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## Objective:

To discuss ideas for using data from the High Resolution Stereo Camera (HRSC) on the ESA Mars Express (MEX) orbiter [1] for geosciences education, with a focus on learning about stereo imaging.

## Background:

- The HRSC on MEX is a pushbroom scanner with 9 CCD channels of 5,184 pixels/line in the focal plane of a 175 mm optics system.
- HRSC scans the surface with one nadir channel, two (forward- and back-looking) stereo channels, two photometry channels (all 675 nm), and four color channels (red (750 nm), green (530 nm), blue (440 nm), and infrared (970 nm)).
- MEX is in a polar elliptical orbit with a ~250 km periapsis, shifting over time. At periapsis, spatial resolution of the HRSC is (typically) 12 m/px (nadir), 25 m/px (stereo 1 & 2), and 50 m/px (color channels).

### ESA Mars Express

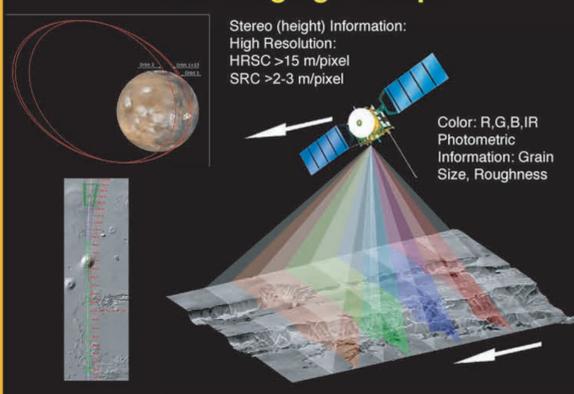


### HRSC

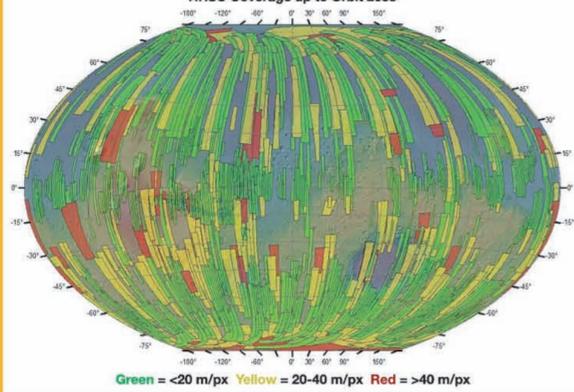


### SRC

## HRSC Imaging Principle



### HRSC Coverage up to Orbit 2688



Map of current HRSC coverage over MOLA base, as of February 2006.

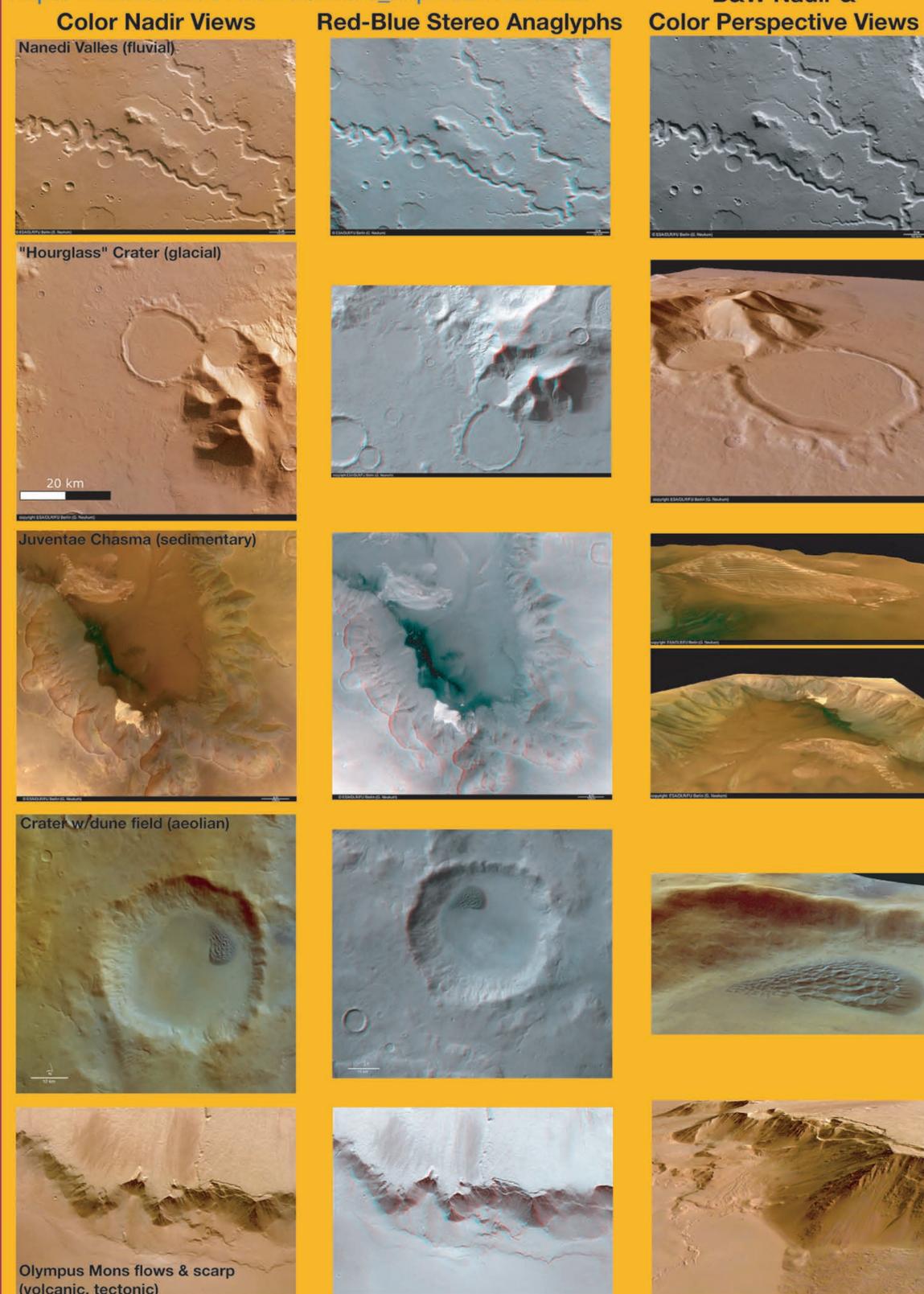
## HRSC Data:

HRSC images through orbit 1224 (through 2005) are available through ESA's Planetary Science Archive (PSA). NASA's Planetary Data System (PDS) has downloadable JPEGs of Level-2 data (radiometrically-corrected, but not map-projected) through orbit 1224. The size of individual HRSC images (up to 15 Gigabytes), the restriction to Level-2 versions in the PSA & PDS, and the requirement to use DLR-based VICAR software for processing presents problems for use of HRSC data by the larger Mars community.

## HRSC Press Releases:

ESA is producing a weekly-biweekly series of press release images (TIFF & JPEG format) of processed HRSC images from throughout the mission, covering interesting features of the martian surface. These images can be downloaded from:

[http://www.esa.int/SPECIALS/Mars\\_Express/index.html](http://www.esa.int/SPECIALS/Mars_Express/index.html)



References: Neukum et al., 2004, ESA SP-1240, ESA Pub. Div., Noordwijk, The Netherlands, 17-36; Neukum et al., 2004, Nature 432, 971-979.

## Ideas for Geoscience Education:

- The existing HRSC press release images, downloadable on any computer with WWW access can be integrated into any Mars-based exercises that focus on particular geologic processes.
- HRSC images could be used to develop exercises to teach students about the concept of stereo imaging. With computers that run software like Adobe Photoshop™, students can make their own red-blue stereo anaglyphs:

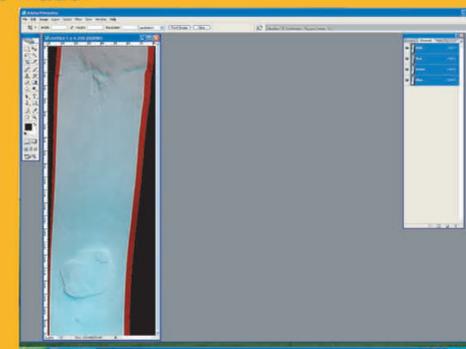
**Step 1:** Open 3 prepared HRSC stereo images in Photoshop. Select "Merge Channels".



**Step 2:** Select "RGB". Assign each image to a channel. For example, stereo 1 to Red, stereo 2 to Green and Blue.



**Step 3:** Select "OK". A RGB stereo anaglyph is made.



## Comments

