

**PDS ANNEX: A PDS IMAGING NODE REPOSITORY FOR GEOSPATIAL PLANETARY RESEARCH PRODUCTS.** T.M. Hare<sup>1</sup>, L.R. Gaddis<sup>1</sup>, M. Bailen<sup>1</sup>, S.K. LaVoie<sup>2</sup>, J. Padams<sup>2</sup>. <sup>1</sup>USGS Astrogeology Science Center, Flagstaff, AZ 86001, <sup>2</sup>Jet Propulsion Laboratory, Pasadena, CA. thare@usgs.gov.

**Introduction:** The Imaging Node (IMG) of the NASA Planetary Data System (PDS) archives and delivers digital image collections from planetary missions [e.g., 1]. Included among these collections are nearly 700 TB of digital image archives, ancillary data (calibration files and software, geometric data, etc.), software, tutorials and tools, and technical expertise to support users of this collection. The PDS Imaging Node Annex, or simply *The Annex*, is a new online facility to support scientists who use PDS image data to create derived geospatial products registered to a solid planetary body (*Figure 1*). Examples of derived products are cartographic and thematic maps of moons and planets, local and regional geologic feature maps, topographic and perspective views of planetary landing sites, and tabular data containing unit information derived from planetary data. Many of these products have been developed as a result of NASA data analysis programs, often years after active missions (and their accumulating archives) have ended.

**Architecture:** The Annex service is built on an online catalogue infrastructure at the USGS Astrogeology Science Center called Astropedia [2]. Astropedia was created to provide a method to catalogue and readily serve the decades of images, mosaics and other derived data products created by Astrogeology scientists and cartographers. Detailed metadata, including documentation, links to source data, and publications are included for each product served. Many of these products have been derived from PDS data collections and are in the form of cartographic maps, global digital image mosaics [3, 4], and Geographic Information System (GIS) projects and layers [5].

**Goals:** The Annex will provide (1) support resources for the planetary community to archive PDS-derived products and (2) fast, on-demand access to derived data products via a robust search interface. Each delivered product includes a minimum set of metadata that cross-references publications, ancillary data and other related products. Products in The Annex can be searched using multiple methods including target information, mission or instrument keywords, author(s) and organization, as well as descriptive information available from the metadata.

The Annex uses the metadata standard created and maintained by the U.S. Federal Geographic Data Committee (FGDC); modified slightly to support planetary data [6, 7]. The FGDC standards, combined with existing PDS3 standards [8], are utilized to develop updated image and file labels for next generation archive, PDS 4 products [9, 10]. Planetary data products such as published USGS maps and Lunar Mapping and Modeling Project (LMMP) results are already required to have associated FGDC records [11].

FGDC geospatial metadata, is documentation that describes the rationale, authorship, attribute descriptions, spatial reference, errors and other relevant information about a given set of data. The Annex, by using this metadata standard also allows us to support this service as a proper Open Geospatial Consortium (OGC) Catalogue Services for the Web (CSW). Methods defined by the OGC CSW standard will facilitate such outside access, so that users need not build new search tools or application layer interfaces (APIs, [12]). Also the CSW API doesn't impede existing methods already supported by the community

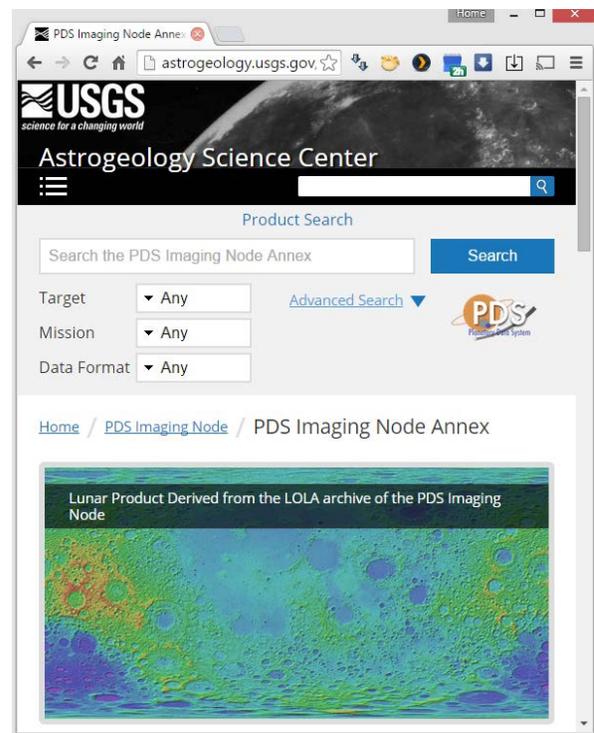
(e.g., RESTful web services provided by the PDS Geoscience Node [13]) and is in use by many other nationally supported data portals e.g., Data.gov (<http://data.gov>).

**Annex Requirements:** The Annex accepts submission of geospatial products for archival that have a PDS planetary data heritage. Submitted products must have extensive metadata that meets PDS standards and using the joint PDS and FGDC planetary metadata standards. Data submissions and metadata development are initiated through a forms-based Web site that guides users through the process and specifies required data entries (see <http://astrogeology.usgs.gov/pds/annex>). Examples of required metadata are originator name and contact information, geographic coordinates, target body, descriptive caption, publication date, lineage and source information, validation and review status, quality and completeness assessments, linkages to other products, and literature citations. The information entered is converted to xml format for ingestion and retrieval through The Annex data catalog. These detailed metadata can readily be viewed for any product and serve to facilitate easy access through the existing Astropedia search interface.

Geospatial products submitted to The Annex are required to be validated and reviewed prior to publication. Products that have already been published in professional science journals will be considered peer-reviewed but PDS review is still required. Other products will require documentation of peer review by at least three researchers; IMG staff will assist with these reviews as needed. All data will be validated by PDS staff prior to public release in The Annex.

**References:** [1] Gaddis, L. et al., 2013, LPSC XLIV, abs. #2262; [2] Bailen, M. et al, 2012, LPSC XLIII, abs. #2478. [3] Eliason, E. et al., Mission to the Moon: The Clementine UVIS Global Lunar Mosaic, 1999, PDS Volumes USA\_NASA\_PDS\_CL\_4001 through 4078,

Produced by USGS and distributed by PDS. [4] Gaddis, L.R. et al., 2007, The Clementine NIR Global Lunar Mosaic, PDS Volumes USA\_NASA\_PDS\_CL\_5001 through 5078, produced by USGS and distributed by PDS. [5] Becker, T. et al., 2009, LPSC XXIX, abs. #2357. [6] Federal Geographic Data Committee, 2011, Preparing for International Metadata, Federal Geographic Data Committee, Washington, D.C., URL: <http://www.fgdc.gov/>. [7] Hare, T.M. et al., 2011, LPSC XXIX, abs. #2154. [8] PDS Standards Reference, v. 3.8, JPL D-7669, Part 2, URL: <http://pds.nasa.gov/tools/standards-reference.shtml>. [9] Crichton, D. et al., 2011, EPSC Abstracts, 6, abs. #1733. [10] Hughes, J.S. et al., 2009, LPSC XL, abs. #1139. [11] Law, E. et al., LPSC XLIV, abs. #1307. [12] Hare, T.M. et al., 2015, LPSC XLVI, abs. #2476. [13] Bennett, K.J. et al., 2014, LPSC XLV, abs. #1026.



**Figure 1.** The Annex main interface showing the derived color shaded-relief for the PDS archived Lunar Orbiter Laser Altimeter (LOLA) digital elevation model from NASA's Lunar Reconnaissance Orbiter spacecraft.