EDUCATION AND PUBLIC OUTREACH WITH THE MARS RECONNAISSANCE ORBITER'S HIGH-RESOLUTION IMAGING SCIENCE EXPERIMENT: A VIRTUAL SCIENCE TEAM EXPERIENCE.
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Introduction and Overview: Looking back over one Mars year, we report on the accomplishments of the HiRISE EPO program during the primary science phase of MRO. Our HiRISE E/PO effort has focused primarily on delivering high impact science opportunities for the general public and students through our various web sites. Uniquely, we have invited students from around the world to become virtual HiRISE team members by submitting target suggestions and analyzing acquired images. The large image sizes and incredible spatial resolution of the HiRISE camera can tax the capabilities of the most capable computers, so we have also focused on enabling typical users to access and enjoy our images. A few key highlights are discussed below.

Quest Challenges: A highlight of our outreach effort has been our ongoing student image suggestion program, conducted in association with NASA Quest as HiRISE Image Challenges (http://quest.arc.nasa.gov/challenges/hirise/). During challenges, students, either individually or as part of a collaborative classroom or group, learn about Mars through our webcasts, web chats and our educational material. They then use HiWeb, HiRISE's image suggestion facility, to submit image suggestions and include a short rationale for why their target is scientifically interesting. The HiRISE team gives priority to obtaining a sampling of these suggestions as quickly as possible so that the acquired images can be examined by the students.

During the challenge, a special password-protected web site allows participants to view their returned images before they are released to the public (http://marsoweb.nas.nasa.gov/hirise/quest/). Students are encouraged to write captions for the returned images. Finished captions along with mention of the suggesting class, teacher's name, and the school name are then posted and highlighted on the HiRISE web site (http://hirise.lpl.arizona.edu).

Through these HiRISE challenges, students and teachers become virtual science team members, participating in the same process (selecting and justifying targets, analyzing and writing captions for acquired images), and using the same software tools as the HiRISE team. Such an experience is unique among planetary exploration EPO programs.

To date, we have completed three HiRISE challenges and a fourth is currently ongoing. More than 200 image suggestions were submitted during the previous challenges and over 85 of these image requests have been acquired so far (e.g., Figure 1). Over 675 participants from 45 states and 42 countries have registered for the previous challenges. These participants represent over 8000 students in grades 2 through 14 and consist primarily of teachers, parents of homeschoolers and student clubs, college students, and life-long learners.

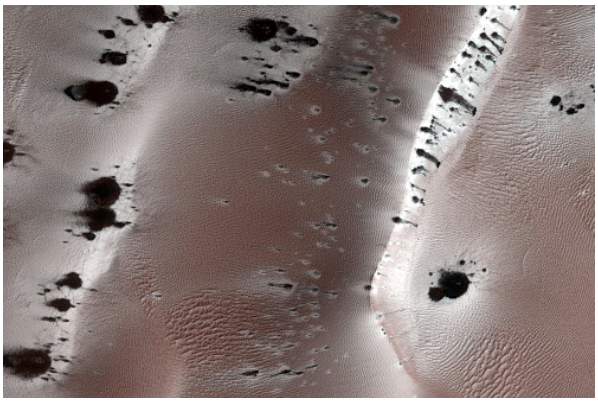

Figure 1: This HiRISE image of a south polar dune field was suggested by Andras Sik's SUPERNOVA astronomy and space research class at the Alternative Secondary School of Economics in Budapest, Hungary.

Clickworkers: Another E/PO highlight has been our citizen scientists effort, HiRISE Clickworkers (http://clickworkers.arc.nasa.gov/hirise). Clickworkers enlists volunteers go identify geologic features (e.g., dunes, craters, wind streaks, gullies, etc.) in the HiRISE images and help generate searchable image databases.

Image Viewer: We've also developed the HiRISE online image viewer where users can browse, pan and zoom through the very large HiRISE images from within their web browser (http://marsoweb.nas.nasa.gov/HiRISE/hirise_images/).

The viewer enables anyone to explore these images interactively at full resolution. These images are deployed in the "zoomify" format, allowing online exploration of these huge images, using continuous pan and zoom, from thumbnail size to full-resolution. This format operates in the Flash environment and requires no extra software. The images include all of the Quest

Challenge images, many of the earlier HiRISE images, and the HiRISE images used for landing site selection studies for the upcoming Mars Science Lander (MSL) mission. There are currently 461 images deployed in the Image Viewer archive. Many more will be deployed once the web server is upgraded with more disk space. The webpages for these images also include links to the various image download products available at the HiRISE Operations Center, as well as context maps showing the image outlines in surrounding context using various basemaps. Images can be graphically navigated on a zoomable basemap of Mars, or picked from dropdown lists. This archive has proven to be a very popular way for the public around the world to explore these images in full resolution, with no downloads of software or images required. Expanding this archive with more images is a top priority.

Education Materials: Educational materials available on our web site include an assortment of K through college level, standards-based activity books, a K through 3 coloring/story book, a middle school level comic book, and several interactive educational games, including Mars jigsaw puzzles, crosswords, word searches and flash cards (http://hirise.seti.org/epo). HiRISE team members have given numerous classroom presentations and participated in many other informal educational and public events (e.g., Sally Ride Science Festivals, CA Science teachers conference workshops, NASA's Yuri's Night, Xprize events, University of Arizona's Mars Mania and Phoenix public events). The HiRISE operations team maintains a blog (HiBlog) (http://hirise.lpl.arizona.edu/HiBlog/) providing insights to the pulse of daily activities within the operations center as well as useful information about HiRISE.

HiWeb HiRISE Image Suggestion Facility: To aid the HiRISE science team and Quest participants in selecting imaging targets, we developed a web-launched Java application to allow users to peruse the various Mars orbital data and image sets and enter their desired imaging targets in an image suggestion registry. To date, over 30,000 suggestions have been entered using this geospatial information system, called HiWeb. Several hundred of these have been entered by members of the public from various countries, as part of NASA's HiRISE Quest Challenge program for students and educators. Users can specify their target locations using a multi-point drawing tool or a standard HiRISE footprint outline, and specify if they want color, stereo, ultra-high resolution, or coordination with other MRO instruments. Camera photometric angles can be specified, and a multiple-repeat observation can be requested as part of, for instance, a seasonal process study. HiWeb users navigate to their areas of interest via typing in coordinates, using a feature finder tool, or interactively browsing Mars through a Google Earth-like Web facility called the HiWeb Mars Browser, which has many different basemap options zoomable from 9 to 512 pixels/cm, including custom color polar elevation maps.

The facility allows users to peruse various Mars orbital imagesets, and features a gazetteer, polar stereographic projections for the poles, a help guide in the form of popup tool tips, and tools for image processing of basemaps and creating elevation profiles using MOLA data.

A user submitting an imaging suggestion specifies his or her region of interest (ROI) graphically in a basemap, using a polygon-drawing tool or a stretchable default HiRISE footprint shape, and supplies a scientific rationale. Suggesters can ask for stereo, color, higher resolution, coordination with CRISM imaging, or multiple observations in a specified solar longitude (Ls) window, and can request specific HiRISE photometric angles for the observations. HiWeb includes several basemap options (MDIM, MOC wide-angle mosaic, MOLA maps, and THEMIS day and night mosaics), Users can navigate to the web pages or to full-resolution images of HiRISE, MOC, and THEMIS images (both visible and IR), with user-selectable orbit and Ls range. Type-in fields are provided for users to go directly to specific HiRISE images or suggestions.

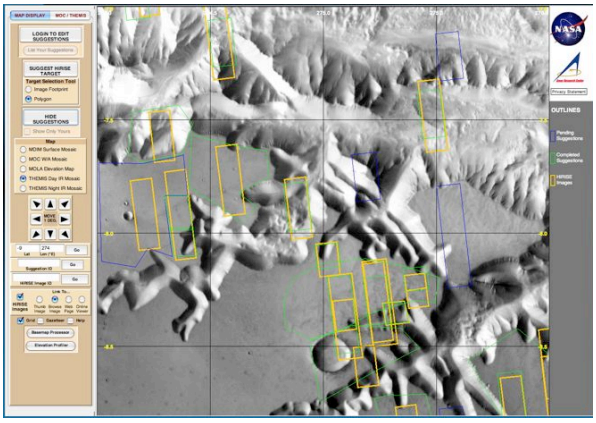

Figure 2: A screenshot from the HiWeb image suggestion facility.

Summary: After a full Mars year, the HiRISE E/PO effort continues. In the extended mission era we will continue to support our ongoing Quest challenges and the various web sites to the fullest extent possible.