Planetary Data System Update

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FEBRUARY 28, 2020

PDS Organizational Structure

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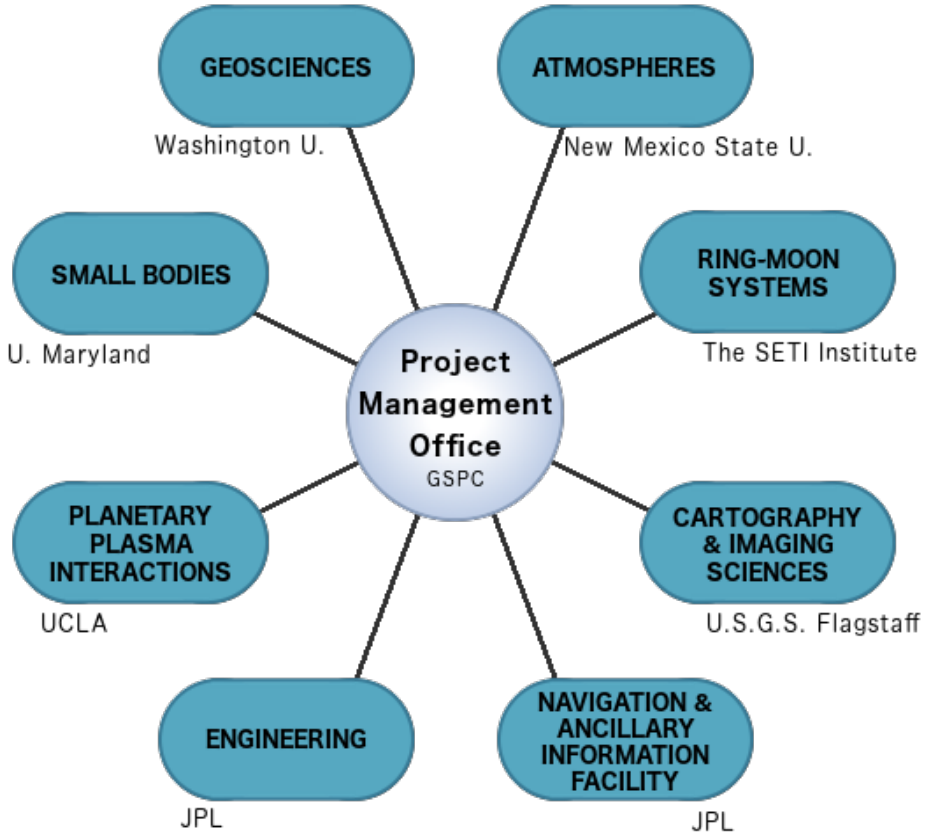


What PDS Does

The PDS Mission Statement: “The mission of the Planetary Data System is to facilitate achievement of NASA’s planetary science goals by efficiently archiving and making accessible digital data produced by or relevant to NASA’s planetary missions, research programs, and data analysis programs.”

PDS helps data providers **put data into the PDS holdings** by…

- Working with developing missions to create quality peer-reviewed archives
- Working with active missions to receive and validate data deliveries throughout the mission
- Working with individual scientists to archive data from their research, e.g., from PDART-funded projects.

PDS helps the planetary science community **get data out of the PDS holdings** by…

- Providing tools for searching and downloading data
- Providing expert help in understanding and using the data.

PDS works to develop standards, policies, tools, and best practices for archiving.

PDS maintains its holdings online and in multiple backups indefinitely.

The Geosciences Node Leads Archiving for Mars Missions

Geosciences is the Lead Node for most Mars missions, including **InSight, MSL, MRO,** and **Odyssey**, and for developing mission **Mars 2020. MAVEN** is led by the Atmospheres Node.

- For each mission we run a Data and Archive Working Group (DAWG) with representatives from the instrument teams, the project, and the PDS nodes that archive the data.
- We coordinate archive development with other PDS discipline nodes and the PDS Engineering Node.
- We oversee peer reviews of the archives.
- Once a mission becomes active, we oversee scheduled deliveries and release of data to the public.

We maintain archives from past Mars missions **MER, Phoenix, Pathfinder, MGS,** and **Viking**.

We provide online search and download services and expert advice to the user community.

Archives from Individual Data Providers

As an example, the Geosciences Node is currently working with 47 data providers, including 17 with proposals using data from Mars missions.

For example:

- Mars Target Encyclopedia Extensions for Historical Mars Missions, Kiri Wagstaff
- Rock Thermal Inertia and Conductivity Measurements Under Martian Atmospheric Pressures, Deanne Rogers
- Completing the CRISM TER/MTRDR PDS Archive: Restricted Gimbal Angle Hyperspectral Targeted Observations, Frank Seelos
- High Resolution 3D Imaging of SHARAD Data, Paul Sava
- An Archive of MSL ChemCam Passive Visible/Near-Infrared Surface Spectra, Jeff Johnson
- Nature and Emplacement History of Lavas Erupted on Mars, Alexander Sehlke
- Formation of bedrock gullies by dry granular flows: Theory, Experiments and Comparative geomorphology of Mars and the Moon, James Dickson
- Archiving the MSL Curiosity Rover Mastcam Multispectral Reflectance Data Set, Jim Bell
- Mars analog handlens-scale images, Aileen Yingst

Last year we responded to 81 requests for letters of support for proposals to NASA programs, including 29 for Mars-related proposals to DDAP, Exobiology, Habitable Worlds, MDAP, PDART, PSTAR, and SSW.

- If you need a letter of support for your proposal, ask PDS at least a week before the proposal deadline.
- If you plan to use PDS-archived data in your proposed work, see the PDS Data Release Calendar for the scheduled and actual release dates of currently active missions. https://pds.nasa.gov/datasearch/subscription-service/data-release-calendar.shtml

Data Repositories

Many science journals now adhere to the FAIR data standard, which specifies that science data should be findable, accessible, interoperable, and reusable. To this end, authors are required to archive the data supporting their publications in a **public data repository**.

Is PDS a suitable repository for this purpose?

- The effort involved in submitting data to PDS—labeling, documenting, and possibly reformatting the data products—may not be justified for a small, simple data set. In this case the Geosciences Node recommends submitting the data to one of the many available online data repositories, such as figshare (**figshare.com**) or Dataverse (**dataverse.org**).
- On the other hand, if you believe your data would be a useful addition to PDS, and you are willing to put in the work and submit the data to peer review, we are happy to help you. Email us at **geosci@wunder.wustl.edu**. If Geosciences is not the right place for your data, we will find the right PDS node to help you.

PDS Services to the Mars Community

To find data:

- PDS main web site and node web sites
- Specialized search tools at PDS nodes
  - MER, MSL, Phoenix, and InSight Analyst's Notebooks (Geosciences)
  - Mars Orbital Data Explorer (Geosciences)
  - Planetary Image Atlas, Map-A-Planet, Photojournal, Annex of Geospatial Products (Cartography and Imaging Sciences)
  - CRISM Spectral Library (RELAB coming soon, demo at LPSC)

To submit data:

- PDS Data Provider's Handbook
- Help For Proposers on node web sites

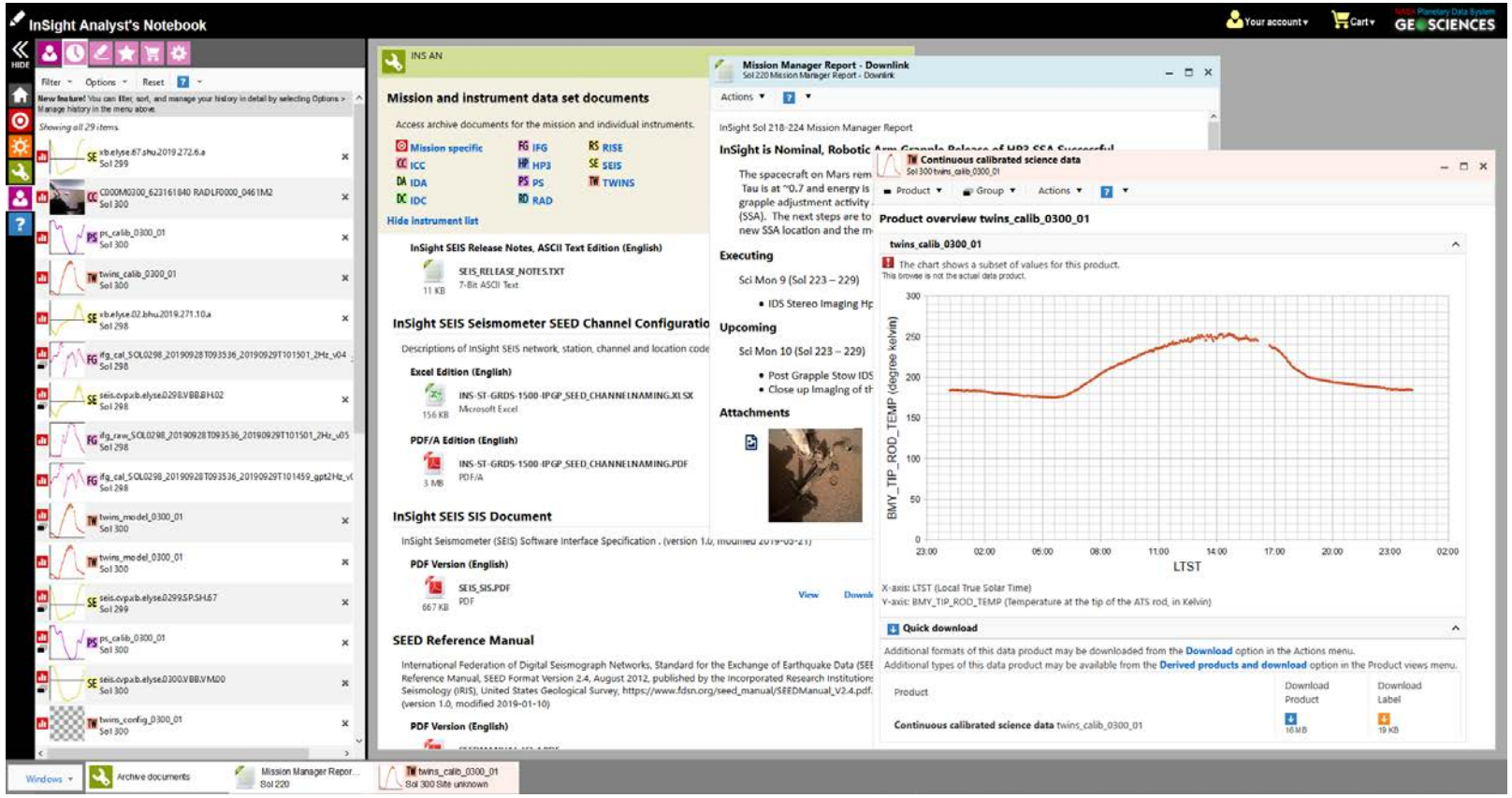
To use data:

- User forums
- Conference workshops
- Tutorials
- Specialized viewing tools
  - Marsviewer (Cartography and Imaging Sciences)
  - PDS4 Viewer (PDS Tool Registry)

See the final slide for links to these services.

See the PDS Tool Registry, https://pds.nasa.gov/tools/tool-registry/, for tools and services submitted by the PDS community

Example: InSight Analyst's Notebook



Example: Working with the Seismic Community

InSight seismometer (SEIS) data are archived in two formats:

- SEED (Standard for the Exchange of Earthquake Data), familiar to seismologists but not PDS-compliant
- GeoCSV Comma-Separated Value text tables which are PDS-compliant, with StationXML metadata

SEIS data are released simultaneously by PDS, by IRIS (Incorporated Research Institutions for Seismology), and by IPGP (Institut de Physique du Globe de Paris).

Future work

Migration of PDS3 data sets to PDS4

- PDS4 is now the required standard for data submitted by missions and individual data providers.
- Active missions that began archiving under the PDS3 standard may continue to do so, but they are encouraged by NASA HQ to plan to convert their archives to PDS4 at or before end-of-mission. PDS nodes are actively involved in this planning.
- Each PDS node has a plan to migrate most of its PDS3 data to PDS4 over the next five years.

Improve discoverability

- Prototype new data services, including the use of the PDS Application Programming Interface (API) to facilitate cross-node search and retrieval functions and other applications.

Cloud services

- As an example, Geosciences currently uses cloud services for backups of data, and is exploring ways to make data available to users for processing in the cloud.

Links to Services and More Information

PDS Main Web Site: https://pds.nasa.gov, with links to all PDS nodes in the sidebar on every page

About PDS4:
https://pds.nasa.gov/datastandards/about/

To search all PDS archives:
https://pds.nasa.gov/datasearch/

Analyst's Notebooks: https://an.rsl.wustl.edu/

Orbital Data Explorer: https://ode.rsl.wustl.edu/

Planetary Image Atlas, Marsviewer, Map-a-Planet, Photojournal, Annex of Geospatial Products: https://pds-imaging.jpl.nasa.gov/

PDS4 Viewer:
http://sbndev.astro.umd.edu/wiki/PDS4_Viewer

Spectral Library: Coming soon, after LPSC

Geosciences Node Forums:
https://geoweb.rsl.wustl.edu/community/

Workshops and tutorials:

- https://pds-geosciences.wustl.edu/workshops/
- https://pds.nasa.gov/datastandards/training/
- https://pds-imaging.jpl.nasa.gov/software/

PDS Data Provider's Handbook:
https://pds.nasa.gov/datastandards/documents/dph/

Help for Proposers:

- https://pds-geosciences.wustl.edu/dataserv/proposerhelp.html (Geosciences Node)
- https://pds-imaging.jpl.nasa.gov/help/proposals.html (Cartography and Imaging Sciences Node)

PDS4 Background

The PDS4 Standard

PDS4 is a revision to the PDS standards for archiving, replacing PDS3 which had been in place for many years.

PDS4 is designed to produce higher quality, more accessible archives using modern software capabilities.

Like PDS3, PDS4 specifies…

- What can and should be in an archive: data, documentation, calibration information, etc.
- What types of data are considered archive-quality
- How data products should be labeled to be consistent across PDS

PDS4 is now the required standard for data submitted by missions and individual data providers.

Active missions that began archiving under the PDS3 standard may continue to do so, but they are encouraged by NASA HQ to plan to convert their archives to PDS4 at or before end-of-mission.

How is PDS4 different from PDS3?

Data types are fewer, simpler, and more rigorously defined.

Four basic underlying types:

1. Array
2. Table
3. Parsable byte stream (e.g. text file)
4. Encoded byte stream (e.g. PDF, JPEG; need special software to read it)

Primary science data products are restricted to arrays and tables, or types derived from them.

- For example, 2D and 3D images are derived from the array data type.
- Tables may be text or binary, with fixed-width columns or CSV-style.

How does PDS4 change archive development?

Not that much, really.

- There is a learning curve.
- Milestones, deliverables, peer review procedures are all the same as before.
- Pipeline processing software will output PDS4 labels instead of PDS3.
- Design of data products may take a little longer because there are fewer PDS4 precedents to rely on.
- The PDS4 model undergoes a scheduled update every six months, but older versions are still maintained and will remain valid over the long term.
- Validation of products for delivery to a PDS node should be easier.