

**STUDENT AND PUBLIC PARTICIPATION IN ACQUIRING AND ANALYZING HIRISE IMAGES.** V.C. Gulick<sup>1</sup>, G. Deardorff<sup>2</sup>, B. Kanefsky<sup>3</sup>, and A. Davatzes<sup>4</sup>, <sup>1</sup>NASA Ames/SETI Institute, MS 239-20, NASA Ames Research Center, Moffett Field, CA 94035, (email: [vgulick@mail.arc.nasa.gov](mailto:vgulick@mail.arc.nasa.gov)), <sup>2</sup>NASA Ames/AMTI, <sup>3</sup>NASA Ames/UCSC, <sup>4</sup>NASA Ames/NPP Program

**Introduction:** The High Resolution Imaging Science Experiment (HiRISE) camera onboard the Mars Reconnaissance Orbiter has begun to obtain the first of what will ultimately be thousands of high-resolution images of Mars. To bring the excitement of this unprecedented imaging experiment to the general public, we have developed an innovative EPO program. Here we describe some of the highlights of this program, particularly our web tools for suggesting HiRISE imaging targets and for analyzing HiRISE images.

**HiRISE Image Suggestion Facility:** Anyone can submit a HiRISE imaging suggestion. The ability to suggest targets has already generated considerable public interest, for example by a group interested in looking for natural arches on Mars. All suggestions are entered into the image suggestion database and are evaluated by the HiRISE team. Suggestions are submitted via a Java-based, web-launched tool we call HiWeb.

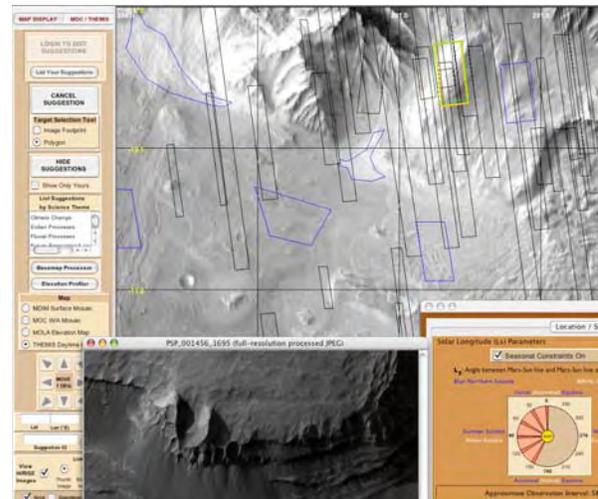
This tool allows regions-of-interest to be specified with a polygon drawing tool or a default HiRISE image footprint; allows for stereographic suggestions or suggestions comprising multiple observations over the course of a Martian season; and allows for the specification of a multitude of camera and image parameters. HiWeb includes a gazetteer, go-to-by-feature tool, and popup tooltips, as well as clickable, sortable suggestion spreadsheets. HiWeb uses polar stereographic views for Mars' polar regions, enabling the planning of polar science.

Available basemap options include surface mosaics from MDIM, MOC wide-angle, and THEMIS daytime IR, as well as color MOLA elevation maps. In addition to quick access to full-resolution HiRISE images, HiWeb also includes clickable access to currently released MOC and THEMIS images, with viewable footprints constrained by orbital series or solar longitude range. Users can navigate to their location of choice via a web-based basemap exploration tool utilizing the Flash/Zoomify toolsuite, enabling continuous pan and zoom over all of Mars.

The HiRISE science team has been using HiWeb to register their imaging suggestions since a few months prior to launch. Along with the requested target locations, users may supply a host of other image parameters as well, including the scientific rationale for the suggestion and reasons to use color or stereo. To date, over seven thousand suggested targets have been registered in the HiRISE image suggestion registry using

HiWeb. Recently, a small group of general users from academia and research have been using HiWeb as well. Use by the general public is forthcoming.

To facilitate public use we have developed step-by-step guides and "tool tips" to clarify the process. The advanced options are not required for public suggestions. Early beta testing has found that those with a minimal understanding of Mars and imaging can successfully generate suggestions. Complete novices have more difficulty, for such users we are developing a "Clickworkers" interface as described below.



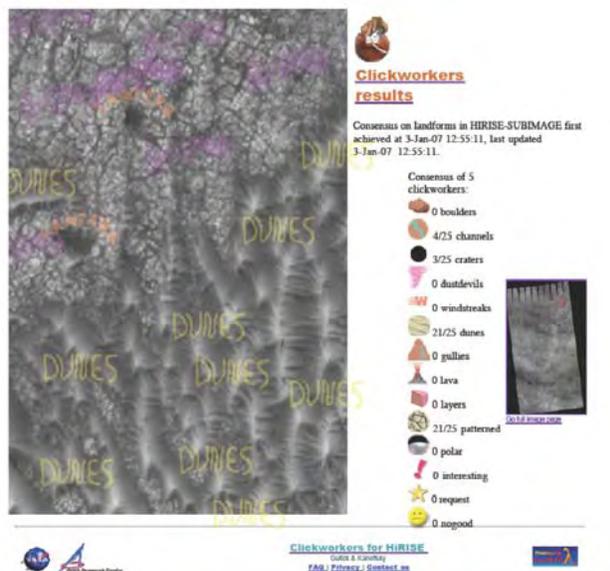
**Figure 1:** The HiWeb Image Suggestion Tool is used to peruse suggestions, a HiRISE image (shown), and MOC images in the Coprates Chasma region. Also shown is a portion of the image suggestion form with a diagram of a multiple-observation suggestion over the requested solar longitude range.

**HiRISE Clickworkers:** Most previous NASA missions have simply delivered final data products to the public through press releases and data repositories. To increase the level of public involvement in the data analysis process itself, we have recruited the public to work as online volunteers ("clickworkers") [1]. Clickworkers are examining HiRISE and MOC images to search for landform types of interest to the science team.

Clickworkers are helping to catalog HiRISE images to help guide the analysis efforts of the science community and also prepare for future, more quantitative, analysis by the volunteer clickworkers themselves. Our goal with the MOC images is to help the

HiRISE science team and the larger science community to identify additional HiRISE targeting candidates for landforms of interest (e.g., gullies, dust devil trails, wind streaks, channels, etc.). We also plan to allow Clickworkers to vote for HiRISE imaging of features in MOC images that they find particularly interesting. This approach should allow even the novice user to make an image suggestion.

In the case of HiRISE images, volunteers are presented with randomly chosen fragments of the images. Users identify image content by “stamping” one of several different labels on geologic features, such as “crater” or “dunes”. Since our previous work [1] recruited enough volunteers to mark four million craters, we may be able to afford such a labor-intensive approach. Preliminary results from the first week suggest that some of the volunteers spend on the order of an hour in one sitting and catalog on the order of 100 sub-images. Our goal is to both provide a useful product to the team and to permit direct public participation in data analysis.



**Figure 2:** Summary frame showing the Clickworkers have successfully identified sand dunes, impact crates, and patterned ground on a HiRISE image.

**Other EPO Highlights:** HiRISE EPO has developed K-14 educational materials including activity, coloring and comic books that focus on Mars geology, the image suggestion process, understanding the HiRISE camera and working with digital image data. In addition, we have developed interactive educational games including Mars crosswords, jigsaws, word searches, and flash cards to provide fun ways for students to learn more about Mars. All educational mate-

rials and games are aligned with the National Science Standards. HiRISE Clickworkers will provide online opportunities for the public to assist the team in creating geologic feature databases (gullies, boulders, craters, wind streaks, etc.) present in the HiRISE images in addition to other innovative opportunities. Web events (including web chats, casts and forums) with HiRISE team members, will help guide students and educators of HiRISE capabilities and science goals and provide support for submitting good image suggestions. Educator workshops will be held each year at or near the institution of HiRISE team members. Workshop support materials and instructions for all hands-on activities will be placed on HiWeb to facilitate sharing of information with other educators and the general public. Large-scale displays of HiRISE images will be available at several museums and planetariums.

**HiRISE Web Addresses:** HiRISE educational materials, HiWeb tutorials, and games can be found at <http://hirise.seti.org/epo/>. The HiRISE main site and the image suggestion facility is mirrored at <http://marsoweb.nas.nasa.gov/hirise> as well as <http://hirise.lpl.arizona.edu>. HiRISE Clickworkers is accessible from <http://clickworkers.arc.nasa.gov/hirise>.

**References:** [1] Kanefsky, B., Barlow, N., and Gulick, V. LPSC XXXII, Abstract #1272.