

Long Term Digital Preservation

20April2018

MOIMS-DAI Responding to MOIMS Plenary tasking:

Please discuss in your WG how MOIMS standards could be injected into the LOP-G programme and how we could be more influential in that forum.

Issues/concerns addressed

- What is long term preservation and
 - how does it differ from archiving as the term is used in space mission operations (i.e. the incumbent processes)?
- What is the value of long term preservation beyond mission ops archiving?
- Can the requirements for long term preservation be supported by mission ops archiving (i.e. can designs for incumbent architectures be extended or is a new architectural element required)?
- What MOIMS standards are available or in process for addressing those requirements?

Arguably, the over-arching purpose of space exploration has always been to record data.

- The Gateway will likely require a data utility beyond simple file management, to support individual missions.
- If mishandled (or not handled at all) data and results from all supported missions will be at risk.
- This shared data utility has conventionally been termed the Archive
 - Whether prefixed OPS or Mission or Platform
 - Intended for immediate, real-time or NRT access
 - Usually involving aging, staging (or purging) of contributed data (files)
 - **Mission Payload** data (“Science data”) not always included but Ops data content is essential to use of Payload data

Lessons Learned (History)

- OPS data archives are intended to hold and serve data to operational processes.
- When data is no longer needed for operations, it may be discarded as no longer useful.
- The prior lunar program, Apollo, incurred significant long-term loss of invaluable mission data.
 - Apollo Moonwalk video has been partly reconstructed from degraded network video, at considerable expense
 - Apollo Science data from the ALSEP (Apollo Lunar Science Experiment Package) is being only partially recovered with great effort (partially permanently lost).
 - NASA Mission telemetry has been completely lost for Skylab, Apollo-Soyuz, Apollo, Gemini and Mercury programs.
- **The next lunar program should have a better track record of preservation for the benefit of following programs and future generations.**

Mission OPS focus

- LOP-G should bring requirements for new standards to fit the LOP-G needs
- Requirements should include Long-Term Data Preservation
- Preservation Requirements must be addressed in initial Platform Development and Ops phases and passed down to individual missions.
- All missions must address data preservation
- Prematurely terminated missions should include preservation and handover of intermediate data (including design and engineering data, if applicable) as source for potential lessons learned information.

CCSDS Standards for Long Term Preservation are universal

Current Standards

- CCSDS 650.0-M-2 Open Archival Information Systems – OAIS
- CCSDS 652.0-M-1 Audit and certification of trustworthy digital repositories)

Initially championed by the Space community

- These standards are now being applied to repositories in many fields of endeavour.
- The first repository awarded certification to the preservation requirements of ISO16363 was an archive of mixed 'born digital' and born analog audiovisual holdings being preserved as cultural heritage.

Future of Long Term Preservation for CCSDS

We have demonstrated how the Space community can apply the OAIS concepts to Mission Ops activities in draft specifications such as

- Producer-Archive Interface Methodology Abstract Standard (PAIMAS) and
- The Produce-Archive Interface Standard (PAIS) which provides an abstract syntax and an XML implementation of descriptions of data to be sent to an archive.
- We are currently drafting Information Preparation to Enable Long Term Use (IPELTU) that should be directly applicable to LOP-G Development and Operations
- Preservation Data Architecture and Interoperable Protocols are a new direction in CCSDS, **which should be informed by LOP-G Requirements**.and interactions with the appropriate CCSDS committees.

Implications of CCSDS Standards

In an OAIS Repository, data that is collected or created must have Additional Information associated with it to insure it will be independently understandable, usable and trusted as being authentic over the long term.

- This information usually falls under the labels [Representation Information](#) and [Preservation Description Information \(PDI\)](#)
{2nd Preceding Hotlink includes usage specific examples of PDI}
 - Some (perhaps most) of the information would be recorded as part of normal OPS
 - Some helps insure quality and integrity of the data
 - Some helps insure interpretability, utility, usability
- For Long Term Preservation, a Designated Community would be identified to specify the PDI needed. The Designated Community is defined and changes to their preservation requirements are monitored by the OAIS Repository

Notional Functional Flow

- Engineering plans and schedules
- Mission status feeds (TLM, Anomalies, Payload states,...)
- Payload and Mission Products

Depending upon Long Term requirements, all feeds will likely include some RI and PDI

OPS Archive

(Analogous to Staging)
Prepare and transmit
Submittal Information
Packages
(SIPs)

Ad hoc and planned responses
to support ops and currently
active missions

Distribution Information
Packages (DIPs)
to missions,
external interfaces,
or OPS Archive

OAIS Repository