Archiving 40+ years of Planetary Mission Data - Lessons Learned and Recommendations

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Planetary Missions

- Mariner Mars 6 & 7, 1969[1]
- Mariner Mars 9, 1971-2[1]
- Pioneer Venus, 1978-1992[1]
- Voyager 1 & 2, 1977-1989[2]
- Galileo Jupiter, 1989-2001[2]

[1] Archived at National Space Science Data Center (NSSDC)

[2] Archived at Planetary Data System (PDS) Atmospheres Node

Lessons and Recommendations

- NASA needs a Mission Document Archive to recover old mission documents
- Hardware, Software and Migration issues
- Metadata from early stages is frequently lost
- Save science observation design documents
- Leftovers - what else is important to save?
- A trained archivist should be part of the team
- Consider post mission time and dollars for archiving
- More PDS Node funding for better response

NASA needs to Establish a central Mission Document Archive and recover old mission documents

- Spacecraft Hardware and Software knowledge resides in these documents - they can be essential to data recovery and or later use
  - clock definitions, data handling and timing
  - spacecraft configuration, instrument specifications, commanding, engineering and computer subsystems
- Science teams routinely discard them as members retire or move and institutions clean house
- NASA should use its grant list to solicit submissions

Hardware, Software and Migration issues

Maintain a NASA technology center for recovering data from old machines and storage devices

When designing mission products, consider future usability

- Documentation: both product and within code
- Backward compatibility
- Non-proprietary software with readable file formats

I suggest PDS creates a new catalog item to containing ASCII samples of each type of archived data product so migration can be verified.

Metadata from early stages of a mission are frequently poorly recorded

Time and energy demands on the science and operations teams can leave few document trails

- The exhilaration of ‘first data’, verifying instrument operation, turn-around PR, new observation designs
- Instrument microprocessors improve science flexibility but changes can impact science and engineering formats, timing, data stream contents, ground handling, archive products; they are rarely archived
- Spacecraft glitches: computer memory bit hits, fault protection, contingency planning

Archiving science observation designs improves data recovery and use

- These describe the scientific objective, detail the instrument configuration, target body and pointing strategy
- Many Project planning design products are not archive friendly due to unique software packages and complex data files
- Observation graphics, with adequate descriptions, are good browse products

Leftovers - what else is important to save?

- Engineering data
- Photographs, newspaper articles, video presentations, digital press products
- Command sequences (routine and real time)
- Instrument operation journals - will the SPICE EK work?
- Scientist's journals
- Other digital material

These are not usually PDS archive items

A trained archivist should be part of the team - at all levels

- An archivist whose main duty is to recognize, document and archive essential information should be an active team participant.
- Should be trained in the archive procedures and formats where data is to be archived (PDS, NSSDC, etc) to reduce time and costs
- Ideas
  - Part-time archivist with other support duties
  - Institution provided professional archivist / educator
  - Collaborative or Professional Society service

More post mission time and dollars need to be allocated for archiving

- Real-time archiving of down linked (raw) data within 24 hours is now mandatory
- Most achievable reduced data is not available until there is a sizeable data set from which to analyze results so these products usually come later or post mission; calibrated data is different from publication level products
- Catalog metadata describes the entire mission
- Like JDAP do we need JARC for post mission preservation?

More PDS Node funding for better response

More timely data ingestion and faster peer review would give quicker public access, for post mission data too

- Because publication quality data, and therefore archiving, frequently comes after the funded mission period is complete, the PDS Node to receive the data frequently has newer missions with higher priority so newly archived data from retired missions fall to the end of the PDS ingestion line.
- Another reason for JARC?

Credits

Thanks to the many science team members, NASA Headquarters and PDS node people, librarians and archivists who not only supported the mission work but encouraged the careful preservation of years of planetary mission data.