

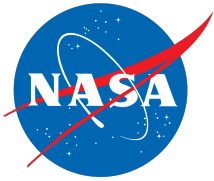


PDS4 Operational Readiness Review LADEE & MAVEN Mission Deliverables

R. Beebe – Atmospheres Node 

E. Law – Engineering Node 

J. Mafi – Planetary Plasma Interactions Node 



PDS Controlling Documents



PDS utilizes 3 official documents (signed and under change control) as the basis for facilitating delivery of Mission Data to the PDS:

Data Management and Archive Plan DMAP)

The Mission plan for the generation, validation, and use of science instrument and ancillary data

Interface Control Document (ICD)

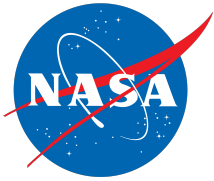
Defines the relationship between a Instrument Team and the participating Planetary Data System (PDS) Node for archiving and distributing the data to the science community and the general public.

Defines specific PDS deliverables

Software Interface Specification Document (SIS)

Defines the format and the content of the data from an individual instrument node

Defines format and documentation needs



LADEE Mission



LADEE Mission Science Goals are

1. Determine the composition of the lunar atmosphere and investigate the processes that control its distribution and variability, including sources, sinks, and surface interactions.
2. Characterize the lunar exospheric dust environment and measure any spatial and temporal variability and impacts on the lunar atmosphere.

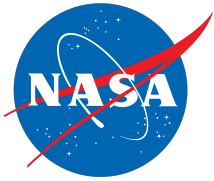
The orbiting spacecraft will carry three instruments to conduct in-situ and remote sensing observations:

1. A Neutral Mass Spectrometer (NMS)
2. An Ultraviolet Spectrometer (UVS)
3. A Lunar Dust Experiment (LDEX).

It will also carry the LLCD, a demonstration of a new technology for implementing high speed data return from future missions (no archiving requirements).

The spacecraft, launched from Wallops on Sept. 6, 2013, executes several Earth-centered phasing loops and, on arriving at the Moon, establishes an elliptical orbit of ~ 250 km to perform the 40 day LLCD technology demonstration during the commissioning phase. The spacecraft then drops into a lower orbit (~75km) for the 100 day science phase. After the primary phase, the mission will continue for as long as it has consumables, and then will be decommissioned through a controlled impact onto the lunar surface.

Mission operations will be run from ARC from the Multi-Mission Operations Center (MMOC). The SOC is located at GSFC. Ground communications will be primarily through the White Sands Complex (WSC) in New Mexico, with the Deep Space Network (DSN) as a secondary network.



MAVEN Mission



MAVEN Science Goals are:

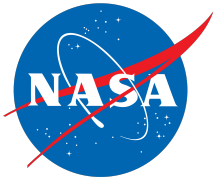
1. Determine the role that loss of volatiles from the Mars atmosphere to space has played through time.
2. Determine the current state of the upper atmosphere, ionosphere, and interactions with the solar wind.
3. Determine the current rates of escape of neutral gases and ions to space and the controlling processes.
4. Determine the ratios of stable isotopes that will tell Mars' history of loss through time.

The orbiting spacecraft will carry ten experiments to conduct in-situ and remote sensing observations:

1. Neutral Gas and Ion Mass Spectrometer (NGIMS)
2. Imaging Ultraviolet Spectrometer (IUVS)
3. SupraThermal and Thermal Ion Composition (STATIC)
4. Solar Wind Ion Analyzer (SWIA)
5. Langmuir Probe and Waves EUV Monitor (LPW-EUV)
6. Langmuir Probe and Waves (LPW)
7. Solar Wind Electron Analyzer (SWEA)
8. Solar Energetic particles (SEP)
9. Magnetometer (MAG)
10. Accelerometer (ACC)

The Mars Atmosphere and Volatile Evolution Mission (MAVEN) will be launched 11/18/13 - 12/7/13, to explore Mar's upper atmosphere, ionosphere and interactions with the sun and solar wind. After a 10 month ballistic cruise the craft will go into orbit no earlier than 9/22/14. The primary mission is planned to last for one earth year. To obtain coverage of near Mars space, the mission is designed with an elliptical orbit that precesses in latitude and local solar time. The mission plan includes nominal orbits that have periapsis near 150 km, with 5 "deep dip" campaigns with periapsis near 125 km. An extended mission is likely.

Mission operations is located at Lockheed Martin/Littleton and LASP/Univ. of Colo. and the SOC is located at LASP. The SSL/ University of Calif. at Berkeley will manage the particle and fields package, the mass spectrometer will be operated at GSFC, the UV spectrometer at LASP and atmospheric parameters will be derived from accelerometer data at JPL.



Timeline for LADEE Mission Deliverables



LDEX and UVS data products are space delimited ASCII tables while NMS is comma delimited.

PDS is required to generate templates for data and documents
PDS will provide assistance and review of SIS and sample data files

9/6/13 Launch

10/7/13 Phasing Loop Ends

11/16/13 Commissioning Ends

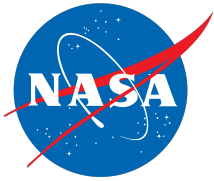
PDS will provide validation tools to the teams so that they can validate that the data conforms to PDS4 standards

2/24/14 Sample Delivery

5/24/14 Final Delivery

PDS will carry out final review and acceptance

PDS will provide data distribution to science community



Timeline for MAVEN Mission Deliverables



NGIMS, MAG and ACC are stored in time-ordered ASCII tables. IUVS is in FITS and STATIC, SEP,SWEA, SWIA, LPW, and LPW-EUV are stored in conformed CDF tables.

11/18/13-12/7/13
9/22/14 (earliest)

PDS is required to generate templates for data and documents
PDS will provide assistance and review of SIS and sample data files
Launch
Mars Orbit insertion

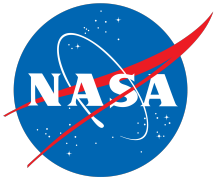
4/30/15 First Delivery

PDS will provide validation tools to the teams so that they can validate that the data conforms to PDS4 standards

Deliveries every three months

PDS will carry out a full review of first 3 months of data to assure quality scientific content and PDS4 conformity
PDS will provide data distribution to science community

PDS will carry out final review and acceptance



PDS4 Requirements Alignment for LADEE & MAVEN Missions



Req 1.4 Archiving Standards: PDS will have archiving standards for planetary science data.

LADEE - LDEX and UVS data products are tab delimited ASCII tables while NMS is comma delimited. MAVEN - NGIMS, MAG and ACC are stored in time-ordered ASCII tables. IUVS is in FITS and STATIC, SEP, SWEA, SWIA, LPW and LPW-EUV are stored in a PDS4 compliant version of CDF tables.

Req 1.2.1 PDS will provide examples and suggestions on organization of data products, metadata, documentation and software.

PDS is required to generate templates for for data and documents

Req 2.4 Peer Review: PDS will conduct peer reviews of all data submissions to ensure completeness, accuracy, and scientific usability of content.

PDS will provide assistance and review of SIS and sample data files

Req 1.5.2 PDS will provide tools to assist data producers in validating products against PDS standards.

PDS will provide validation tools to the teams so they can validate that the data with PDS4 standards

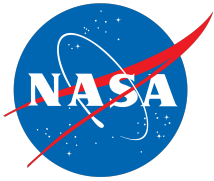
Req 2.5.2 PDS will implement procedures for accepting archival data.

PDS will carry out final review and acceptance

Req 3.1 Search: PDS will allow and support searches of its archival holdings.

Req 3.2 Retrieval: PDS will facilitate transfers of its data to users.

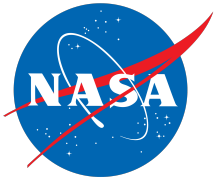
PDS will provide data distribution to science community



Traceability (1 of 2)

Deliverable	PDS Requirements	PDS Components	Review & Test Cases
LADEE LDEX & UVS products - tab delimited ASCII tables	Req 1.4 Archiving Standards	Information Model, Schemas, Standards Reference	Standards Review, Build 3b NODEFUNCTION.1**
LADEE NMS products - comma delimited ASCII tables	Req 1.4 Archiving Standards	Information Model, Schemas, Standards Reference	Standards Review, Build 3b NODEFUNCTION.1
MAVEN IUVS products - FITS files	Req 1.4 Archiving Standards	Information Model, Schemas, Standards Reference	Standards Review, Build 3b NODEFUNCTION.1
MAVEN NGIMS, MAG, ACC products - ASCII tables	Req 1.4 Archiving Standards	Information Model, Schemas, Standards Reference	Standards Review, Build 3b NODEFUNCTION.1
MAVEN STATIC,SEP,SWEA,SWIA, LPW,LPW-EUV products - PDS4 compliant CDF files	Req 1.4 Archiving Standards	Information Model, Schemas, Standards Reference	Standards Review, Build 3b NODEFUNCTION.1

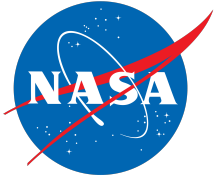
** NODEFUNCTION.n – Test Case IDs



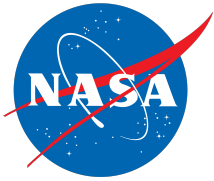
Traceability (2 of 2)

Deliverable	PDS Requirements	PDS Components	Review & Test Cases
Templates for data and documents	Req 1.2.1 PDS will provide examples and suggestions	Samples, Data Provider Handbook, Archive Preparation Guide	Standards Review, Build 3b NODEFUNCTION.1**
Assistance & review of SIS and sample data files	Req 2.4 Peer Review	Peer Review Guideline	Follow the PDS review process
Validation tools for PDS4 standards compliance	Req 1.5.2 PDS will provide tools to validate products against PDS standards	Validate Tools	Build 3b, NODEFUNCTION.2
Final products review and acceptance	Req 2.4 Peer Review, Req 2.5.2 PDS will implement procedures for accepting archival data	Peer Review Guideline, Archive Preparation Guide	Follow the PDS review process
Data distribution to science community	Req 3.1 Search, Req 3.2 Retrieval	Search service (discovery and download)	Build 3b, NODEFUNCTION.4

** NODEFUNCTION.n – Test Case IDs



Backup Slides

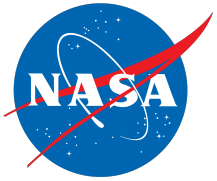


Test Cases

Test Case ID	NODEFUNCTION.1
Description	Create a PDS4 Product Label using a design tool based on PDS's schema.
Requirements	L5.PRP.DE.1-7
Success Criteria	Design tool produces a syntactically valid PDS Product Label else indicates where the label is invalid.

Test Case ID	NODEFUNCTION.2
Description	Validate PDS4 label
Requirements	L5.PRP.VA.1-.3, L5.PRP.VA.5-9
Success Criteria	Validation tool validates a file or all eligible products in a directory tree, indicates the schemas utilized during the validation, and ensures that a product label is well formed XML and conforms to its schemas.

Test Case ID	NODEFUNCTION.4
Description	Search for PDS4 data
Requirements	L5.SCH.1, L5.SCH.6-8, L5.SCH.10-11
Success Criteria	Search returns the data harvested in the previous step.



Requirement 1.4

1.4.1 PDS will define a standard for organizing, formatting, and documenting planetary Science data

1.4.2 PDS will maintain a dictionary of terms, values, and relationships for standardized description of planetary science data

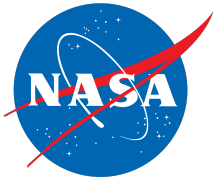
1.4.3 PDS will define a standards grammar for describing planetary science data

1.4.4 PDS will establish minimum content requirements for a data set

1.4.5 PDS will, for each mission or other major data provider, produce a list of the minimum components required for archival data

1.4.6 PDS will develop, publish and implement a process for managing changes to the archive standards

1.4.7 PDS will keep abreast of new developments in archiving standards



PDS4 Components meeting LADEE & MAVEN Requirements



PDS4 Standards

Information Model, Schemas

PDS4 Standards Documents

Standard Reference, Data Provider Handbook, APG

PDS4 Process / Practice

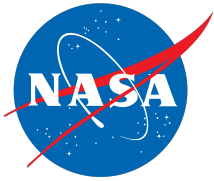
Mission Interface Peer Review Guideline, APG

PDS4 Tools

PDS4 Design, Validation and Generation

PDS4 Distribution Services

PDS4 Search and download



Process Defined in an ICD



With help from the designated PDS Discipline Node, the instrument team is responsible for writing the Interface Control Document (ICD) and the Data Product Software Interface Specification (SIS).

The designated node provides assistance and templates to the instrument team during production of documents and samples of all data products and product labels as described in the instrument SIS.

The mission supplies mission and spacecraft descriptions and other files common to the mission.

The designated node, with assistance from the lead node, organizes and conducts a pre-launch peer review of the individual instrument team's SISs and sample data products and labels.

The individual instrument teams are responsible for resolving all liens and interacting with the designated node to assure that the data pipelines that are based on the results of the pre-launch review are PDS4 compliant.

The instrument team is responsible for documenting the instrument, providing data set descriptions and performing internal science validation on data products prior to submission to the PDS.

The instrument team delivers science data products in the appropriate PDS Archive Bundle structure to the designated node according to the schedule in the Mission Project Data Management and Archive Plan.

The designated discipline node validates the science data for PDS4 compliance, including an external peer review, and assists the instrument team in resolving any liens that may be placed against the data sets. PDS validation ensures that a data set is compliant with PDS4 standards and with the SIS.

The instrument team is responsible for resolving any liens generated during the peer review and for delivering a complete data set to the PDS according to the schedule in the Mission Project Data Management and Archive Plan.

The PDS is responsible for maintaining the data archive and developing and operating an interface for the science community that provides search and retrieval capabilities to access the online repository of the data.