

IPDA PDS4 Project: Final Report

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Introduction

This year the project was focused on the following activities:

Activity 1: Review of PDS4 Documentation.

Activity 2: Assessment of existing PDS4 Tools. Identification of additional functionalities and support tools needs for data preparation and exploitation.

Activity 3: Analysis of existing validation rules (syntactic, semantic, content and referential integrity). International validation strategy and need of single validation tool.

Activity 4: Identification and analysis of guidelines for consistent use of keywords within PDS4-compliant products (e.g. CDF, FITS).

Activity 5: Assessment of PDS4 Cartography and Geometry data models. Approach for consistent use of e.g. coordinate systems and reference frames, handling of geometry and footprints.

Guidelines and material for the assessment were provided for each activity.

Assessment Summary

The project members provided a large number of comments. These have been compiled into the [IPDA PDS4 Assessment Spreadsheet](#) (still being populated with comments / feedback) and are uniquely identified and appended with a status column for logging progress.

The following table provides a count of the comments for each activity.

Classification	Count	General Remarks
Documentation	+100	
Tools	29	Mostly issues and suggestions, focused on PDS4 validate and transform tools
Validation	20	
Geometry + Cartography	10	Simplification suggestions and use of existing formats/standards
Others	20	Related to the use of the PDS4 standards

A list of the key issues is provided below for discussion.

- ❖ Consolidation of the formation rules for the LIDs (logical identifiers) and associated conventions for filenames / directory names needed across international partners. A lot of work has been done on this area at PDS and PSA; final consolidation needed to ensure consistency across international partners. Data users would benefit a lot from consistent use of these conventions.
 - PDS master Schematron to be updated to allow LIDs with international URN prefix e.g. urn:esa:psa, or to remove rules that enforce urn:nasa:pds (CCB issue)
 - LID formation rules for PDS4 Context products well documented in DPH, Appendix F; Examples of other LIDs consistent with current PDS implementation to be provided in documentation
 - Initial draft of LID conventions for ExoMars16 and BepiColombo reviewed by PDS; recommendations and comments to be applied.

- ❖ Governance of Context products. Proposal summarised below, for discussion.
 - Target Context products are expected to be unique. Suggested that the master copies of these products are hosted and maintained by PDS (except calibration targets if specific to a mission).
 - For other Context products (i.e. agencies, missions, instrument hosts, instruments) master products to be hosted (and maintained) by the responsible agency.
 - Other archives can host replicates of the master Context products; these archives will need to query the registry of federated archives to regularly check for updates to the master products. Clarification needed on what LID to use for replicates (original or new LID?).

- ❖ Procedure for namespace registration, generation of LDD (local data dictionary) and ingestion into PDS information model needed.
 - ExoMars16 and BepiColombo will be producing mission dictionaries soon.
 - Planning to add mission phase, orbit number (start/stop) and spacecraft clock count (start/stop) attributes to mission LDDs. It would be useful to use consistent names for these attributes across missions (although the definition might differ from one mission to the other).

- ❖ Mapping of PDS3 <> PDS4 keywords needed; mapping to attributes on existing interoperability protocols might be also useful (PDAP, EPN-TAP). Propose to use / exercise the concept of Property Maps for this purpose, currently being developed by PDS.

- ❖ PDS4 Documentation: General status is good, consistency across documents and examples improved; feeling that there is still some overlap between Concepts and DPH documents; Missing guidelines / recommendations for:
 - Data Preparation Process, Archive Planning and Peer-review (description of the archiving process)
 - Dealing with multiple versions of PDS4 (information model) in a mission, in particular for missions with long lifetimes i.e. when to fix version of the information model to be used, whether all data in the archive should stick to the same version or if updated per instrument / data set.

- ❖ Requirements / recommendations for use of delivery transfer packages (i.e. AIP, SIP), being exercised by ESA/PSA.
- ❖ International validation strategy to be discussed. ISRO and ESA agree on the use of a single validation tool internationally; it seems that evolving the PDS Validate tool to an international validation tools would be the best option. Agreement by other international agencies needed.
 - Validation requirements seem in good state; syntax and semantic validation is properly covered by the Schematron; aspects of the PDS validation process not covered by the documents are detailed in the assessment spreadsheet
 - Clarification needed on how / if availability of registered products will be done (federated registries).
 - Some validation rules missing (e.g. version consistency with archive content, checksums in inventory files; see detailed comments in the spreadsheet.
 - Provide library instead of standalone application; recommendations related to this provided as comments in the spreadsheet. Discussion on need to go open source.
 - Confirmed readiness of the PDS4 validate tool for international use: Integrated as part of the pipeline process for product validation; need to exercise further bundle validation
- ❖ Recommendations and suggestions for tools (or features in existing tools) to support the preparation, archive, search and exploitation of planetary science data in PDS format (with focus in PDS4).
 - Data Dictionary Lookup Tool (now available! <https://pds.jpl.nasa.gov/tools/dd-search/> ; some suggestions on spreadsheet)
 - Label Generation (tools known: NASA/APPS; ESA/BepiColombo XLS2PDS)
 - Bundle generation tool (two tools currently known: NASA/APPS, ESA/PSA)
 - Visualization/Viewing Tools
- ❖ Need to compile list of other existing / planned PDS4 tools compiled
- ❖ Questions related to tools that we would like to discuss during the IPDA meeting:
 - How can IPDA promote some of these tools so that they are better known by the community?
 - The increasing use of python may require looking into some Python-based solutions
 - < Any additional question / topic for discussion, please let us know >
- ❖ CDF Guidelines / Resources compiled, including scripts from CDDP and PDS-PPI for generation of CDF/A data and for validation of compliance with PDS4.
 - To be exercised with BepiColombo MMO data (based on ERG project data)
- ❖ FITS Guidelines: How to translate FITS keywords into their PDS4 equivalents if the FITS file is already compliant with PDS4 structural and logical requirements. It also includes the most common circumstances that make a FITS file non-compliant with PDS4. http://borrelly.astro.umd.edu/wiki/Notes_for_Labelling_FITS_files

- ❖ Geometry data model. Some suggestions mostly related to:
 - Simplify the data model by using generic classes instead of specific classes (position and velocity vectors)
 - Footprint attributes to follow as much as possible existing formats e.g. polygons in GIS shapefiles; Clarify plans / possibilities to make GIS-compliant shapefiles part of the archive (e.g. geometry collection)
 - Include target information in Context files, rather than repeating the information in the Geometry metadata
 - Geometry working group being setup at ESA for discussion on planetary data geometry handling in PDS4 missions (ExoMars16 and BepiColombo), including generation of needed products to support GIS services

- ❖ Cartography data model: Only visual inspection done, need to exercise to provide better feedback. Documentation and examples would help to better understand the data model.

- ❖ Need of a framework to exchange resources, information, tools related to PDS4 (IPDA website?)

In addition, during the last IPDA telecon, it was agreed that the following topics would be clarified during the IPDA SC meeting:

- Explain current frequency of the PDS4 releases (every 6 months), and how to follow up major changes
- Explain PDS4 CCB, and international participation in the process (see CCB slides); Discuss how to improve international participation in this process. Proposal:
 - Summarise status of PDS4 standards / CCB issues during the IPDA telecons
 - Organise discussions on issues raised by the IPDA more frequently (follow-up issues raised in spreadsheet, analyse and discuss issues to be raised to CCB)
 - One representative for each agency to become part of CCB interested parties
- How agencies are dealing / planning to deal with different versions of PDS4

Statement for applicable version of the PDS4 standards in BepiColombo:

“All science data resulting from BepiColombo must be compliant with the NASA’s Planetary Data System (PDS) standards. The applicable version of the standards is PDS4 version TBC, dated TBC (corresponding to the PDS4 Information Model version TBC). Changes to the applicable version of the PDS standards — if required during the mission lifetime — will be documented in this section.

IMPORTANT: *The exact version of PDS4 applicable to BepiColombo will be agreed and fixed by the Data Handling and Archiving Working Group (DHAWG) two months before the first science data are acquired.*

Since PDS is incrementally releasing new versions of the PDS4 standards as it matures, the SGS is continuously monitoring the progress of the PDS4 releases and applying the required changes to this document and to the existing BepiColombo PDS4 schemas and templates. Progress reports are regularly provided to the DHAWG. Details of the PDS4 version currently in use in BepiColombo are provided below. ”