THE PLANETARY SCIENCE SUBCOMMITTEE OF THE NASA ADVISORY COUNCIL

The Status of the PDS

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Dan Crichton, Manager
PDS Engineering Node

Topics to be Discussed

- PDS Mission, Vision and Structure
- PDS Level 1 Requirements
- PDS Functions and Relationship to Missions
- PDS Challenges
- What PDS is doing to address those challenges
  - Mission Interface
  - User Access
- Modernization Efforts in PDS
- Data Provider Challenges
- What is PDS not doing/not providing
- How PDS is engaging/getting requirements from the broader scientific community
- Recommendations

PDS Mission and Vision Statement

- Mission: The mission of the Planetary Data System is to facilitate achievement of NASA's planetary science goals by efficiently collecting, archiving, and making accessible digital data produced by or relevant to NASA's planetary missions, research programs, and data analysis programs

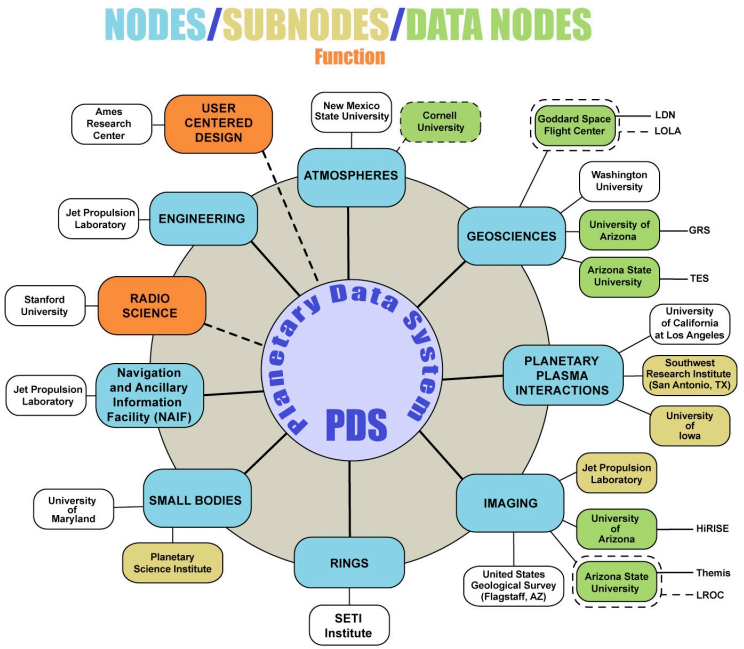
- Vision:
  - To gather and preserve the data obtained from exploration of the Solar System by the U.S. and other nations
  - To facilitate new and exciting discoveries by providing access to and ensuring usability of those data to the worldwide community
  - To inspire the public through availability and distribution of the body of knowledge reflected in the PDS data collection

- PDS is a federation of heterogeneous nodes including discipline and service nodes

Credit: PDS Roadmap 2006 - 2015.

PDS Structure

- PDS is composed of service and discipline nodes
- Program Executive – Bill Knopf
- Program Scientist – Michael Kelley
- Program Manager – Ed Grayzeck/ Goddard – in 2005 NASA separated the Central node into a management office and an Engineering node (JPL).



Internally the Management Council –representing each node deals with PDS issues and planned revisions – has monthly telecons and 3 annual meetings –chaired by Reta Beebe who serves as Chief Scientist and coordinator.

PDS Level 1 Requirements

1. PDS will provide expertise to guide and assist missions, programs, and individuals to organize and document digital data supporting NASA's goals in planetary science and solar system exploration

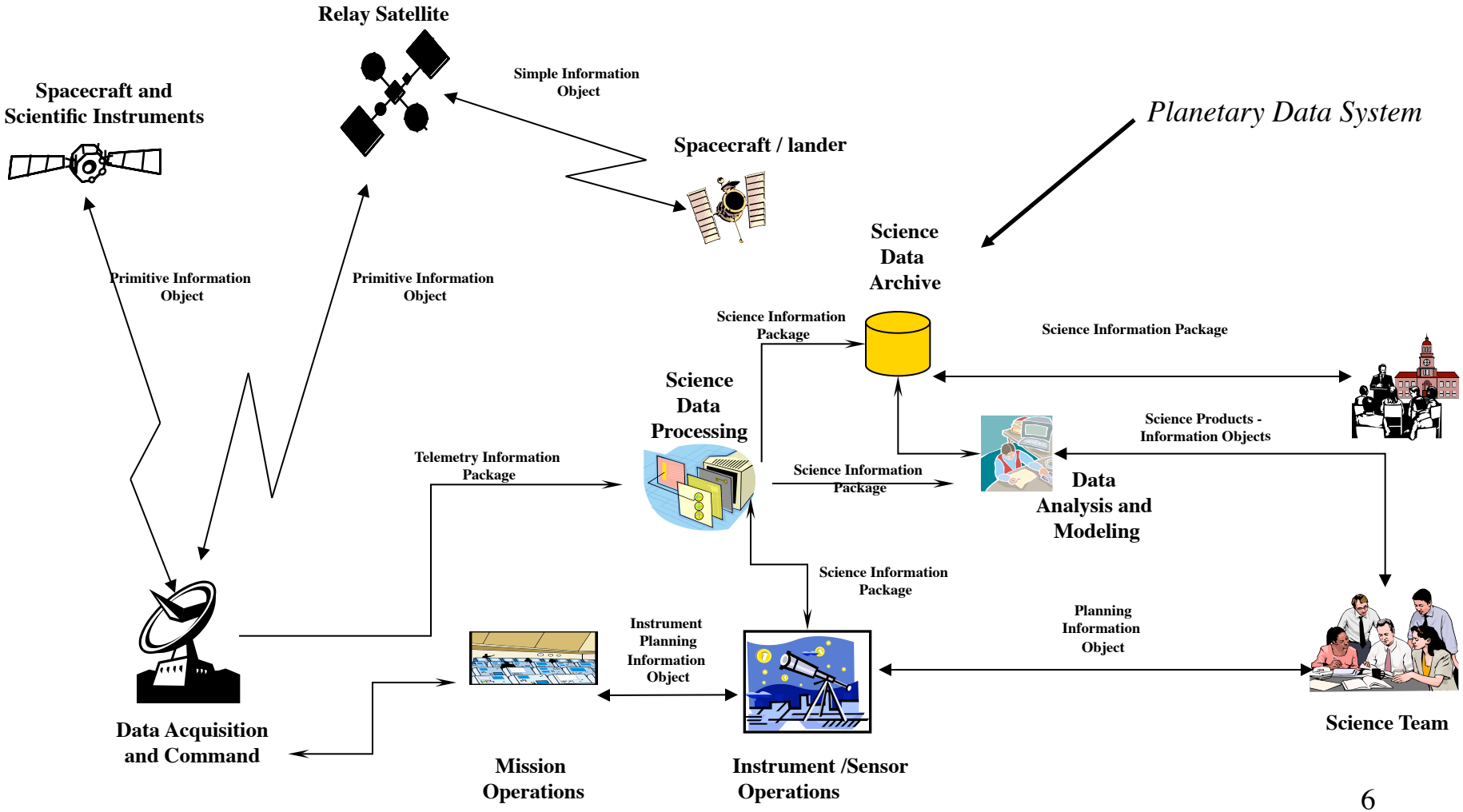
2. PDS will collect suitably and well-documented data into archives that are peer reviewed and maintained by members of the scientific community

3. PDS will make these data accessible to users seeking to achieve NASA's goals for exploration and science

4. PDS will ensure the long-term preservation of the data and their usability

Credit: PDS Level 1,2,3 Requirements. August 2006.

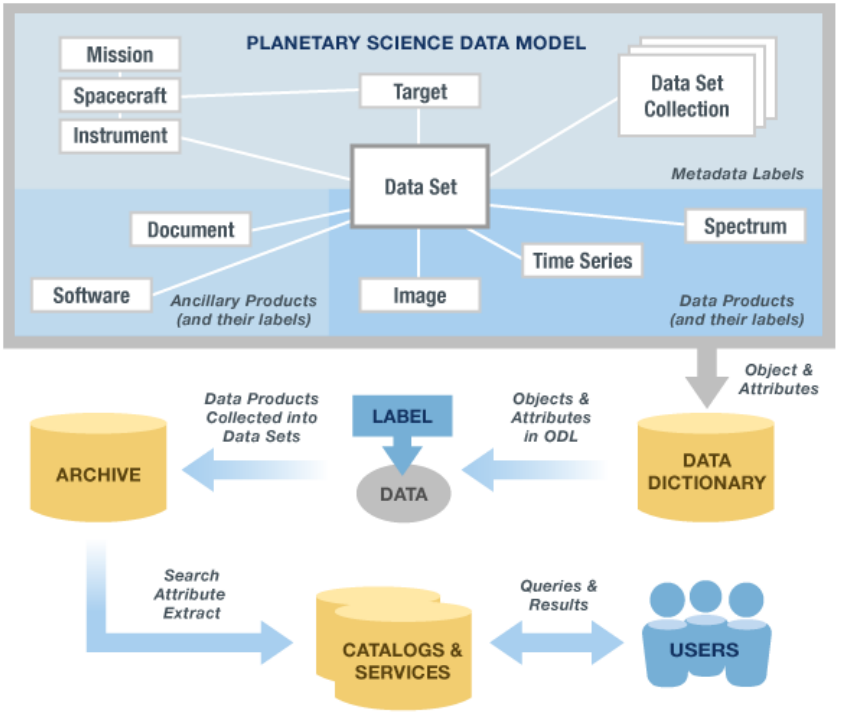
PDS Role in Distributed Space Systems Architecture



Credit: CCSDS Reference Architecture for Space Information Management

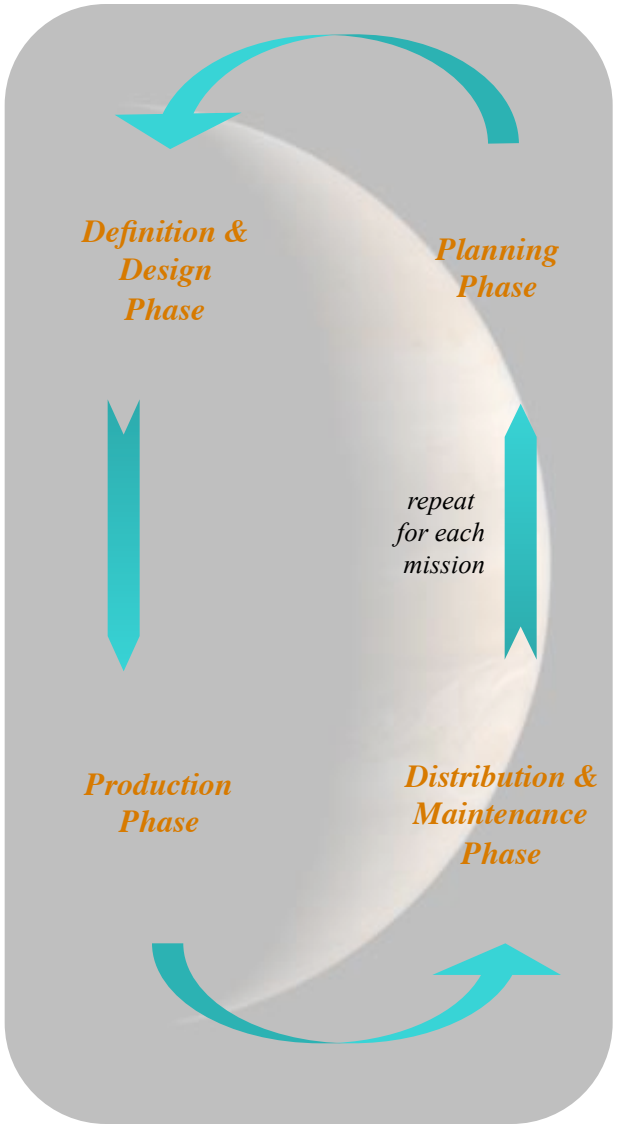
PDS Functions

- PDS serves the scientific community by assuring the availability of high quality and scientifically useful data products
- To accomplish these goals, PDS strives to:
  - Work with Data Providers to Prepare Archival Quality Data Products
  - Provide Access to Data from NASA and International Missions
  - Deliver Data to the Scientific Community
  - Establish a Common Data Model and Data Dictionary for Planetary Data
  - Sets Archival Standards
  - Preserve the Data
  - Assist Scientists in Accessing and Using Planetary Data
  - Be responsive to a diverse community of users
  - Facilitate Education and Public Outreach



PDS Planetary Science Data Model

PDS participates in all phases of a projects lifecycle



Planning Phase:

- Data archiving requirements written into mission Announcement of Opportunity
- Pre-proposal briefing on PDS data archiving requirements given to potential proposers
- Proposal data archiving section reviewed by PDS
- PDS orientation to flight project staff
- Data archiving working groups formed

Definition & Design Phase:

- Project Data Management and Archive Plans define data to be archived
- Data Product and Volume Organization Software Interface Specifications detail the data and volume structure
- Preliminary metadata labels loaded into PDS catalog

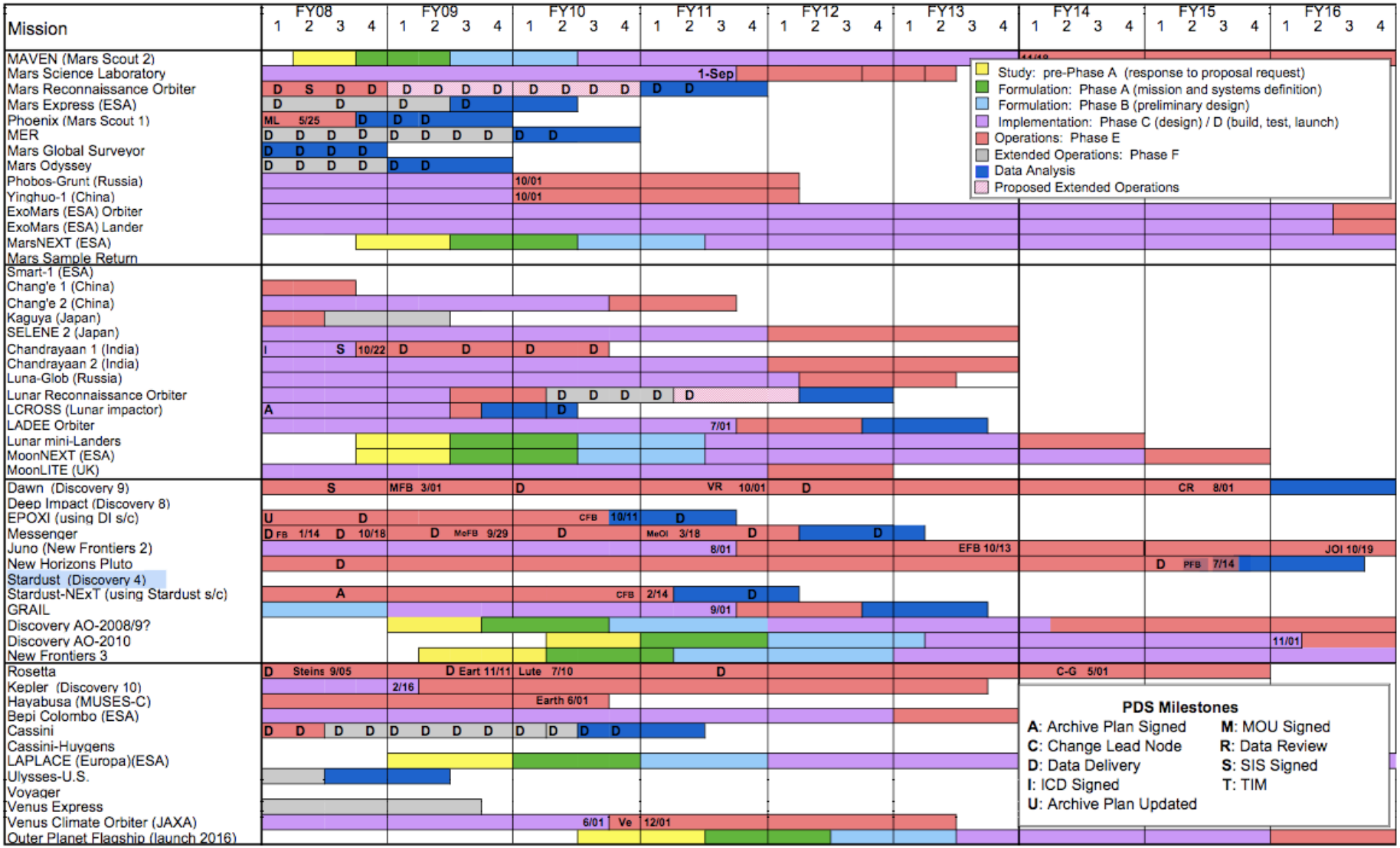
Production Phase (IV&T):

- Raw and processed data products, labels (metadata) and documentation
- Preliminary and quick-look data made accessible via Project and PDS web pages
- Data archive products validated, peer-reviewed; liens addressed

Distribution & Maintenance Phase:

- Final data products made available on-line
- PDS adds the data to the archive
- Copies sent to National Space Science Data Center (NSSDC) @ GSFC
- PDS provides data, documentation and science expertise to users
- Data archive maintained via periodic media refreshes/audits, addition of new / updated data products

PDS participates in many concurrent missions

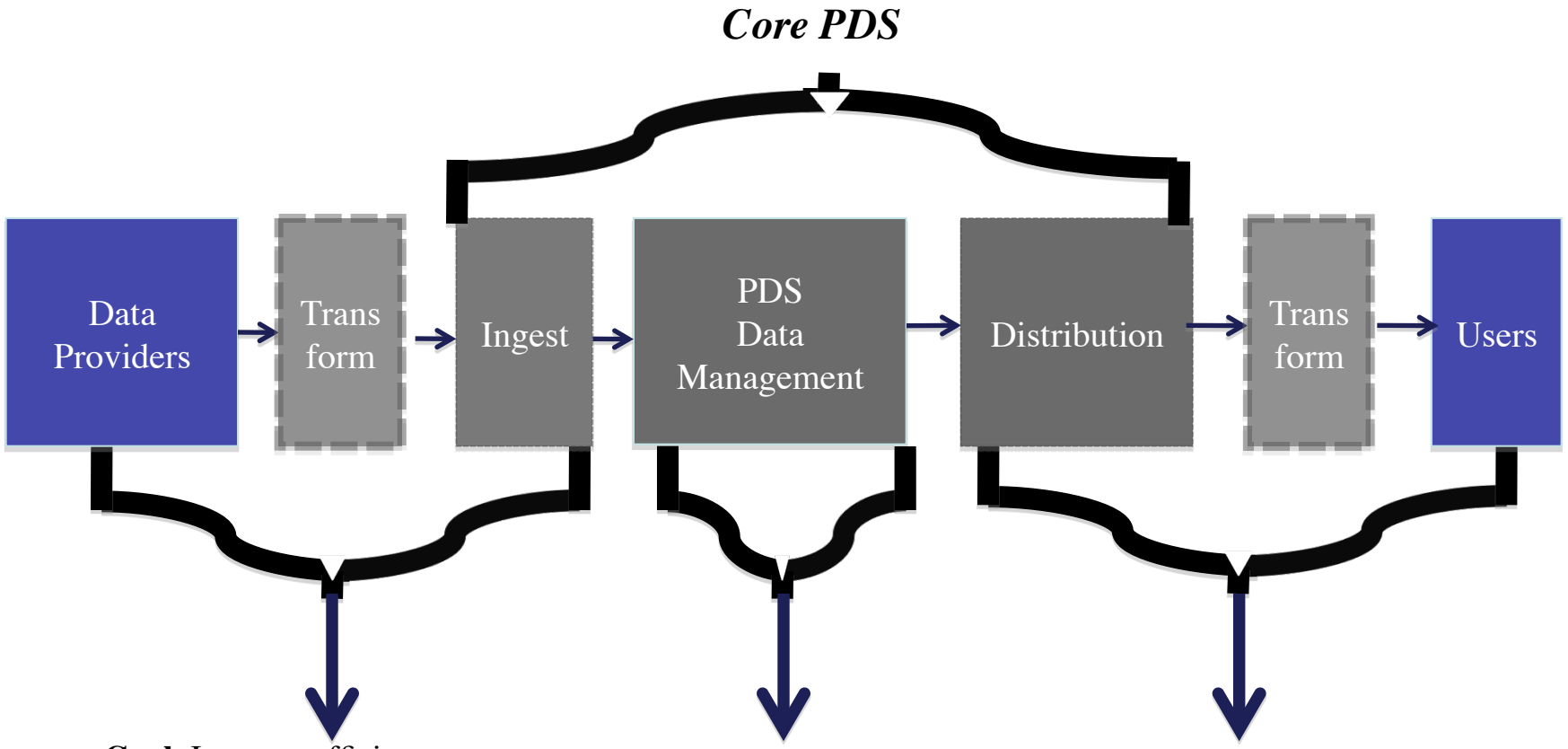


~20 concurrent missions will need to be supported by PDS over the next decade

PDS Challenges

- Number and diversity of missions and instruments
  - PDS is receiving data from 110 instruments hosted on 15 active missions as well as concurrently working with missions in development
  - New mission data nodes being added to PDS (LROC, for example)
- Preservation vs. Usability
- International collaborations
- Increasing volume of data
  - In 2001, the PDS archive was 4 TBs
  - In 2009, the PDS online archive is 90 TBs
- Budget pressures which affect archiving/usability across data providers/missions, PDS and the users
- ITAR
- Replacing aging technology, tools, standards and processes
  - Shift from an offline system to a fully online system

PDS Key Goals



Goal: Improve efficiency and support to deliver high quality science products to PDS

Goal: Preserve and ensure the stability and integrity of PDS data

Goal: Improve user support and usability of the data in the archive

What is PDS doing to improve its mission interface?

- Works with NASA HQ to assure that AO's contain the appropriate constraints.
- Provides support for pre-proposal conferences.
- Supports Proposal Reviews to assure appropriate assessment of the data analysis and archiving component of the mission to ensure the proposers will supply data that will adequately support the team's science goals and that they have adequately sized the task to produce high quality data sets
- Works with the mission Science Operations Center as early as possible to assure the mission develop a PDS conformant pipeline.
  - This helps to prevent erosion of science funding due to mission over runs.

What is PDS doing to improve its mission interface? (cont.)

- Works to get detailed Data Archiving Plans (DAP) and Systems Interface Documents (SIS). This is the "contract"; if you don't get plans for reduced data and higher level products you are NOT going to get them.
- Provides label making tools and data validation tools to be integrated into the instrument data pipelines. If the tools are adequate and integrated into the pipelines the labels will contain adequate keywords to provide effective searches, analysis and processing by the users.
- Encourages the instrument teams to develop PDS compliant pipelines. If the instrument team scientists use the same data that is archived this greatly enhances the reliability of the products. In addition, it provides a cost effective approach for recalibration of the data should problems be discovered and overcome.
- Serves on Data/Science Archive Working Groups.
- Works to provide free flow in ingesting data deliveries.
  - For new missions these procedures have streamlined the data ingestion and have led to more higher-level products.

What is PDS doing to improve its mission interface? (cont.)

- Performs end-to-end tests with missions to validate the pipeline and science products prior to formal delivery
  - First tested on MRO
- Modernization of the technologies, tools, standards and processes to embrace an international, fully online system
  - More to come on this….

Mission Interface: International Missions

- PDS has been a leader in supporting movement towards internationalization to share data from planetary science archives
  - Trained Joe Zender from ESA on PDS standards who spent time at PDS and then embedded the standards into the Planetary Science Archive at ESA
  - Helped start the Planetary Data System in China (via Geosciences Nodes)
  - Founded along with Joe Zender the International Planetary Data Alliance
- PDS Standards are currently used as the de facto standard for archiving planetary science data internationally
- In 2006, ESA and NASA proposed and started the *International Planetary Data Alliance* to improve efficiency in coordinating data archiving for international missions and improving access to international archives
- In 2008, COSPAR passed a resolution recognizing IPDA and supporting its efforts to establish standards for archiving and sharing planetary science data
- Representatives include: ESA, NASA, ISRO, JAXA, DLR, BNSC, CNES, CSA, ASI, CNSA, RSA/IKI with Japan as the current chair

IPDA Steering Committee (2009-2011)

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Deputy Chair	Dan Crichton	(NASA/JPL, PDS)
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Italy (ASI)	Paolo Giommi
Japan (JAXA)	Iku Shinohara, Yukio Yamamoto
UK	Mark Leese (Open Univ.), Peter Allan (RAL)

with the participations from China and Russia.

What is PDS doing to improve user access?

- Improving search and access through
  - Working with teams to produce and archive descriptive, consistent labels and metadata
  - Modernization and application of newer search strategies and technologies (e.g., Google and Google-like, for example)

- Peer reviewing data for usability
  - Instrument teams beginning to set up PDS complaint pipelines
  - Establish peer review teams with external reviewers
  - Working with teams when products are deemed inadequate

- Expanding commonly used tools to support newer product formats
  - ISIS expanded to support HiRISE data products

What is PDS doing to improve user access (cont…)?

- Improving the look and feel of PDS websites
  - A new PDS look and feel was released in 2008
  - Improving navigation between nodes
- Working with international missions to ensure proper linkages are in place so users of PDS can access international data sets
- Crafting online tutorials for using data (for example, Cassini INMS)
- But, ultimately, a modernization of PDS to improve product definitions, search/access, usability of data products in desired formats, and international interoperability has become necessary

Modernization of PDS

- "PDS 2010" is an implementation effort to move PDS to a fully online, federated system coupled with an upgrade of PDS Standards
  - The architectural approach allows for better leveraging of modern IT technologies
  - Major effort is in 2010 and 2011
- Addresses several drivers which require a modernization to continue to meet demand and users expectations (volume, number of missions, complexity of missions, international missions, better user support, etc)
- Improves "efficiency in the mission interface" and "usability" in the distribution to data to PDS users
- Better addresses the tension between "preservation" and "usability" of data
- Replaces aging technology, tools and processes

Modernization of PDS (cont…)

Specific goals for PDS 2010

- Simplified, but rigorous, archiving standards (PDS V4) that are consistent, easy to learn, and easy to use
- Adaptable tools for designing archives, preparing data, and delivering the results efficiently to PDS
- Online services allowing users to access and transform data quickly from anywhere in the system
  - Services that allow for operation on the archive, but distribution for usability
- A highly reliable, scalable computing infrastructure that protects the integrity of data, links the nodes into an integrated data system, and provides the best service to both data providers and users

Challenges in Working with Data Providers

- In general, teams are working well with PDS
- Contention areas that can arise include:
  - Data sets and data products that
    - Lack good, consistent metadata and labels (key for usability)
    - Are difficult to use and/or preserve over time
    - Lack ancillary data or require proprietary software
  - Higher order products
    - Funding pressures can change what is being delivered and what is needed by the science community
  - Products that do not comply with PDS Standards and/or are deemed inadequate during a PDS peer review
    - In some cases, PDS has reworked products to ensure they can be used by the teams
- Establishing mission requirements and working together early is critical to improve efficiency and usability the system

What is PDS Not Providing?

- Generation of higher order products
  - In general, PDS is an archive and distribution system, it does not have the resources to produce higher order products that the community may desire
- Maintenance of software
  - PDS can not be expected to maintain software developed by instrument teams
  - Preserving software is a challenge because team software is frequently dated by end of mission
- Transformations and support to convert data in the archive to any format desired by a user
  - Although, the modernization of PDS will provide a structure which will deal with a limited number of formats
- Ability to search on any possible feature in a data product
  - Although, good labels in the data products will improve this

How is PDS engaging the broader scientific community?

- Each discipline node has an advisory board that meets and communicates regularly; PDS also participates in various NASA reviews
- PDS actively works with NASA and the proposal teams both for missions and data analysis programs
- For its modernization efforts, PDS is working with candidate missions and is developing an engagement plan that will include input from data providers and users
- PDS developed a white paper with community input regarding the status and future of PDS for the decadal study teams
- PDS plans to use decadal survey white papers to identify a wide set of users to seek more input
- …and if you have more input, send them to Reta Beebe (rbeebe@nmsu.edu)

Recommendations to Decadal Survey Committee*

- Emphasize the NASA Planetary Science Division to assure that its polices and procedures guarantee adequate, consistent support for data analysis within the missions and community and to enable effective archiving.

- Recommend Archive planning be an integral part of the proposal planning, and funding should be identified in the award to ensure teams have adequate resources to meet this obligation.

- Emphasize NASA Planetary Science Division support for the upgrade of PDS including leveraging modern database and web technologies in order to ensure improved data standards and efficient, effective storage, search, retrieval and distribution of scientifically useful planetary data in the coming decades

*** Beebe, et al. Data Management, Preservation and the Future of PDS. White Paper for Decadal Survey Committee.**

THANK YOU!