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A Systems Engineering Approach to Planetary Data Archive Development

Archive System Planning

- Data returned from NASA Planetary missions are the scientific legacy of these endeavors.
- NASA requires all missions to archive raw and calibrated scientific instrument data and encourages derived data products.
 - Missions have used many methods to fulfill this requirement.
- A systems engineering approach looks at the archive as an integral part of the complete mission system.
 - Includes the archive-lifecycle development from proposal through delivery.
 - Integrates archive development into mission planning and operations
 - Ensures the archive is developed in coordination with mission requirements, mission operation objectives, and the ground data-processing system

Archive Scientist

- Appoint a Mission Archive Scientist to be responsible for archive planning and development.
 - Act as interface between the project, instrument teams, ground data system and PDS.
 - Inform and enforce mission-wide metadata standards or spatial data infrastructures.
 - Reduce risks through end-to-end mission planning.

Requirements and Product Traceability

Requirements
Development



Data Products
Traceability Matrix

- Level-1 and Level-2 science requirements are developed to address the scientific objectives of the mission.
- Level-2 science requirement satisfying data products are often derived products that require input or analysis of lower-level products.
- Use a traceability matrix to map the derived Level-2 products to the lower level products.
- Use the traceability matrix to develop the DMP.

Data Product Traceability Matrix

Req Number	Level-2 Science Requirement	Level-2 Mission Requirements Meeting Data Product	Input Products	Processing Environment	Working Group
MRD -1	For a 3-sigma error ellipse around each candidate landing zone, produce a topographic map at spatial and vertical resolution of <50cm	Local Digital Terrain Model	Altimeter Raw Data	LIDAR Cal Processing	LIDAR Instrument Team
			Altimeter Reduced Data	LIDAR Cal Processing	LIDAR Instrument Team
			Altimeter Calibrated Data	LIDAR Cal Processing	LIDAR Instrument Team
			Object mass	RS Mass Calc.	Radio Science Team
			Object gravity	RS Gravity Calc.	Radio Science Team
			SPICE Kernels	SPICE	Mission Team

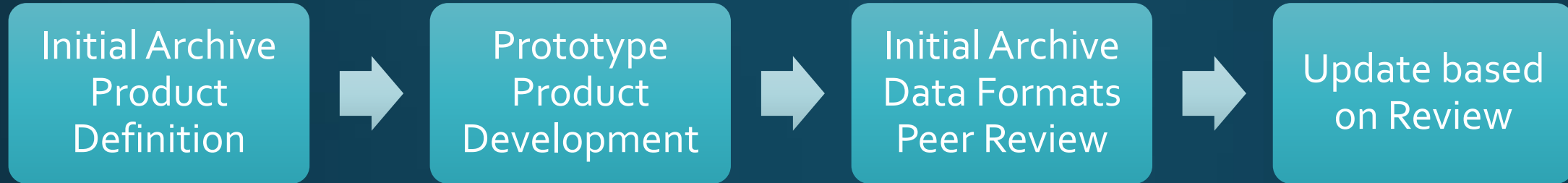
- Identifies the links from high-level derived to the lower level data products
- Links to the mission observation plan.
- Identifies interfaces between software processing environments
- Identifies interfaces between mission working groups or instrument teams

The Data Management Plan

Data Management Plan

- Contains a top-level description of the mission data processing elements, their roles and responsibilities, and relationship to one another.
 - This includes the data processing required to produce the data products that meet the mission Level-2 science requirements.
- Outlines the relationship between the mission and the PDS.
 - **Early and regular communication between the mission and PDS aids archive development**
 - Includes archive development, peer review and delivery schedules

Archive System Development



- Identify product formats and develop your prototype products.
 - Develop draft archive documentation
- Initial review is used to make sure the plan is reasonable before getting too far down the development path.
 - Useful with the change from PDS₃ to PDS₄ Standards
 - Identify any holes in planned products, metadata, or ancillary information.

Archive Pipeline and Delivery



- Develop an automated data processing pipeline.
 - With the pipeline, develop a CM plan with your Node
- With planning and reviews/testing completed prior to nominal data collection, the delivery review should go smoothly, allowing for the archive to be made public rapidly.

Summary

- A systems-engineering approach sees the archive as an integral part of the mission system.
- Mission science requirements inform archive design.
- Early planning and review results in a comprehensive, scientifically useful archive.
- Communication between the mission and the PDS is essential.