MARS DATA VISUALIZATION AND E/PO WITH MARSOWEB. V. C. Gulick[1,3] and D. G. Deardorff[2,3], [1]Space Science Division, Center for Mars Exploration, SETI Institute (vgulick@mail.arc.nasa.gov), [2]NASA Advanced Supercomputing Division, Exploratory Computing Environments Group, AMTI (deardorff@mail.arc.nasa.gov) [3]NASA Ames Research Center, Moffett Field, CA 94035.

Introduction: Marsoweb is a collaborative web environment that has been developed for the Mars research community to better visualize and analyze Mars orbiter data. Its goal is to enable online data discovery by providing an intuitive, interactive interface to data from the Mars Global Surveyor and other orbiters.

Recently Marsoweb has served a prominent role as a resource center for the site selection process for the Mars Explorer Rover 2003 missions. In addition to hosting a repository of landing site memoranda and workshop talks, it includes a Java-based interface to a variety of datamaps and images. This interface enables the display and numerical querying of data, and allows data profiles to be rendered from user-drawn cross-sections. High-resolution Mars Orbiter Camera (MOC) images (currently, over 100,000) can be graphically perused; browser-based image processing tools can be used on MOC images of potential landing sites. An automated VRML atlas allows users to construct "flyovers" of their own regions-of-interest in 3D. These capabilities enable Marsoweb to be used for general global data studies, in addition to those specific to landing site selection. As of September 2002, over 70,000 distinct users from NASA, USGS, academia, and the general public have accessed Marsoweb.

Landing Site Selection: A central focus of Marsoweb has been on its role as a resource center for those involved in landing site selection for the Mars Explorer Rover (MER) 2003 rover missions. It serves as a repository for maps, data, and memoranda related to this activity (such as workshop talks and announcements, current landing ellipse parameters, etc.).

Java applets are used to provide a graphical interface to view and query landing site resources in the equatorial region amenable to the MER 2003 landers and rovers (Figures 1 and 2). Perusable resources include visible surface images and interactive data maps of the candidate landing sites, using data from the current Mars Global Surveyor (MGS) and previous missions. An archive of candidate sites for the previous (since cancelled) Mars Surveyor 2001 lander mission is also available.

The visible surface basemap is used to display, query, and link to high-resolution elevation maps (from the Mars Orbiter Laser Altimeter, or MOLA) for the prime landing sites. The data map viewer also allows users to peruse 3D VRML (Virtual Reality Modeling Language) scenes of the candidate landing sites

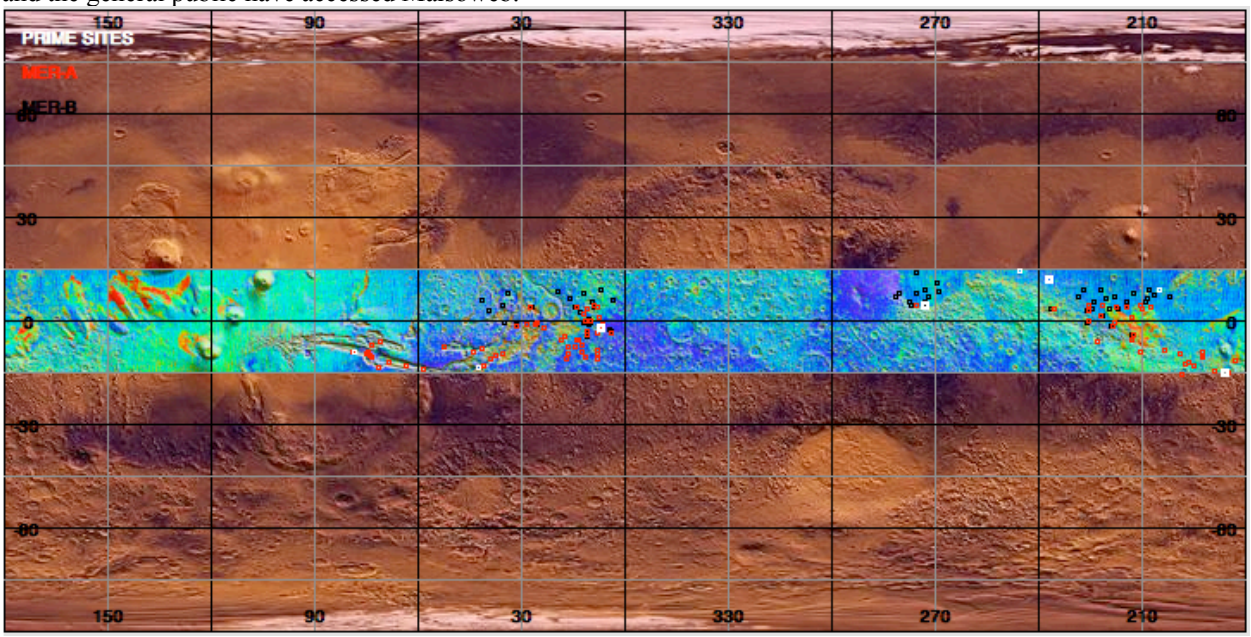

Figure 1. A map of Mars showing possible landing sites is overlain by an equatorial datamap of vertical roughness data (data courtesy of James Garvin). Squares denote various proposed landing sites. Clicking on map 'zooms' to higher resolution including links to images, clicking on square brings up data repository for specific landing sites.

(Figure 2). Actually, all of the equatorial region of Mars between 15 degrees N and 15 degrees S is available as ready-made VRMLs, allowing Web users to navigate this region in true 3D; the candidate sites are labeled where they occur. The VRMLs consist of terrain data from the Viking missions Digital Terrain Models (DTMs), texture-mapped with Viking orbiter visible imagery from the Mosaicked Digital Image Models (MDIMs). High-resolution images from the current Mars Global Surveyor (MGS)'s aerobraking mission phase are also included as embedded strips in the Viking MDIM texture maps. (A separate automated VRML atlas allows users to construct VRMLs on-the-fly for any region on Mars is also available.)

Marsoweb also features an archive of, as of this writing, over 460 high-resolution (up to 3 meters/pixel) Mars Orbiter Camera (MOC) images taken by the camera of the candidate landing sites, to aid in the landing site selection process. This MOC archive allows the images to be graphically perused via regional image maps. The webpage for each MOC image contains several download options, image subframes (for more selective viewing), a MOC wide-angle context image showing the footprint of the (narrow-angle) MOC image, and a Java-based image processing toolsuite. This tool includes histogram display and equalization, manual contrast/brightness-stretching, zooming, cropping, and edge detection.

Special products generated by members of the landing site selection community are also included on Marsoweb. For instance, high-resolution composite maps from JPL contain MOC images that have been "hand-placed" on top of elevation contour maps, made from Mars Orbiter Laser Altimeter (MOLA) data, and include the current landing ellipses of the prime landing site candidates. Marsoweb provides a value-added service that allows users to interactively link to the full-size MOC images directly from these maps.

Marsoweb and E/PO:

Today: Although Marsoweb was designed for use by professional planetary scientists, we have found that many of our users are from the general public. Usage (Figure 3) predictably spikes before Mars Landing Site workshops, but also reached even higher levels after a recent NASA press release and media coverage.

Tomorrow: Interface for HiRISE. The High Resolution Imaging Experiment team for the Mars 2005 Orbiter (HiRISE, PI Alfred McEwen) plans to cast a wide net to collect targeting suggestions. Members of the general public as well as the broad Mars science community will be able to submit suggestions of high resolution imaging targets. The web-based interface for target suggestion input (HiWeb) will be based upon Marsoweb. 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. Public input will be filtered by NASA Quest. Web events, on-line chats with science team members, other E/PO material, and on-line polling, all orchestrated by Quest, is expected to produce an interesting and diverse set of targets. Details about public and community targeting will be released closer to the launch date.

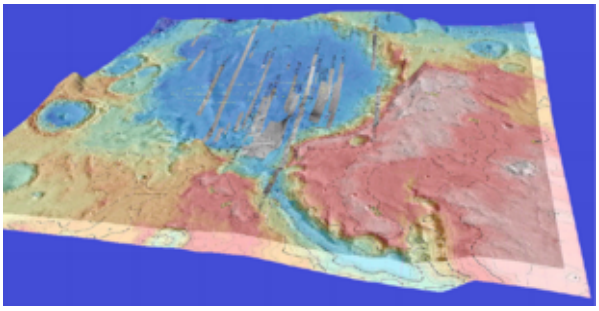

Figure 2. A 3D VRML of the Gusev Crater, one of the prime landing areas for MER 2003, using a MOLA contour map as a texture map. High-resolution MOC images are included and can be zoomed to.

Figure 3. Marsoweb usage statistics. Red bars show total number of requests handled by server to display number of web pages indicated in blue. Spikes in February 2001, August 2001, and February 2002 precede landing site workshops, reflecting use by Mars LSS community. The largest spike in August 2002 coincides with a NASA press release on the Marsoweb site, reflecting interest by general science community and others. From its inception in August 1999 through December 2002, Marsoweb has been viewed by 88,000 distinct users with a total of 3.3 million hits (801,000 page requests in all).