

MRO's HIGH RESOLUTION IMAGING SCIENCE EXPERIMENT (HiRISE): EDUCATION AND PUBLIC OUTREACH PLANS. V. Gulick¹, A. McEwen², W.A. Delamere³, E. Eliason⁴, J. Grant⁵, C. Hansen⁶, K. Herkenhoff³, L. Keszthelyi³, R. Kirk³, M. Mellon⁷, P. Smith¹, S. Squyres⁸, N. Thomas⁹, and C. Weitz¹⁰. ¹NASA Ames/SETI Institute, ²LPL, University of Arizona, ³Ball Aerospace and Tech. Corp., ⁴USGS, ⁵CEPS, Smithsonian Ins., ⁶JPL, ⁷University of Colorado, ⁸Cornell University, ⁹University of Bern, Switzerland, ¹⁰PSI/NASA

Introduction

The High Resolution Imaging Experiment, described by McEwen et al. [1] and Delamere et al. [2], will fly on the Mars 2005 Orbiter. In conjunction with the NASA Mars E/PO program, the HiRISE team plans an innovative and aggressive E/PO effort to complement the unique high-resolution capabilities of the camera. The team is organizing partnerships with existing educational outreach programs and museums and plans to develop its own educational materials. In addition to other traditional E/PO activities and a strong web presence, opportunities will be provided for the public to participate in image targeting and science analysis. Below we summarize the main aspects of our program.

The entire HiRISE EP/O effort will be vetted by an Educator Advisory Committee (EAC) that we will soon establish. The EAC will consist of approximately a half dozen members of both formal and informal educators. Members will be drawn from a variety of levels within the target K-14 grade range with a focus on representation from minority-serving institutions. The EAC will provide critical evaluation and input into all aspects of HiRISE's E/PO activities.

Members of the science team and EAC will review all curriculum support materials to insure scientific accuracy, sound pedagogy, usability, and alignment with national education reform efforts (e.g. Project 2061 and the National Science Education Standards). All materials will also undergo testing and revision prior to publication or broad dissemination, and will be matched with national science and technology content standards. Lesson plans and other curriculum materials will be translated into Spanish and other languages by Imagiverse (<http://imagiverse.org>) and made available on the HiWeb E/PO site and at educator workshops.

Public Targeting

The HiRISE team plans to cast a wide net to collect targeting suggestions for the ~10,000 high-resolution images to be collected over the two Earth year mission. Although most image targets will be selected from suggestions submitted by the science team, the Mars Exploration Program Office, and the general Mars community [see 3], approximately one image per week will be targeted based on suggestions from the general public.

The web-based interface for target suggestion input (HiWeb) will be based upon Marsoweb, the Mars Landing Site web environment (<http://marsoweb.nas.nasa.gov/landingsites>). In addition to the current data browsing capabilities, users will be able to select targets, specify special constraints (e.g. season), and upload short justifications. HiWeb will also display and distribute previously obtained HiRISE images.

Input from the general public will be motivated and filtered by NASA Quest, NASA's web-based K-12 education portal based at NASA Ames Research Center (<http://quest.arc.nasa.gov>). To inform the public about the capabilities of HiRISE and the plethora of potential targets, Quest will host web events, on-line chats and webcasts with science team members, and provide access to other on-line E/PO material. To select targets from public suggestions Quest will advertise and conduct on-line polls. Public image target suggestions will be selected through the polling, chats, and webcasts hosted by Quest. We expect the public suggestions will produce an interesting and diverse set of targets that will then enter the usual target selection stream further explained in [3]. Once obtained, the resulting public-motivated images will be highlighted on the HiWeb site. Further details about public and Mars community targeting will be released closer to the launch date.

Public Science Analysis

The public will also have the opportunity to participate in HiRISE data analysis through the 'Clickworkers' project. Clickworkers aims to produce science data products from images by harnessing the huge public interest in planetary missions. The proof-of-concept effort involved having the public look at images of Mars and identify the locations and diameters of impact craters in each image. Over 85,000 individuals visited the site (<http://clickworkers.arc.nasa.gov>) and submitted over 1.9 million crater location/diameter entries and a quarter million crater classification entries [4]. Results from the prototype Clickworkers web site show that the accuracy of volunteer inputs, when appropriately tested and filtered, is comparable to that of existing crater databases.

The Clickworker's project will work with the HiRISE team to develop similar analysis modules to harness the enthusiasm of the public while educating them about Mars, mission goals, accomplishments, and

resulting science. For example volunteers could quickly establish a database of features (e.g. craters, boulders, gullies) imaged by HiRISE.

The fact that the public equipped with basic online tutorial and analysis modules was able to essentially duplicate the results of an existing crater database in the original proof of concept Clickworkers' effort, suggests that output of new databases in this fashion can result in output that has scientific value. This proof of concept website has also demonstrated that there is strong interest generated by direct public participation in science. The site has been featured in the *New York Times* and a dozen other publications in several languages, on BBC Online, and on a television program on the Canadian Discovery channel. The fact that they are contributing to science can inspire people to think of planetary science not as something that others do and they passively consume, but as something to which they can contribute their efforts. By empowering the public with user-friendly web tools, timely access to data and unique opportunities to participate not only in the discovery process, but also in the actual science as well, we hope to make the dream of exploring Mars a virtually real experience for all.

Education and Public Outreach Partnerships

HiRISE will provide lesson plans to educators via publications, workshops, and the Internet. Rather than create an entirely new set of materials, will draw upon the large number of existing classroom-tested, standards-based, Mars and space science lesson plans whenever possible. Modified or new lesson plans created after orbit insertion will be able to draw upon a wealth of new data, including high-resolution color images of the surface of Mars. New data and images will allow us bring the excitement of an active spacecraft mission and it's discoveries into classrooms and informal settings.

Technology-based activities will be published through JPL's Space Place alliance with the International Technology Education Association's (ITEA's) Technology Teacher magazine. Several activities will be published during the mission. NASA Quest will support HiRISE sponsored Web events. HiRISE activities may also be developed and published in partnership with established space science education programs such as ASU's Red Planet Connection publication.

Beginning the summer of 2006, educator workshops using HiRISE and Mars Educational Program (MEP) educational products will be held each year in partnership with a professional workshop provider. Each workshop will be held at or near the institution of a HiRISE team member. Workshop background materials and instructions for all hands-on activities will also be placed on the HiWeb E/PO site. This will facilitate the sharing of information with educators who are unable to attend a workshop and the general public. We will also provide materials and speakers to a num-

ber of existing educator workshop programs including MarsQuest, and the JPL Solar System Educators and Ambassadors Programs. Individual EAC members will also be encouraged to share HiRISE/MEP workshop materials with educators at their home institutions.

HiWeb: HiRISE's Innovative Public Website

As mentioned above, HiRISE's web presence will center around HiWeb, an interactive data analysis, repository and target suggestion system. HiWeb will be based upon Marsoweb, a collaborative web environment (<http://marsoweb.nas.nasa.gov/landingsites/>) that allows for the planetary community to better analyze, visualize and compare Mars Global Surveyor, Mars Odyssey and other data sets. These tools have grown out of a four year effort by the Center for Mars Exploration (CMEX) at NASA Ames Research Center (ARC), the NASA Advanced Supercomputing (NAS) Division's Data Analysis Group at Ames, and the Mars Exploration Program to promote interactions among the planetary community and to coordinate landing site activities for the MER 2003 mission.

Marsoweb serves as a repository for maps, data, and memoranda related to this activity (such as current landing ellipse parameters, workshop talks and announcements, etc.). Large map and image datasets may easily be browsed and zoomed. Special tools are available for viewing MGS laser altimeter data and for processing MOC images. The facility will continue to evolve over the next several years as new tools and features are added to support the ongoing Mars missions. Over 88,000 distinct users (resulting in over 3 million hits and over 800,000 page requests) from government, academia, and the general public have accessed the site since its inception in 1999.

The current web-based clickable, zoomable image data map will allow seamless access to all HiRISE, other MRO, and previous Mars mission data including image, topographic, spectral, and derived data sets. The interface will allow inter-comparison of data sets via transparent overlays on the image data map. A key feature will be rubber-band selection of image targets and a simple justification interface.

In addition to providing targeting and data browse capabilities, HiWeb will fill the data distribution function of HiRISE. Five captioned images will be released per week and users may order full resolution images from the HiRISE data processing facility. In addition tools for viewing and processing the large images will be made available.

Additional EP/O Activities

Each HiRISE science team member will be responsible for local EP/O activities in their home region. Team members have committed to spending at least 5% of their time in outreach activities and to coordinating local EP/O. HiRISE images will be displayed at full resolution on the giant projection screen

at the Smithsonian Air and Space Museum between IMAX shows.

To learn more about HiRISE's exciting plans, go to <http://marsoweb.nas.nasa.gov/HiRISE/>.

References: [1] McEwen, A. et al. this conference. [2] Delamere, W. A. et al. this conference. [3] Eliason, E. et al. this conference. [4] Kanefsky, B. et al. (2001) 32nd LPSC, abstract no. 1272.