**AN ARCHIVE OF MGS/MOC IMAGING DATA .** M. A. Caplinger[1], E. Jensen[1], K. Edgett[1], E. M. Eliason[2], and P. A. Garcia[2], [1]Malin Space Science Systems, P.O. Box 910148, San Diego, CA 92191-0148, [2]United States Geological Survey, 2255 North Gemini Drive, Flagstaff, AZ 86001

**Introduction:** The Mars Orbiter Camera (MOC) Imaging Team for the Mars Global Surveyor (MGS) Mission has released an archive of digital image data for distribution to the science community. These data are being made available through Internet services and CD-ROM media by NASA's Planetary Data System (PDS) [1]. The archive, produced at Malin Space Science Systems (MSSS), contains raw MOC digital images for the wide-angle and narrow-angle camera systems, supporting ancillary data, an HTML-based image browser, and documentation for understanding the data collection. This initial archive distribution provides data from the orbital insertion phase of the mission during the period September 1997 through September 1998. Data from the first 551 orbits are included on this distribution. Future releases of MOC data following the start of the systematic mapping phase (in April 1999) will occur at approximately six-month intervals. More information on the complement of MGS instrument data and the release of data products can be found in [2,3]. Link to the MSSS web site for more information on the MOC instrument at: http://www.msss.com/. For information on obtaining the MOC data, contact the PDS Imaging Node [4] (eeliason@usgs.gov), or link to the Node's home page on the web: http://www-pdsimage.jpl.nasa.gov/PDS/.

**The Mars Observer Camera:** MOC is a three-component imaging system, one narrow-angle (NA) and two wide-angle (WA) cameras, designed to take high spatial resolution pictures of the surface and to obtain lower-resolution synoptic coverage of the surface and atmosphere [5,6]. The cameras employ "push broom" technology, acquiring one line of data at a time as the spacecraft passes over the Martian surface during its orbit about the planet. During the systematic mapping phase of the mission, the NA camera will have the ability to acquire imaging at 1.4 meters/pixel resolution in ground swaths of 2.8 kilometers crosstrack and up to 25.2 kilometers downtrack. Onboard pixel summing and editing of the images allows for greater downtrack areal coverage at reduced pixel resolution. The WA cameras are capable of viewing Mars from horizon to horizon at lower resolutions (230 meters/pixel) using narrow-band "red" (575-625 nm) and "blue" (400-450 nm) color filters

The pre-mapping MOC observations, incorporated in this initial archive collection, were taken while the MGS spacecraft was in its elliptical capture, aerobraking, and science “phasing” orbits (orbits 1-573). Imagery were acquired only a few minutes immediately after periapsis, when the spacecraft was either tracking the nadir or performing the so-called "rollout," a reorientation maneuver that returned it from the aerobraking drag phase orientation to an Earth-pointed attitude. Altitudes were at times lower than those expected in mapping, but high velocity of the spacecraft usually precluded clocking the line array fast enough to produce images with a 1:1 pixel aspect ratio. In this period, a wide variety of pixel summing modes and line integration times were used to meet image acquisition objectives. Global coverage with the WA cameras was not possible in this period; typically a small fraction of the MOC onboard data storage capacity was devoted to reduced-resolution WA images for regional monitoring, while the lion's share of the data storage was used for the NA imaging.

Narrow angle coverage includes locations from the north polar cap to the south polar cap, but--owing to the northward migration of the periapsis position during aerobraking and most of science phasing--there are fewer images in the middle and high southern latitudes. Cloud cover sometimes limited the quality of narrow angle data returned, particularly during the dust storm period in November-December 1997 and during mid-1998, when much of the lower elevations were under water-ice cloud cover. Cloud cover also limited the number of narrow angle observations of the northern lowland plains. In addition, four orbits in August-September 1998 were devoted to observation of the Martian satellite Phobos.

**Archive of MOC Imaging Data:** The MOC Decompressed Standard Data Product (DSDP) Archive, stored on CD-ROM media, contains decompressed raw images, ancillary data that describe the geometric and camera properties of the image observation, an HTML-based image browser and reduced resolution JPEG images for rapidly viewing the image collection, and supporting documentation.

The image data in the archive are raw--they contain the artifacts and inherent radiometric and geometric properties of uncorrected data. Processing on the data was limited to extracting image data from telemetry packets, decompressing the on-board compressed data (when appropriate), recovering image data dropouts (when possible) caused by bit errors in the telemetry stream, and organizing the data according to PDS standards. For most of the pre-mapping phase of the mission, data quality did not allow error-free transmission to Earth, causing higher than expected bit error rates. As a result, considerable data losses were incurred in

the image data. The majority of the processing for the pre-mapping data was done to minimize the effects of this data loss. These efforts are ongoing at MSSS, and additional data recovery corrections may appear on future volumes.

Ancillary data on the archive provide the necessary information for understanding the image observations. These data are found in an image index and in the PDS label that accompanies each image. The image index provides a record for each observation and is organized as an ASCII table for easy ingestion into a data base system or spread sheet application. The table includes information on the camera operating gain and offset modes, crosstrack and downtrack summing, focal plane temperature, line exposure duration, observational intent, and time of observation. Additionally, observational geometry information is provided for locating an image on the surface and describing the photometric characteristics (emission, phase, and incidence angles) of the observation.

The HTML-based image browser provides a convenient method for rapidly viewing the images contained on each archive volume as well as accessing the supporting documentation. The image browser is started by opening the *index.htm* file, located in the root directory of each CD-ROM volume, with a standard Web browser such as Netscape® Navigator or Microsoft Internet Explorer®. The image browser displays sub-sampled MOC images in a JPEG format along with pertinent information that describes the observation. A simple point-and-click method is used to view an image. Simply point the screen cursor to a marked position on a global map of Mars and click to view the MOC image that corresponds to the observation at that point.

MSSS delivers individual archive volumes on CD-WO media to the PDS for permanent archival. The PDS performs data validation to ensure data are complete and properly organized (problems discovered with the archive are either noted or corrected in a collaborative effort with MSSS). Following the validation step, the PDS replicates the volumes on CD-ROM media for distribution to the NASA science community. The archive is included in the on-line data access servers available through Internet services. Also, copies are provide to the National Space Science Data Center (NSSDC), who provide a data ordering service to the general public and international science community.

**Web Access to the MOC Data:** Users of MOC imaging have two options currently available for accessing the data via the World Wide Web. For simple downloading of large data volumes, "ftp" access is available by connecting your web browser to the PDS Imaging Node home page at http://www-pdsimage.jpl.nasa.gov/PDS and then linking to the "on-line CDs" resource.

Alternatively, a web interface provides the capability for locating and viewing images in the archive before downloading the data. Connect to the PDS Imaging Node home page and then link to the "Planetary Image Atlas" resource. Data can be located by clicking on a global map of Mars resulting in a list of all images that are contained in a 30-degree square area of the planet. When an image is located, the user can download the raw image or, for NA image data, a cosmetically corrected image with an aspect ratio correction. Also, for NA imaging, context images created from Viking imagery can be viewed and downloaded.

**Processing Capabilities for MOC Imaging:** ISIS (Integrated Software for Imagers and Spectrometers) [7] provides to the science community an image analysis and cartographic processing package for the systematic reduction of planetary image data acquired by NASA flight projects. Currently, ISIS is being enhanced to further support processing of MOC imaging. When completed in the summer of 1999, ISIS will have the ability to create MOC images that are radiometrically corrected, photometrically normalized, and geometrically reprojected to standard map projections.

ISIS, developed by the USGS Astrogeology Program, runs on a variety of Unix-based platforms including PC-based Linux, Sun (SOLARIS), DEC Alpha (DEC UNIX), and Silicon Graphics. Investigators interested in obtaining more information about the freely-distributed ISIS system can link to the World Wide Web site at: (http://wwwflag.wr.usgs.gov/isis-bin/isis.cgi).

**References:** [1] McMahon, S., (1996), Overview of the Planetary Data System, *Planet. Space Sci*., 44, 1, 3-12. . [2] Albee, A.L., et. al., Mars Global Surveyor Mission: Overview and Status, (1998), *Science*, 279, 1671-1672. [3] Arvidson, et., al., Archiving and Release of Data from Mars Surveyor Program Missions, (1999), this volume. [4] Eliason, E.M., et. al., (1996), The Imaging Node for the Planetary Data System, *Planet. Space Sci*., 44, 1, 331-332 [5] Malin, M.C., et. al., (1998), Early Views of the Martian Surface from Mars Orbiter Camera of Mars Global Surveyor, *Science*, 279, 1681-1685. [6] Malin, M.C., et. al., (1992), Mars Observer Camera, *J. Geophys. Res*., E5, 7699-7718. [7] Torson, J.M., et. al., (1997), ISIS - A Software Architecture for Processing Planetary Images, LPS XXVIII, 1143-1444.