MAP PROJECTION WEB SERVICE FOR PDS IMAGES. T.M. Hare, S.W. Akins, R.M. Sucharski, M.S. Bailen, and J.A. Anderson. U. S. Geological Survey, Astrogeology Science Center, 2255 N. Gemini Drive, Flagstaff, AZ, 86001 (thare@usgs.gov).

Introduction: The USGS Astrogeology Science Center has developed an on-line tool, called the Map Projection Web Service (POW) which transforms a raw Planetary Data System (PDS) image to a science-ready map projected image. POW will employ existing PDS tools to find and then allow the user to select and submit individual images to be processed on our compute cluster using Astrogeology's image processing package Integrated Software for Imagers and Spectrometers (version 3, ISIS3) [1, 2].

PDS archives are typically stored in their "raw" or Engineering Data Record (EDR) format. Before they are truly useful for analysis, these images, at a minimum, should be radiometrically calibrated and map projected (Figure 1) [3]. While some instrument teams provide science-ready versions of their data, many other archives must first be processed by the individual researcher. POW will provide users with calibrated cartographic images that can be used for geologic mapping, analysis in a Geographic Image System (GIS), change detection, merging of dissimilar instrument images, and use in a host of other scientific applications (e.g., ArcMAP, ENVI, Matlab, JMARS, etc.).

Successful services like this have previously been made available to the planetary community. For example, the THMPROC service hosted by Mars Space Flight Facility at Arizona State University can process THEMIS images using ISIS2 (and other software components) [4]. We are providing a similar service for many data sets in the PDS, with the addition of further transparency and user-defined function integration.

Background: While ISIS3 is free to the community, it can be a difficult package to learn. Currently, ISIS3 must be installed on a UNIX platform (e.g., Linux or MacOSX) and requires the user to be familiar with UNIX operating system commands. Also for each supported instrument, the user must learn to not only run the appropriate ISIS3 command but then to evaluate the results. POW will allow researchers to make use of a wealth of PDS science data without having to install or learn how to run ISIS3 and benefit from a recommended processing pipeline as defined by USGS and the various instrument teams. This service can also be used as a learning tool or introduction to ISIS3 because the commands will be documented and delivered to the user.

ISIS3's primary function is to provide planetary scientists and their technical support personnel with the ability to process PDS images through radiometric calibration, systematic noise removal, and cartographic map projection. It is widely used throughout the planetary community to process images from a variety of instruments. Examples of supported instruments are as follows:

- Apollo 15/16/17 Metric Camera
- Cassini Imaging Science Subsystem (ISS) and Visible and Infrared Mapping Spectrometer (VIMS)
- Clementine Near Infrared (NIR), Ultraviolet and Visible (UVVIS), High Resolution (HIRES), and Long Wave Infrared (LWIR)
- Galileo Solid State Imaging (SSI)
- Lunar Orbiter 3, 4, and 5 medium and high-resolution cameras
- Lunar Reconnaissance Orbiter Wide Angle Camera (WAC), Narrow Angle Camera (NAC), and Mini-RF
- Mariner 10 vidicon cameras
- Mars Express High Resolution Stereo Camera
- Mars Global Surveyor WAC and NAC
- Mars Reconnaissance Orbiter High Resolution Imaging Science Experiment (HiRISE), Context Camera (CTX)
- Messenger Mercury Dual Imaging System (WAC and NAC)
- Mars Odyssey Thermal Emission Imaging System (THEMIS) IR
- Viking Orbiter 1 & 2 vidicon cameras
- Voyager I & II Imaging Science Subsystem (ISS) vidicon cameras

While not every instrument in the list will be provided at the initial release of POW, we will strive to include all instruments currently supported by ISIS3.

Implementation: Using the web-based POW front end, a user will be able to 1) submit a list of PDS EDR images, 2) define an output map projection (e.g., Polar Stereographic, Sinusoidal), 3) pick a set of geometric backplanes to be computed (e.g. Longitude, Latitude, Phase and Emission Angle, etc.), 4) define the output bit type (e.g. 8, 16, or 32 bit), and 5) select an ISIS cube output or a more standardized geospatial format such as GeoTiff, GeoJPEG2000, PNG, or a standard JPEG image [3]. Currently, the recommended instrument-specific suite of noise removal and radiometric calibration algorithms will be chosen for the user but future versions will allow the user to define their own. Conversion to the various supported image formats will be completed using the Geospatial Data Abstraction Library (GDAL) which maintains all cartographic information into the output format [5].

POW jobs will be processed on Astrogeology's ~100 CPU compute cluster. While the cluster will be shared with other PDS tasks, POW will be given priority access to a subset of nodes but it can also make use of other available CPUs in the cluster when they are idle. Upon completion, the user will be notified via email that their processed images and ISIS3 processing log are available for download. Until we fully understand the load, we will limit each POW submission to about 20 images, although the user can submit multiple runs. This will also facilitate minimizing the download size of the processed images which are zipped into a single file.

PILOT and PDS Archive Integration: The Planetary Image Locator Tool (PILOT) is a web-based interface that provides a robust search interface for many PDS image archives [6]. PILOT's interface will be the main method to find and select images for processing in POW. Since POW currently limits the user to about 20 to 50 images per run, PILOT can be used to segment many images into multiple submissions. Also PDS websites at the USGS, which list individual images, will be modified to include a direct connection to the POW submission interface.

Conclusion: The core infrastructure for POW has been finished and will be externally tested before public release in March 2013. Many terabytes of PDS data will be available for processing into science-ready products for planetary researchers. Over the next couple of years, POW capabilities will continue to grow and be improved. Additions like user defined calibration routines, filtering and equalization, images automatically registered to controlled base maps, and eventually image mosaic capabilities will be proposed.

Acknowledgments: This project is supported by NASA's PG&G Cartography Program. POW website can be found on the Astrogeology page: http://astrocloud.wr.usgs.gov

References: [1] Keszthelyi, L., 2013, this volume. [2] Sides, S.C., 2013, this volume. [3] Hare, T.M., (2010), LPS XLI, abs. #2728. [4] http://themis.asu.edu/thmproc, [5] Hare, T.M., et al., 2007, Advanced Uses of Open Geospatial Web Technologies for Planetary Data, LPSC XXXVIII, abs #2364. [6] Bailen, M.S. et al., 2013, this volume.

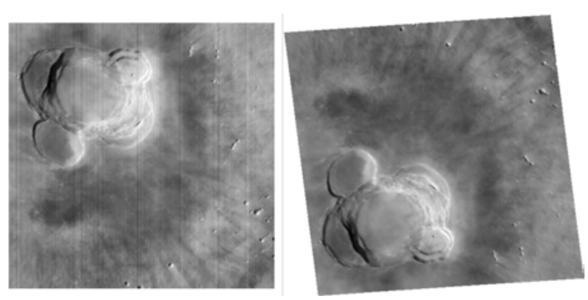

Figure 1. Viking image of the Olympus Mons caldera on Mars. The image on the left shows the raw PDS EDR and the image on the right shows the calibrated and map projected (orthorectified) science-ready image.