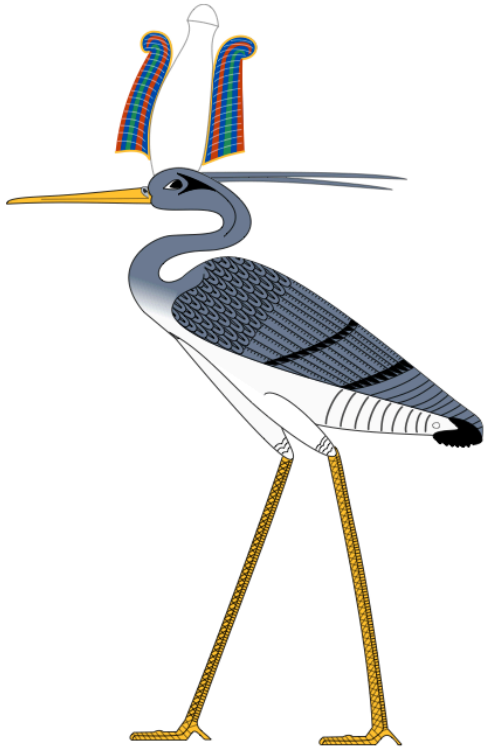
Small Bodies Node

Planetary Data System

PDS4 issues for OSIRIS-REx



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Background – O-Rex Mission Archiving Timeline

- Successful launch on Sept. 8, 2016.
- We are now doing internal (SBN/EN) reviews of pipeline products in preparation for the external pipeline reviews.
- Pipeline peer reviews mid-2017.
- In-flight peer reviews after EGA in mid-2018.
- Bennu pipeline deliveries begin mid-2019

Background - Organization of O-REx Archive

- One bundle per instrument, containing both raw and calibrated data
- Each bundle covers the duration of the mission for its instrument
- Collections organized by processing level
- Several bundles for higher level products and other specialized products such as RS.
- A bundle for the mission-wide materials
- O-Rex has a single mission data dictionary broken into classes by common mission, instrument, and scientific discipline items.

Background - Overview of O-Rex Product Types

- **2D arrays**: Science images, calibration images, science spectra, spectral calibration data.
- **3D arrays**: Science spectral arrays.
- **Binary tables**: LIDAR science tables, science spectral tables, housekeeping tables.
- **Character tables**: Calibration tables

Background – O-REx Review Planning

- Review panels mostly by instrument, but combine some instruments which require similar expertise.
- A panel typically has three external reviewers.
- Three review panels for pipeline instruments, one each for OCAMS, and OLA, and a combined panel for OVIRS and OTES.
- Separate review panels for other non-pipeline data, including REXIS, Bennu coordinate system, SPICE, RS, and higher level products.

O-Rex Experiences with PDS4 –

Review process

- Review planning process between SBN and O-Rex has gone well and we have set up a complete schedule of reviews for the duration of the review and archiving process.
- We introduced a new type of review, “Product design review”, to get feedback on science design issues from peer reviewers back to the mission before finalization of the product design. Product design reviews took place in 2015.
- Pipeline reviews have been delayed because discipline dictionaries are not ready to support O-Rex label design. We have worked around this temporarily by using the mission dictionary as a placeholder so work could proceed.

O-Rex Experiences with PDS4 –
Support for Label Development

- Basic support for labeling all product types is sufficient.
- Extension of types by discipline classes is immature and not adequate.
- Label design tools are helpful but require supplementation by O-Rex-produced code.
- Label generation was done by O-Rex-produced code.
- Documentation of label development process is inadequate.
- Details on the next slides...

O-Rex Experiences with PDS4 –
Discipline Dictionaries

- Discipline classes are immature and in many cases not yet ready to use.
- Changes and uncertainties create a moving target and cost SBN and the mission in re-work.
- Documentation of processes is inadequate. The best documentation is in the SBN PDS4 Wiki, but it doesn't cover everything.
- O-Rex archive team uses PDS4 Viewer heavily and suggested that it might be extended to enable easy inspection of data dictionaries, similar to the way it enables inspection of product label content.

O-Rex Experiences with PDS4 –
Label design and generation

- O-Rex used the NASA Ames LACE tool for initial label design.
- LACE tool is good but labor-intensive, so O-Rex archive team made preliminary design using LACE and produced their own code to generate final label templates for all product types.
- O-Rex briefly tried the EN Generate tool for label production, but found it difficult to interface to their database and instead created their own tool for label production.
- PDS4 Viewer has proved to be a valuable tool for O-Rex during label development. In addition to displaying image and tabular data, including translation of binary data tables, PDS4 Viewer also enables easy inspection of label content and provides a quick form of on-the-fly validation.
- In addition to its use in the archiving effort, O-Rex archive lead and archive developers say the PDS4 Viewer has become a popular tool across the mission for data product display.

O-Rex Experiences with PDS4 –
Validation

- O-Rex uses standard xml validation tools and Validate version 1.9.0.0 to validate labels and archives.
- O-Rex archive team reports that Validate does not catch all standards issues, leading to problems which are caught later by SBN. But this may be an issue with using it correctly. We are working to help them with their validation procedure. But this may indicate deficiency in the documentation.
- There is as yet no standard PDS-wide documented procedure for validation of labels, collections, and bundles, so there is no guarantee that validation will produce an acceptable archive standards-wise.

OSIRIS-Rex is an early user of PDS4 – Lessons learned

OSIRIS-REx is one of the earliest missions to be required to archive in the PDS4 standards, and has thus borne the greater burden of the PDS4 development process and changes. Naturally there have been setbacks and difficulties in this process; I have tried to capture here the lessons learned so far relating to tools and support.

The following is a list of the things that could still be improved based on SBN experiences with the OSIRIS-REx archiving process so far.

O-Rex Lessons Learned and Recommendations

- The O-Rex experience so far indicates that standards, processes, tools, and documentation all still need improvement.
- There are as yet no adequate published processes or procedures for PDS4 end-to-end archive development, so ad hoc procedures have had to be developed in detailed collaboration between SBN and O-Rex.

O-Rex Lessons Learned and Recommendations

- O-Rex has spent a lot of effort chasing a moving target of the changing standards, and SBN has used a lot of effort trying to help them. Standards should be stabilized and care should be taken to protect ongoing missions from the necessary changes that do occur.
- The detailed process for label and archive design is not yet well documented. Data providers will need more process-oriented documentation to help with label design and generation.

O-Rex Lessons Learned and Recommendations

- Validation is a work in progress and not yet well documented.
- It would be helpful to have a documented PDS-wide standard procedure for validation of labels, collections, and bundles, which could be also used by missions to validate prior to delivery.

O-Rex Lessons Learned and Recommendations

- Discipline dictionaries are not yet sufficiently mature for use by data providers, and this has hampered O-Rex label design.
- Descriptions of attributes in the discipline dictionaries should be reviewed and improved by actual end-users to insure that users will understand what they mean.
- Documentation of discipline dictionaries and how to use them needs to be improved.

Thanks! Questions?