A NEW PLANETARY DATA SYSTEM ROADMAP FOR THE NEXT DECADE 2017-2026. R. L. McNutt, Jr[1], T. H. Morgan[2], [1]Johns Hopkins Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD, ralph.mcnutt@jhuapl.edu [2]Goddard Space Flight Center, Greenbelt, MD, thomas.h.morgan@nasa.gov.

Introduction: NASA established the Planetary Data System (PDS) in 1989 to deal with concerns that the data being returned by scientific satellites was in danger of being lost. Problems included data storage media, adequacy of documentation, lack of availability outside of the implementating science team, and the lack of any long-term archiving of the data in a consistent manner. The National Academy of Sciences had chartered the Committee on Data Management and Computation (CODMAC) in 1982 [1]. Over the next six years, CODMAC issued three reports detailing means to address what were identified as serious problems in the way that NASA was managing its planetary data holdings [2,3,4]. Central amongst the recommendations were to have a scientifically guided distributed data system, adequately funded both to archive data and distribute it to researchers in a timly fashion. On the basis of peer-reviewed proposals, discipline oriented nodes were selected to form the core of the PDS. These included [5]: Geosciences [6], Atmospheres, Small Bodies (asteroids and comets) [7], Planetary Plasma Interactions [8], Rings [9], Imaging (focused on archiving large raw and derived imaging data sets and the ability to generated derived data) [10], Navigation and Ancillary Information Facility (NAIF) [11], and a Central Node for management.

The structure of the PDS has remained remarkably resilient through growth in the archive holdings and number of missions included over the past 27 years. At the same time, technological changes in storage media and storage density and accessability of digital data have made tremendous sides, changes to which the PDS continues actively to adapt.

Background

The Planetary Data System (PDS) archives electronic data products from NASA planetary missions, sponsored by NASA's Science Mission Directorate. It actively manages the archive to maximize its usefulness, and the PDS has become a basic resource for scientists around the world.

All PDS-curated products are peer-reviewed, well documented, and available online to scientists and to the public without charge. Online search capabilities are also provided. The PDS uses standards for describing and storing data that are designed to enable future scientists who are unfamiliar with the original experiments to analyze the data and to do this using a variety of computer platforms, with no additional support. These standards address the data structure, description contents, media design, and a set of terms.

Though the PDS does not fund the production of archive data from active missions, it works closely with project teams to help them design well-engineered products that can be released quickly.

PDS Science nodes are now working closely with the community to provide higher order data products (and new archive materials) by supporting investigators in NASA's Planetary Data Archiving, Restoration, and Tools Program (PDART).

While PDS-curated products are freely available online, the PDS provides teams of scientists to help users select and understand the data. It also offers special processing for products tailored to the needs of individual users.

Current Structure of the PDS: The PDS continues to be organized as a federated data system; data are archived by scientist-led organizations, called Discipline Nodes, which present a single interface to the world (http://pds.nasa.gov). The organization of the PDS is shown below in Figure 1. Additional functional groups provide engineering and user interface design services.

The current Discipline Nodes are organized around broad areas—based on scientific discipline, as originally urged by CODMAC, by target body type, and by sensing modality. These broad areas reflect NASA's mission and the Agency's strategic plan for planetary science:

- Atmospheres (composition, structure, meteorology, and aeronomy) of planets;
- Geosciences (geology, geophysics, surface properties, and tectonics) of planets;
- Small bodies (comets, asteroids, dwarf planets, and also dust);
- Planetary Plasma Interactions (PPI) (solar wind-planetary interactions, magnetospheres, ionospheres, plasma tori) of planets;
- Ring Moon Systems; and,
- Cartography and Imaging Science (pushbroom imagers, hyperspectral imagers, analysis tools) of solar system objects.

In addition, the PDS has two technical Support Nodes:

- The Engineering Node (systems engineering support, standards (data, software, documentation,

operating procedures), technology investigations, coordination and development of system-wide software, PDS catalog development and implementation, and maintenance), and

• NASA's Navigation and Ancillary Information Facility (SPICE, the observation geometry information system named "SPICE" widely by both NASA mission scientists and engineers).

In addition, there is a Project Office, which manages funding and budgets, and establishes common policies across the PDS.

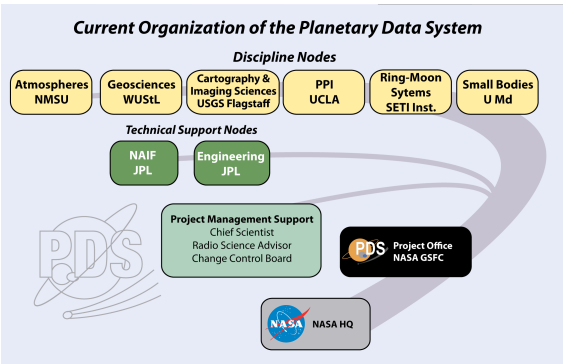

Figure 1. Current organization of the PDS

Developments of the last year. During the previous year, NASA has recompeted and reviewed all node activities.

A competition of all Science Nodes took place through the means of a Cooperative Agreement Notice (CAN) NNH15ZDA006C. This activity was completed in September of 2016, and all of the selected Science Nodes are now funded for 5 years with an option for an additional 5 years. The CAN process provides a difference governance model for PDS, similar to the "Institute Model" used elsewhere in NASA.

Performance Reviews were completed of the two internal nodes not competed through the PDS CAN, the Engineering Node and the Navigation and Ancillary Data Facility, scheduled for completion in early February and discussed here.

Against this backdrop, a Planetary Data System Roadmap activity was established to look ahed to the 2017 – 2026 time period. This activity began on October 2015 with the release of an Request for Information (RFI) asking for community input.

A Roadmap Study Team (RST) consisting of sixteen individuals of differing backgrounds and interactions with the PDS to consider what steps the PDS should take during the next decade to progress. Initial examination began with the items in the RFI, namely, an examination of:

1. Tools, resources, workflows, tutorials, and interfaces
2. Making the archiving process seamless, less costly, and more efficient
3. The role of PDS relative to other archiving alternatives (e.g., journals), in providing the public access to NASA-generated data
4. Integration of PDS data products and services with those of other facilities, e.g., the U.S. Geological Survey's cartography program and the Minor Planets Center, and other products
5. The role the PDS should play in encouraging the development of higher-order data products
6. Appropriate improvements to the current search capabilities of the PDS

The RST has also examined the Roadmap of 2006 and interacted with the nodes on that doecument, obtaining self-assessemetns of progress against those plans during the previous decades.

Good progress is being made on the Roadmap document, and the delivery date of a completed document to NASA is currently planned for the April 2017 timeframe.

Details on the RST membership and affiliations, related activities, and reference documents can be found at https://pds.nasa.gov/roadmap/index.shtml.

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