

ASTROPEDIA – A DATA PORTAL FOR PLANETARY SCIENCE. M.S. Bailen, T.M. Hare, S.W. Akins and C. Isbell. U. S. Geological Survey, Astrogeology Science Center, 2255 N. Gemini Dr., Flagstaff, AZ, 86001 (mbailen@usgs.gov).

Introduction: The USGS Astrogeology Science Center has been generating cartographic products using data from planetary missions for several decades. While many of these products are available from an official Planetary Data System (PDS) archive, many other data sets have not fit appropriately into a PDS archive due to data format, category, or update frequency. Some examples include: 1) the planetary nomenclature database which is often updated weekly, 2) merged products that describe things like future rover landing sites or collaborative multi-agency scientific efforts which can be difficult to categorize, and 3) Geographic Information System (GIS) products which apply formats that are not supported by the PDS. Therefore, to make it easier for the planetary community to locate the wealth of available cartographic data housed at the USGS, we have implemented a cartographic repository (or data portal) to allow easy ingestion, presentation, and delivery of our products in a consistent, efficient, and user-friendly manner.

Data Portal: Astropedia will provide a one-stop-shop, web-accessible data portal that can be searched using multiple methods including: target information, geospatial coordinates, mission or instrument keywords, author and organization, as well as additional descriptive information available from the metadata. The USGS Astropedia data portal has several goals:

- Quick access to current and featured data
- Robust searching
- Data downloads in various formats
- Viewable metadata
- Interaction through web map services
- Cross-links to ancillary and relevant data

To optimize the search capabilities, Astropedia will heavily use the information detailed in the data's metadata to catalog and index the documentation. The metadata standard we have based our data documentation on was created by the Federal Geographic Data Committee (FGDC)

with some small extensions to better support the planetary domain [1, 2].

Metadata: FGDC geospatial metadata is defined as ancillary documentation that helps describe the rationale, authorship, attribute descriptions, spatial reference, errors and other pertinent information about a data set. Metadata are commonly referred to as “data about data”.

For Astropedia to be successful, the ingested data products must be well documented. It is not unusual for researchers to make use of data found on-line without a full understanding of accuracy or intent – simply because this information is not made available. Once a planetary data set is released in a derived map-projected form, there is no longer any reason to consider it a highly specialized product requiring specialized documentation or software. Thus, the same FGDC metadata standard which is widely used to support Earth-based data can be used for these planetary products [2]. When this standard is applied correctly, users will have a significantly clearer understanding of the data set and allow them to more confidently use it for their research.

Existing Infrastructure: Astropedia has embraced support for the Open Geospatial Consortium (OGC) web services including Web Mapping Service (WMS), Web Feature Service (WFS), and the Google Keyhole Markup Language (KML) [3,4]. Services built using OGC technologies allow users to stream geospatial raster and vector data sets across the Internet to mapping applications or simple web browsers.

In building the web-based visualization capabilities for Astropedia, the USGS is relying on their existing on-line mapping infrastructure. This infrastructure is built in JavaScript and customized to access live WMS mapping resources running the open-source software product, Mapserver [5]. The combination of these two resources provides the ability to display maps, zoom to specific lat/lon locations on a planetary body, plot various vector geometries,

and add labels. Currently Astropedia provides image-based and some geologic maps for Mercury, Venus, Earth, Moon, Mars, Phobos, Demos, Jupiter, Europa, Ganymede, Io, Saturn, Titan, and more. Web sites such as the Gazetteer of Planetary Nomenclature [6] and the Planetary Image Location Tool [7] already use this service.

It is worth noting that these resources will not only provide a benefit for USGS, but they will allow any web designer to access these live planetary maps from Astropedia and serve them on their own web pages [3]. Also as the USGS continues to update the holdings of Astropedia new and better products will become available for the community to use.

Approach: Astropedia is built entirely on an open-source infrastructure that includes the PostgreSQL database with the PostGIS add-ons [8] to support geographic objects, Alfresco Document Management System (DMS) as a data repository [9], Openlayers for web-based interactive mapping [10], and as stated above, Mapserver as a WMS to serve the planetary base maps. A web-based search form was designed to enable quick access to Astropedia holdings from the main USGS Astrogeology Science Center website (<http://astrogeology.usgs.gov>). The interface provides a typical keyword-based search form and an interactive mapping tool that allows selection of planetary targets upon which the user can specify a geographic bounding box and seek location-based search results. The map allows Simple Cylindrical, North, and South Polar Stereographic projections. Users can restrict searches based on instrument or data type (e.g. image mosaic, topography, geology), mission dates, data types, and more. Specially formatted search result pages are being built to restrict data based on such things as historical holdings, geologic products, and level of public interest.

Future: The core infrastructure for Astropedia has been established and many of the more prominent products have been loaded into the repository. Now, a more thorough round of ingestion is required. Many terabytes of

cartographic products built over the years by various members of the Astrogeology Science Center are standing in the queue, awaiting a proper accumulation of metadata and data ingestion. Over the next couple of years, the holdings of Astropedia will steadily grow and the searchability will improve. In addition, new features are being proposed that include special repositories for software and tutorials, mission-specific password-protected areas, and the ability to include non-USGS products.

References: [1] see <http://www.fgdc.gov/> [2] Hare, T.M., et al., 2011, FGDC Geospatial Metadata for the Planetary Domain, LPSC 42, Abs #2154. [3] Hare, T.M., et al., 2007, Advanced Uses of Open Geospatial Web Technologies for Planetary Data, LPSC 38, abs #2364. [4] see <http://www.opengeospatial.org/> [5] see <http://www.mapserver.org> [6] see <http://planetarynames.wr.usgs.gov> [7] see <http://pilot.wr.usgs.gov> [8] see <http://postgis.refrations.net/> [9] see <http://www.alfresco.com/> [10] see <http://openlayers.org/>



Figure 1. The Astropedia logo and initial login page.