

**THE ASTROGEOLOGY MAPPING, REMOTE-SENSING, CARTOGRAPHY, TECHNOLOGY, AND RESEARCH (MRCTR) GIS LAB.** T.M. Hare, J.A. Skinner, Jr., C.M. Fortezzo, K.L. Tanaka, and R.A. Nava. U.S. Geological Survey, Astrogeology Science Center, 2255 N. Gemini Dr., Flagstaff, AZ, 86001. (thare@usgs.gov).

**Introduction:** This year we have formalized the MRCTR, as in “Mercator”, Geographic Information System (GIS) Laboratory, a concept we have initiated as a means to support GIS mapping and to help develop mapping tools. We will focus on creating a physical and technical foundation for the GIS Lab prior to the breakup and eventual retirement of Planetary Interactive GIS on-the-Web Analyzable Database (PIGWAD, <http://webgis.wr.usgs.gov>) by the end of 2012. We will also invest in an official GIS guest facility as a functional part of the MRCTR GIS Lab. While many scientists have taken advantage of on-site and on-line services offered through PIGWAD, we are witnessing increased demand for many facets of the GIS services offered therein, including both introductory and specialized technical training, tutorials, and workshops. We expect the demand for these resources to increase with the community’s focus on the need for data fusion, NASA’s acquisition of an ESRI ArcGIS site license for each of its research centers, and the functional advances that have been made in open-source GIS packages [1].

Another immediate and critical foundation of the Astrogeology MRCTR GIS Lab will be its availability to assist planetary geologic mappers in finalizing projects prior to publication submission. This will directly support and maintain NASA’s geologic requirement for “GIS-only” map submission and review, promote consistency in published products, and support a more timely submission and review process [2, 3].

**Background:** NASA’s Planetary Geology and Geophysics (PG&G) Cartography Program has funded PIGWAD for the past 10 years. Historically, PIGWAD has primarily served a dual function in the community: 1) data dissemination and storage, and 2) GIS analytical tool development and technical training. As we take the steps to retire PIGWAD, we have the opportunity to partition the “data dissemination” and “development/training” core tasks. The data clearing-house components of PIGWAD will be managed as part of Astrogeology’s new data portal called *Astropedia* [4]. It provides a natural point-source for users to archive, explore, and download planetary data. The *Astropedia* holdings (and eventually all relocated PIGWAD holdings) will be searchable from Astrogeology’s website (<http://astrogeology.usgs.gov>). The second core task, data development and technical

training components of PIGWAD, will be transitioned to the MRCTR GIS project and guest facility.

**Physical Lab and Guest Facility:** The establishment of a GIS guest facility will provide planetary researchers and students a location within which to work on planetary GIS projects with direct help from USGS staff. Following the model of the Photogrammetry Guest Facility, the Astrogeology MRCTR GIS Lab will be open for training, mapping, and analysis to outside users at least 50% of the year [5]. Researchers will be able to bring planetary projects to the Lab for help with data integration (beyond the bundled GIS packages currently distributed by the PIGWAD project), mapping technologies (software and hardware), and map-based topical analyses. We will populate the Lab with planetary-specific GIS tutorials and self-guided workbooks, and will assure the availability of staff scientists and GIS analysts for questions, issues, and advice.

Initially the Lab will be outfitted with at least two GIS workstations each equipped with one large monitor and one pen-driven draw screen. The Lab will also house a large format plotter/scanner.

**Training and Learning Modules:** The MRCTR GIS Lab will provide GIS training to help users understand its’ potential for mapping, database management, and spatial analysis. The training will provide beginners with an introduction into GIS and for the advanced users with the tools and resources to understand advanced analytical capabilities, implement proper database design, and work with huge image sets within a GIS environment.

Existing planetary GIS tutorials written by USGS staff (<http://webgis.wr.usgs.gov/pigwad/tutorials>) will be modernized and partitioned into new “learning modules”. We recognize that these types of materials exist for terrestrial applications, but there are no documents explicitly detailing efforts common in the planetary community. We will use existing literature, our collective experience, and our GIS support boards as guides to develop the curriculum. Another variation from the terrestrial literature will be our use of planetary data examples using Mars, Moon, Mercury, Venus, etc., and datasets in scenarios that are community specific (e.g., thematic and geologic mapping, crater statistics, global spatial analyses, volume estimates, etc.). Each of the modules will be made available as on-line Adobe PDF documents and

available in hardcopy format for use in the MRCTR GIS Lab. We will produce four planetary-themed manuals over the next year:

- GIS: Planetary Fundamentals
- GIS: Tools and Functionality
- GIS: Advanced Topics (community-driven)
- GIS: Ingesting Planetary Datasets (ISIS/PDS/VICAR/Other)

The first two modules will be updated as methods evolve, whereas the advanced topics and data ingestion manuals are living documents and will require annual updates to keep them current. Lastly, our final goal for the manuals is to attempt to make them practical in a university classroom setting.

Starting in 2013, the MRCTR GIS will provide yearly hands-on GIS workshops for larger groups (including the potential for on-line workshops). While not as intimate a setting as the guest facility, we can reach several researchers at once. The previously PIGWAD-hosted workshops have been very beneficial for researchers and students alike. The classroom setting also allows the researchers to discuss their own widely varying topics and approaches.

**Standards:** Digital mapping standards have been an important aspect of PIGWAD that will be continued with the MRCTR project. All of these standards require collaboration with many facilities across the planetary community. These mapping standards include file formats (e.g. GeoTiff, GeoJpeg2000, GML) [6], digital geologic database conventions [7], planetary extensions for Federal Geographic Data Committee cartographic symbols [8] and geospatial metadata [9], and on-line mapping services as defined by the Open Geospatial Consortium (e.g. WMS, WFS, WCS) [10].

**Conclusion:** The creation of the Astrogeology MRCTR GIS Lab, which includes the establishment of comprehensive training materials and a formal training destination for scientists, is timely and fills a large need within the planetary community. The forthcoming learning modules will provide a method for our staff to reach a wide range of researchers with both basic instruction and consistent GIS workflow models whether they attend a workshop, visit the MRCTR GIS Lab facilities, or want to learn at their own pace. Because of the increasing need for the ability of data fusion that GIS software provides and the increasingly easier access to robust GIS packages, these types of materials will benefit not only the planetary geologic mapping community, but also any planetary researcher wishing to utilize multiple geospatial data sets.

**Additional Information:** This project is supported by NASA's PG&G Cartography Program. If you would like to schedule a Lab visit, participate in a future GIS workshop or have questions, please email the author. MRCTR website:

<http://astrogeology.usgs.gov/research/MRCTR-GIS-Lab>

**References:** [1] Frigeri, A., et al., (2011), A Working Environment for Digital Planetary Data Processing and Mapping using ISIS and GRASS GIS, *Planetary and Space Science* 59, p. 1265–1272. [2] Hare, T.M., et al., (2009), GIS-based Planetary Geologic Maps: Recommendations for Improved Preparation, Review, and Publication LPS XL, abs. #2538. [3] Tanaka, K.L., J.A. Skinner, Jr., and T.M. Hare, (2010). Planetary Geologic Mapping Handbook – 2009, NASA Conf. Pub. CP-2010-216680, p. 21. [4] Bailen, M., (2012), Astropedia – a Data Portal for the USGS Astrogeology Science Center, this volume. [5] Kirk, R.L. et al., (2009), Build Your Own Topographic Model: A Photogrammetry Guest Facility for Planetary Researchers, LPS XL, abs. #1414. [6] Hare, T.M., (2010), A Case for a PPS Supported Cartographic Raster Library, LPS XLI, abs. #2728. [7] van Gasselt, S., A. Nass, (2011), Planetary Map Data Model for Geologic Mapping, Cartography and Geographic Information Science, HighBeam Research. [8] Nass, A., et al., Implementation of Cartographic Symbols for Planetary Mapping in Geographic Information Systems. *Planet. Space Sci.* (2010), doi:10.1016/j.pss.2010.08.022. [9] Hare, T.M., (2011a), Standards-based Collation Tools For Geospatial Metadata in Support of the Planetary Domain (thesis), Northern Arizona Univ., in press. [10] Hare, T.M., et al., (2011b), Planetary OGC Interoperability Experiment, LPS XLI, abs. #2638.

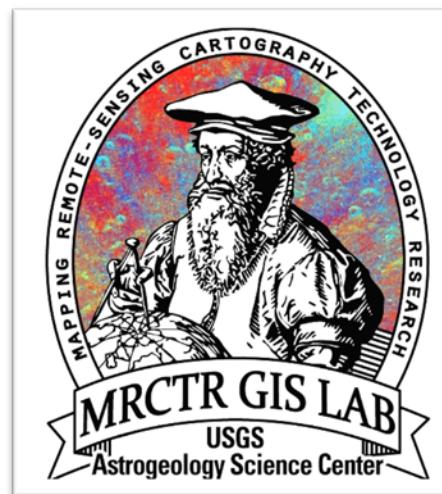


Figure 1. Astrogeology MRCTR Lab logo showing Gerardus Mercator.