

OSIRIS-REX PLANETARY DATA SYSTEM ARCHIVE IMPLEMENTATION. M. K. Crombie^{1*}, D. S. Lauretta² and the OSIRIS-REx Team ¹Indigo Information Services, LLC, Tucson, AZ, USA ²Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ, USA (*crombie@indigoinfos.com)

Introduction: The OSIRIS-REx team is dedicated to long-term preservation of the mission science data in a form that will be useful to future researchers. The OSIRIS-REx Planetary Data System (PDS) archive is implemented as bundles for each instrument, DSN radiometric data, SPICE, higher-order data products bundled by scientific discipline (altimetry, astrometry and photometry, image processing, radio science, spectral processing, regolith development, and thermal analysis), and two special product bundles, a sample-site selection bundle that contains the data products used to make the site selection and a remote-observations bundle that contains data and pointers to Bennu observational data collected by team members from ground- or space-based telescopes. Each bundle contains data collections grouped by data processing level and by time interval. Each PDS bundle also contains a document collection, a context collection, and a schema collection to provide the appropriate ancillary information to properly interpret and use the data. The OSIRIS-REx archive is designed to and implemented in the PDS4 standard.

Instrument-Specific Science Bundles: The instrument specific science bundles comprise the OSIRIS-REx uncalibrated data products derived from science telemetry and ancillary data, and the calibrated data products derived from uncalibrated data products. Uncalibrated and calibrated data products are produced by the OSIRIS-REx Science Processing and Operations Center (SPOC) using a validated, configuration-controlled data processing pipeline built from validated algorithms passed to the SPOC from the instrument teams. The data processing pipeline is validated both by the OSIRIS-REx team and further by a PDS-led peer review, followed by a lien resolution period.

Instrument specific data bundles comprise data and documentation collections that include science goals for specific measurement sequences, instrument description files, calibration reports, data processing methodology, and data anomaly reports. The following paragraphs are short descriptions of each of the instruments standard data products.

OSIRIS-Rex Camera Suite (OCAMS): OCAMS data consist of images and ancillary data of temperatures and voltages recorded during remote operation. Image and ancillary data are reduced using software developed or implemented by the OCAMS and Image Processing Working Groups. Test and calibration data are also included in the dataset to allow a recalibration of all three cameras. Image and ancillary data are formatted in PDS-compliant image and table formats. Uncalibrated data are raw images with associated ancil-

lary data. Calibrated data are geometrically, radiometrically and spectrally corrected images with associated ancillary data.

OSIRIS-REx Laser Altimeter (OLA): The data from OLA consist of scanning lidar data with instrument derived timing, pointing, and mechanical status. OLA data are reduced using software developed at the Applied Physics Laboratory and the Canadian Space Agency/McDonald Dettwiler and Associates/York University. Uncalibrated data are lidar footprints with associated instrument timing, spatial and temperature information. Calibrated data are lidar footprint data that are geometrically calibrated to yield asteroid shape information.

OSIRIS-REx Visible Infrared Spectrometer (OVIRS): The data from OVIRS consist of visible and near-infrared point spectra and ancillary instrument data. Data reduction is straightforward and includes bias and background removal, as well as spectral calibration. Uncalibrated data are raw OVIRS spectral data. Calibrated data are radiometrically calibrated spectral data and instrument temperature trend data.

OSIRIS-REx Thermal Emission Spectrometer (OTES): OTES data consist of thermal infrared interferograms and ancillary instrument data. Radiometric calibration is provided by periodic views of space and an internal calibration flag. Uncalibrated OTES data are raw voltage spectra with ancillary instrument data. Raw interferograms will not be archived. Calibrated OTES data are radiometrically-calibrated spectra with associated instrument data.

Regolith X-ray Imaging Spectrometer (REXIS): As a student collaboration experiment, REXIS will be incorporated into OSIRIS-REx operations on a non-impact basis and will remain clearly separable from the rest of the OSIRIS-REx investigation. Data analysis will be handled as a student project, available to both Harvard and MIT students, for credit or non-credit within the MIT curriculum, and within the MIT Undergraduate Research Opportunities Program. Only raw REXIS telemetry sorted into science observations and housekeeping data will be archived to the PDS.

Touch and Go Camera Suite (TAGCAMS): TAGCAMS is a camera suite that consists of the navigation camera (NavCam), the natural feature tracking camera (NFTCam) and the stowage camera (Stow-Cam). TAGCAMS data consist of images and auxiliary data of temperatures and voltages recorded during remote operation. Images are not calibrated; they are simply observations reconstructed from raw telemetry and appended with appropriate timing and spatial metadata. Housekeeping observations are converted

from DN values to physical units and packaged by time. As TAGCAMS cameras are all spacecraft engineering components, calibrated data products are not necessary for their primary mission function, as such calibrated data products will not be produced.

Deep Space Network (DSN) Radiometric Data: This data set comprises DSN tracking data as well as the ancillary files necessary to interpret and analyze the tracking data. Data products to be archived are TRK-2-34 files, DSN light time files, DSN media calibration files, and DSN weather data.

SPICE: The Navigation and Ancillary Information PDS Node will archive all SPICE kernels used by the OSIRIS-REx Mission. Archived kernels will include leap second kernels (LSK), spacecraft clock kernels (SCLK), planetary constants kernels (PCK), ephemeris and trajectory kernels (SPK), orientation kernels (CK), frame kernels (FK), instrument kernels (IK), digital shape kernels (DSK), and event kernels (EK). Other kernels may be added as mission progresses.

Derived Products: Higher-level products are bundled by discipline area. The bundles contain collections of derived data products. Higher-level OSIRIS-REx derived data products are produced at the SPOC using software developed by subject matter specific working groups consisting of subsets of the OSIRIS-REx Science Team. Science Team members are assigned to the working groups based on area of expertise and interest.

Special Products: The OSIRIS-REx team has identified two types of special derived-science bundles: remote asteroid observations and sample site selection data products. During proposal development and in the years leading to asteroid encounter several OSIRIS-REx science team members have made ground- and space-based observations of Bennu. These observations include visible CCD images, visible spectra, near-infrared spectra, radar data, Spitzer data, astrometry data, and orbital elements and ephemerides. Data that are not routinely ingested into other public data archives will be ingested into the PDS using standard, well-defined procedures on a predefined schedule. Data that are available in other archives will be cataloged, so that users can see the complete set of OSIRIS-REx Science Team ground-based observations.

The second bundle of special derived science data products identified is the group of derived data products from which the sample site selection is made. These data products may not be the ultimate data set for science purposes, but they are the operational data set from which the site selection was made. The sets of Science Value, Sampleability, Deliverability, and Safety Maps will be archived, along with an explanation of how these data products were produced. The data products that are inputs to the Sampleability, Delivera-

bility and Safety are also expected to be included in the sample-site special product.

Table 1. OSIRIS-REx Derived Products

Bundle	Derived Data Product
Altimetry	
	Topographic Map of Asteroid
	Asteroid Shape Model
	Asteroid Properties (Pole, Coordinate System,
Astrometry & Photometry	
	Color Index Photometry
	Phase Function Photometry
	Satellite Orbits & Ephemeris
	Temporal & Phased Light curves
Image Processing	
	I/F Images
	Pan Mosaics Maps, Projections
	Color Maps, Projections
	Color Ratios, Maps, Projections
	Stereo Products
Radio Science	
	Co-Orbital Dynamics
	Gravity Field Model
	Spin State
	Spherical Harmonic Coefficients
	Slope Map
	Asteroid Ephemerides (Final)
Spectral Processing	
	Spot Products
	Mineral and Chemical Abundance Maps
	Dust Cover Index Maps
	Bond Albedo Maps
	Rotationally Resolved Mineralogy and Chemistry
	Plume and Satellite Spectral Characteristics
Regolith	
	Geologic Maps
Thermal	
	Thermal Inertia Maps
	Temperature Maps

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