. This allows an automated update of the information in the web application directly after new entries for a recent press release have been added to the database. The web application is a JavaScript, HTML, and CSS-based program whose main component is the JavaScript library OpenLayers, which is the prerequisite for working with and displaying geo-referenced data and information in web applications. The map is an interface to a Mapserver hosted by Freie Universität Berlin, which enables and provides the retrieval and integration of maps and geo-referenced information in the form of layers that can be arranged on top of each other using standardized OGC interfaces.

The Planetary Sciences and Remote Sensing Group at FUB also offers a web-based data access using an interactive map server setup [1]. The HRSC Map Server offers easy data access with direct preview and download functions of panchromatic Level-3 single strip images and panchromatic and pan-sharpened color level-4 single strip images. In addition, quadrangle based mosaic products can be downloaded directly from the HRSC Mapserver. It is automatically updated on a daily basis.

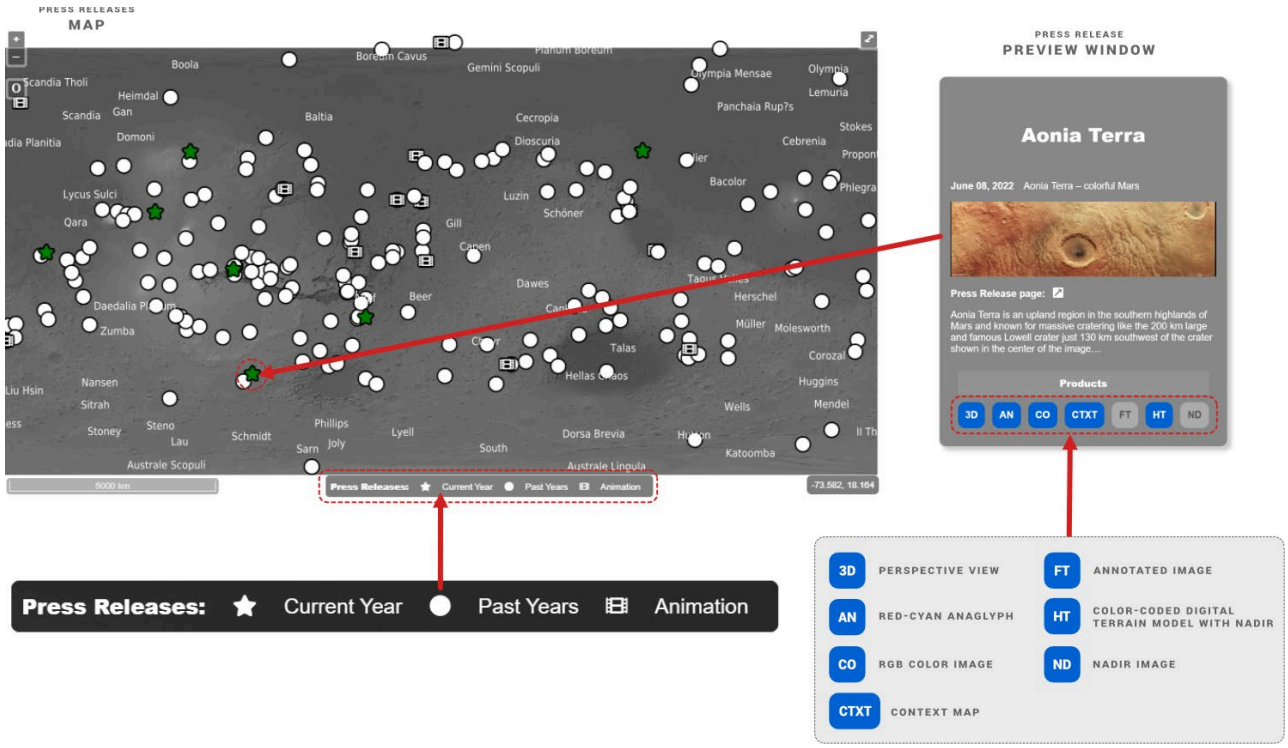

Figure 1: Overview of the new interactive "HRSC Press Release Map" interface containing all HRSC press releases since start of the mission. The preview options offer an easy access to the selected products.

Another application developed by the Planetary Sciences and Remote Sensing group is the "Interactive Virtual Hiking Map for the Jezero Crater" [2]. The user can explore the landing site of the Mars2020 Perserverance rover in an interactive hiking map loaded with orbital imagery, terrain data and virtual 3D panoramic views of Jezero and its surroundings. The map allows quick zooming and panning for the exploration of the available data in several magnitudes of scale levels, from high altitude down to centimeter detail. Several waypoints with pre-rendered 360° panoramas and several real panoramas derived from the MastcamZ instrument can also be accessed. The rover path is constantly updated so the user is always provided with the current location of the rover at the Martian surface.

All mentioned applications can be found here:
https://www.geo.fu-berlin.de/en/geol/fachrichtungen/planet/projects/imaging

or simply browse our working group website:

https://www.geo.fu-berlin.de/planet

Acknowledgements: The HRSC experiment teams at DLR Berlin and FUB as well as the Mars Express project teams at ESTEC and ESOC are thanked for their successful planning, data acquisition, and systematic processing. This work was supported by ESA contract 4000138170/22/ ES /JD. RJ, RM, BS, and SW received funding from the German Space Agency (DLR Bonn), grant no. 50 OO 2204, on behalf of the German Federal Ministry for Economic Affairs and Climate Action. We also want to thank our former team members and all persons that were involved in our public relations efforts.

References: [1] Walter, S. H. G. et al. (2018) The Web-Based Interactive Mars Analysis and Research System for HRSC and the iMars Project. Earth and Space Science Vol 5, Issue 7, p 308-323. https://doi.org/10.1029/2018EA000389.
[2] Walter, S. et al. (2022) Interactive Map for Jezero Crater, the Mars 2020 Perseverance Rover Landing Site. Europlanet Science Congress 2022, Granada, Spain, 18–23 Sep 2022, EPSC2022-32. https://doi.org/10.5194/epsc2022-32, 2022.