



Planetary Data System



JPL

Preserving and providing
access to space exploration
data to enhance our
understanding of the
Solar System.

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Perennisation et Valorisation

<http://pds.jpl.nasa.gov>

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Topics



- Introduction and Background
- Challenges
- Solution
- Implementation
- Benefits
- Next Steps



PDS Overview



The PDS acquires, preserves, and distributes the large volume of unique and valuable data returned by Solar System Exploration missions

Key PDS Products and Services

- High quality peer-reviewed data archives
- Data distribution to planetary community
- Archiving expertise to planetary missions
- Scientific expertise and support for users
- Value-added aggregated data products
- Education and outreach data products and services



Planetary Data System



JPL



New Mexico State Univ.



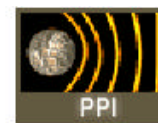
Wash Univ. St. Louis



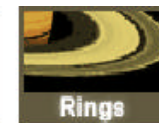
JPL/USGS Flagstaff



JPL



UCLA



NASA Ames

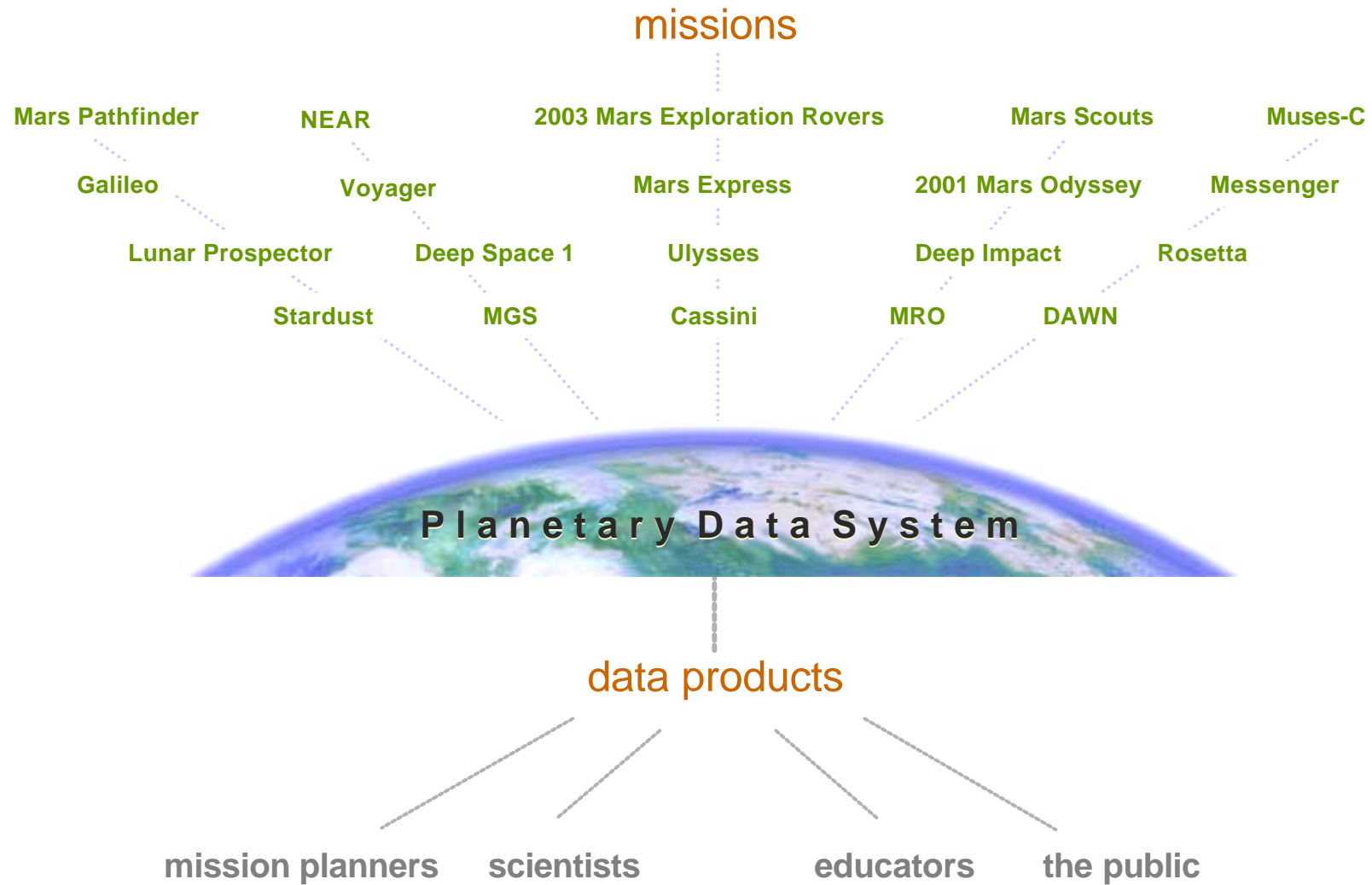


U. Maryland

Node structure provides focus on key disciplines

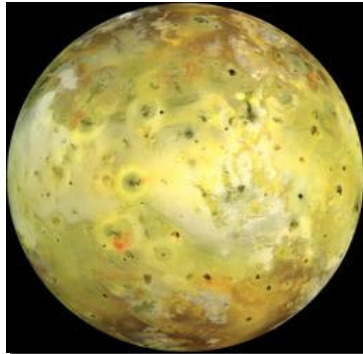


PDS Role for Planetary Science Data

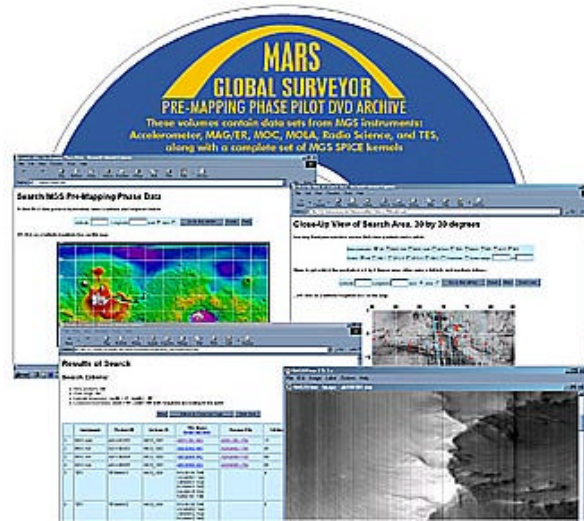




Recently Archived PDS Products



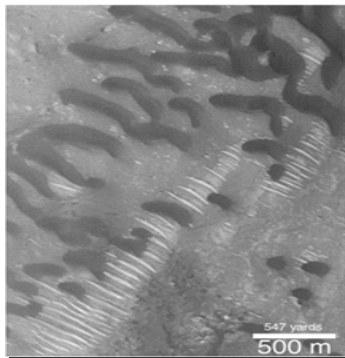
Galileo SSI Global image of Io (true color) Catalog #: PIA02308 8/27/99



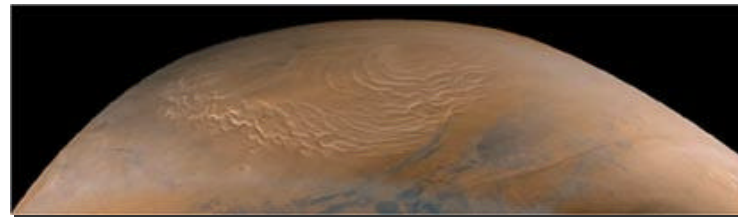
MGS Pre-Mapping Phase Pilot DVD Set



The Environs of NEAR Shoemaker's Landing Site on Eros Catalog #: PIA03141 2/07/01



*Dark Dunes Over-riding Bright Dunes
MGS MOC Release No. MOC2-201, 1/31/2000*



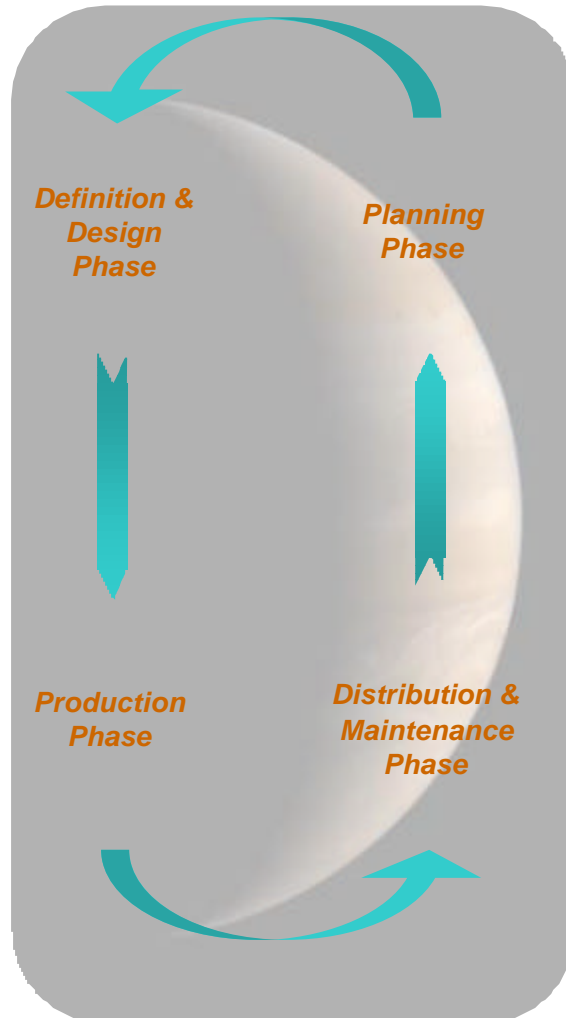
*MGS Martian North Polar Cap on September 12, 1998
Catalog #: PIA01471*



Clementine Observes the Moon, Solar Corona, and Venus Catalog #: PIA00434 11/04/97



Data Archiving Life Cycle



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:

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

Distribution & Maintenance Phase:

- Final data products made available on-line
- PDS adds the data to the archive
- Physical copies sent to NSSDC
- PDS provides data, documentation and science expertise to users
- Data archive maintained via periodic media refreshes, addition of new / updated data products



- **PDS receives data from flight projects for archive and distribution**
 - PDS helps planetary missions to create high quality data archives and to release them in a timely manner
 - PDS validates data for compliance to PDS standards
 - PDS assembles, publishes, distributes, and maintains peer-reviewed, documented planetary data sets
 - PDS archive data also available on-line at PDS discipline nodes
- **Problem: Planetary missions are producing larger data volumes**
 - CD-ROM distribution is too expensive
 - Even if DVDs replace CDs, there will still be hundreds, even thousands, of volumes
 - Difficult for users to store; difficult to locate data of interest
- ***A new paradigm for archive and distribution is needed***



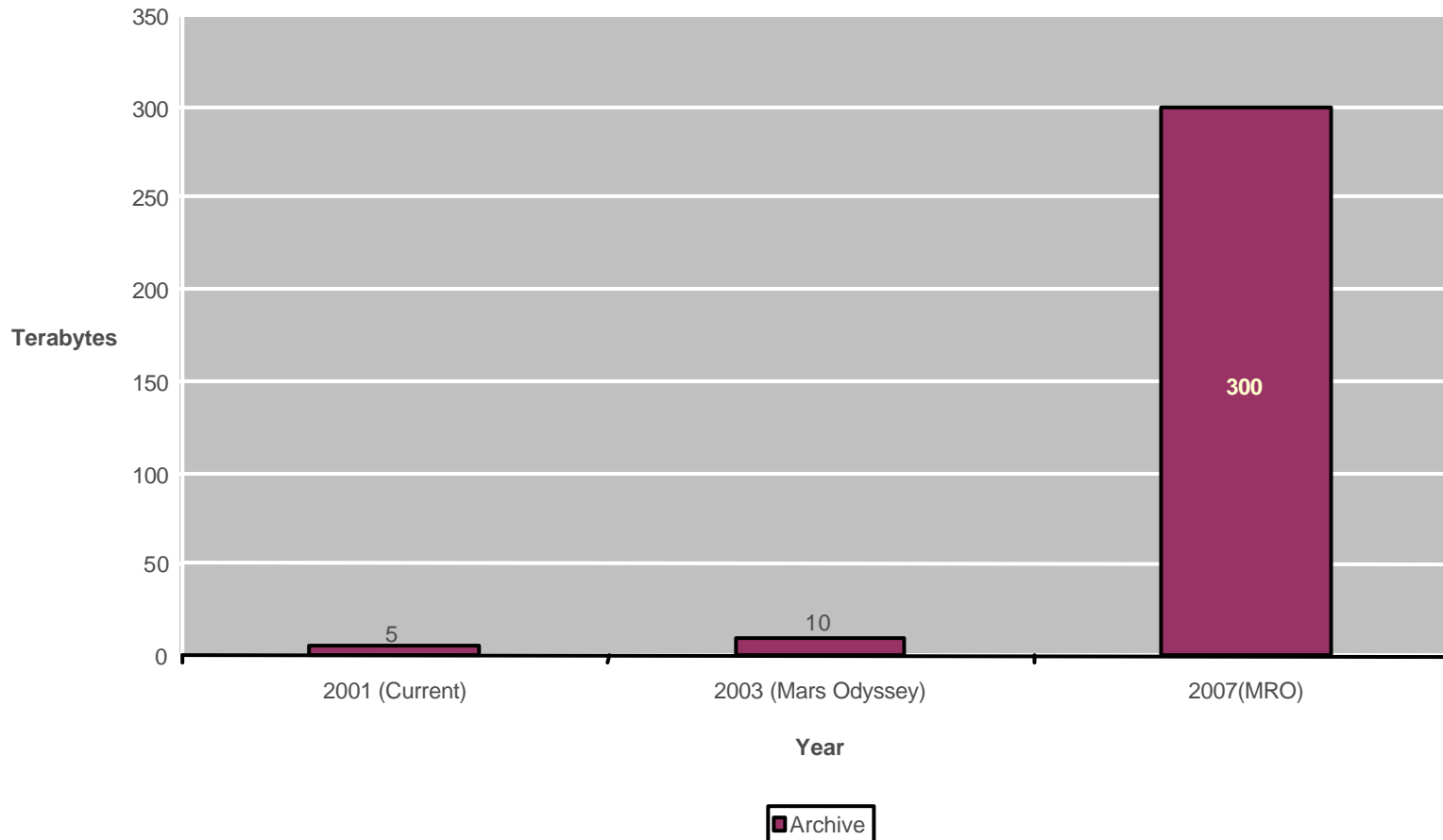
Current Challenges



- **More missions**
 - Smaller, more frequent missions; more orbiters
 - New programs (Mars Exploration, Discovery, New Frontiers)
 - Inadequate mission archiving budgets
 - New PIs with little experience in data archiving
- **Larger data volumes**
 - Bigger payloads (Cassini-18 instruments, Galileo-16, Rosetta-20)
 - More complex instruments/better resolution/higher data rates
 - THEMIS will return ~5TB of data (2 Magellans)
 - Mars '05: ~ 300TB (100 Magellans!)
- **Increased user expectations**
 - Demand for instant internet access and modern interfaces
 - Need for sophisticated methods to access larger data volumes and to locate data of interest



Growth in Size of Archive





PDS Data Distribution: New Paradigm



- Online access is the primary method for data distribution, with improved tools to support users
 - Find out what data exist
 - Select data of interest
 - Retrieve data
 - Correlate data across instruments, missions, and nodes
- Data are publicly available as soon as possible
- Copies on physical media are available on demand using limited resources
- Special collections containing data of high interest can be published on physical media from time to time
- Copies of complete data sets on cost-effective physical media for long term archives at PDS and NSSDC (minimum 3 copies) are still required from the flight projects



PDS-D Implementation



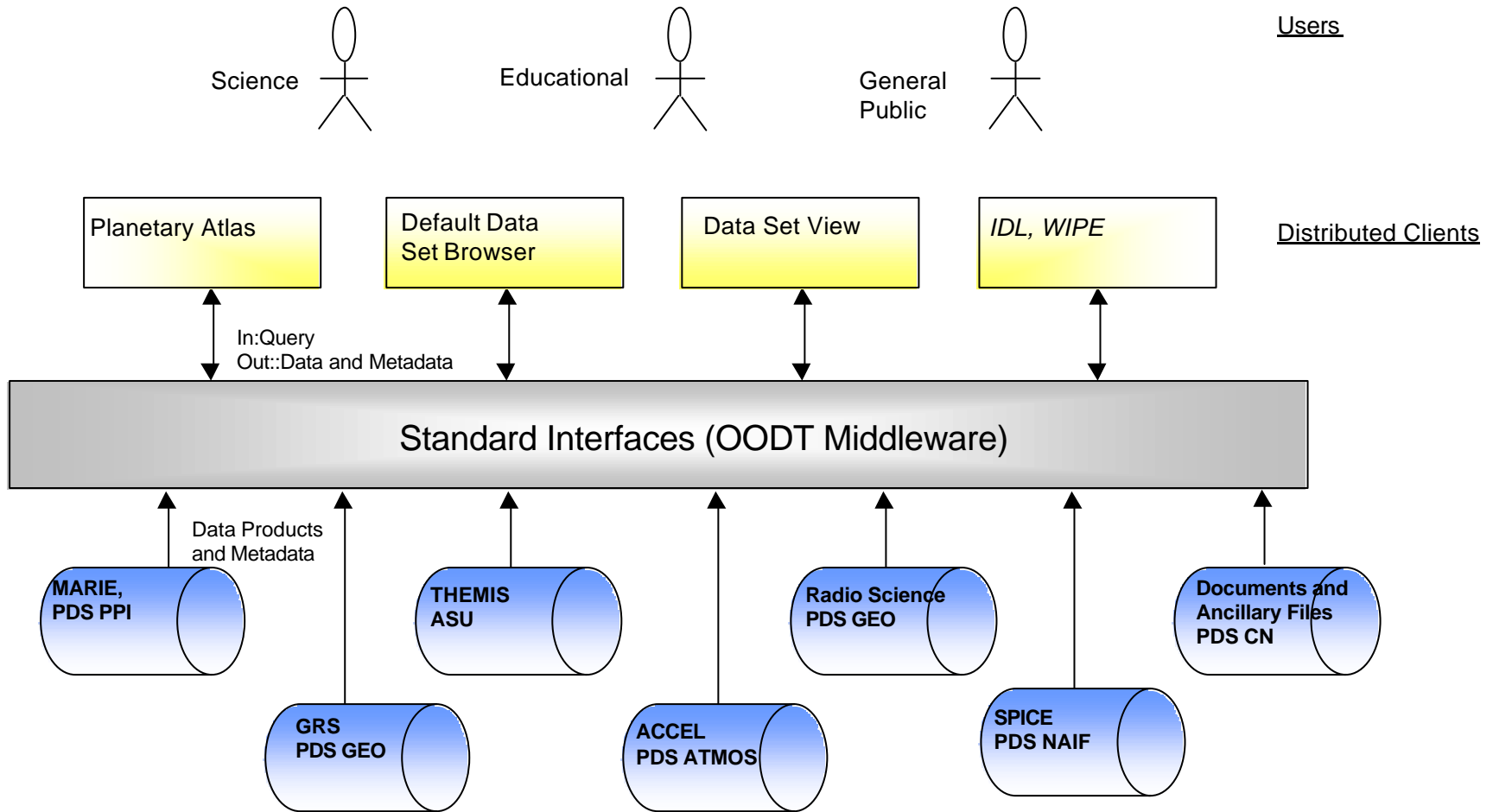
- **Multi-tiered information architecture**
 - Application Clients (Browsers/Interfaces)
 - Middleware (OODT)
 - Data and Metadata Servers (product server, profile server)
 - Data Repositories and Catalogs

- **Existing PDS subsystems**
 - Data and resources remain physically distributed and locally managed
 - Underlying heterogeneity is encapsulated and hidden from the users
 - User Interfaces (Image Atlas, DITDOS, etc.)
 - Data repositories (disk farms, databases, CD Jukeboxes)
 - Catalogs

- **Separate data and technology architectures**
 - PDS archive metadata used to its full potential
 - Evolved technology architecture deployed
 - Internet used for data distribution



PDS - D Architecture for Mars Odyssey





Data Set Quick Search

Select ONE parameter from below to perform your query.

RESET

Missions:

- 2001 Mars Odyssey
- Mariner69
- Mariner71
- Mars Global Surveyor
- Mars Observer
- Mars Pathfinder

Target Name: All

Target Type: All

Instrument Name:

- Accelerometer (ACCEL)
- Camera 1 (CAM1)
- Camera 2 (CAM2)
- Gamma Ray Spectrometer/High Energy Neutron Detector (GRS)
- IHW Infrared Spectroscopy Data
- Imager for Mars Pathfinder (IMP)

Instrument Type: All

Advanced Search | **Power Search** | **GO!**



Search Results (5 data sets found)

Data Set	Instrument Host	Information About the Data Set	Data Products & Related Files	Other Resources
1. 2001 Mars Odyssey Gamma Ray Spectrometer, Neutron Spectrometer, and High Energy Neutron Detector Experiment Data Records	ODY	View Information	Product Search	<ul style="list-style-type: none"> • 2001 Mars Odyssey Data Archives
2. 2001 Mars Odyssey Thermal Emission Imaging System Infrared Experiment Data Records	ODY	View Information	Product Search	<ul style="list-style-type: none"> • Correlative Search • 2001 Mars Odyssey Data Archives • Planetary Image Atlas
3. 2001 Mars Odyssey Thermal Emission Imaging System Visible Experiment Data Records	ODY	View Information	Product Search	<ul style="list-style-type: none"> • Correlative Search • 2001 Mars Odyssey Data Archives • Planetary Image Atlas
4. 2001 Mars Odyssey Thermal Emission Imaging System Infrared Reduced Data Records	ODY	View Information	Product Search	<ul style="list-style-type: none"> • Correlative Search • 2001 Mars Odyssey Data Archives • Planetary Image Atlas
5. 2001 Mars Odyssey Thermal Emission Imaging System Visible Reduced Data Records	ODY	View Information	Product Search	<ul style="list-style-type: none"> • Correlative Search • 2001 Mars Odyssey Data Archives • Planetary Image Atlas



Planetary Data System: Challenges and Solutions

Custom Data Set Browser – THEMIS Search



File View Help

Longitude: 326.656 Latitude: -2.781
Sample: 373.000 Line: 89.000

Legend: Red dots are Themis IR Images, Blue dots are Themis Visible Images
Odyssey - East Longitude, areocentric coordinate system. Drag mouse to define an area on the map and then click the search button in the browser window to complete the search.

Unsigned Java Applet Window



Planetary Data System: Challenges and Solutions

Custom Data Set Browser – THEMIS Results



File View Help

Longitude: 341.906 Latitude: -11.000
Sample: 381.000 Line: 352.000

Previous Map

Legend: Red dots are THEMIS IR Images, Blue dots are THEMIS Visible Images
Odyssey - East Longitude, areocentric coordinate system. Drag mouse to define an area on the map and then click the search button in the browser window to complete the search.

Unsigned Java Applet Window



Basic Product Search

- Mars Global Surveyor Accelerometer EDR Data Set
- Mars Global Surveyor Accelerometer Altitude Data Set
- Mars Global Surveyor Accelerometer Profile Data Set

SOFTWARE, DOCUMENTATION AND OTHER ANCILLARY DATA

[View](#)

Search for individual data products by entering one or more of the parameters below, or for further information on the dataset, read the [Data Set Catalog](#) file.

[MAP](#) [RESET](#)

Product ID:
Identifier assigned to a data product

Release ID:
Identifier for a data set release

	Minimum	Maximum	Valid Range
Latitude: Latitude on the planet's surface	<input type="text"/>	<input type="text"/>	-87 degrees - 61.22 degrees
Longitude: Longitude on the planet's surface	<input type="text"/>	<input type="text"/>	-171 degrees - 354 degrees
Orbit Number: Orbital revolution of the spacecraft	<input type="text"/>	<input type="text"/>	1 - 1285
Solar Longitude: Measure of season on a target body	<input type="text"/>	<input type="text"/>	-171 degrees - 354 degrees



Benefits

- **New system architecture provides seamless search and retrieval of all PDS data products in the system**
 - Users can access all PDS resources without knowing their location
 - Users are presented with an integrated set of PDS Nodes (one PDS, not seven)
 - Primary method of data distribution is now electronic and saves media costs
 - Heterogeneous data repositories can be located anywhere for optimum performance and cost savings (e.g., THEMIS data node at ASU)
- **PDS-D provides a standard interface for software developers thereby increasing the availability of user clients**
 - Supports plug-ins for analysis tools and graphical user interfaces
- **PDS-D supports evolution and scaling to incorporate new information technology and requirements changes**
- **Mission are now more involved with the PDS sooner and data are released through the PDS as soon as they become available**
 - Mars Odyssey data were released to the public through the PDS on October 1st -- the same day they were delivered!



Next Steps

- Collect and analyze requirements from upcoming planetary missions (e.g., Cassini, MER, Mars Express, MRO)
- Gather user community feedback from PDS D-01
- Incorporate both of these to determine future releases of PDS - D
- Automate the data archiving processes to streamline getting data *into* the PDS
 - Automated archive product creation work flow
 - Product generation, labeling, validation, and ingestion
 - Derived product processing and versioning
- Upgrade the PDS data model to support new requirements
 - XML modeling and interfaces
 - Ground-based data sets
 - Wavelength regimes
 - Targets with multiple identifiers and types



PDS Development Timeline

