Charting the Course:
Life Cycle Management of Mars Mission Digital Information

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Society of American Archivists Annual Meeting
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August 22, 2003
Getting to Mars is a Challenge

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<th>USSR/Russia*</th>
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<td>15</td>
<td>4</td>
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<td>3</td>
<td>3</td>
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<td></td>
<td>-</td>
<td>8</td>
<td>0**</td>
<td>8 (2 LV)</td>
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<td>18</td>
<td>23</td>
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* Japanese Nozomi mission is expected to arrive in Dec 2003

** Mars 3 in 1971 apparently transmitted for 20 sec after landing but no significant information was returned
Mars Exploration Rover Recipe

- Start with Mars Pathfinder design
- Add Athena Payload
- Make rover independent of lander (new design)
- Combine
- Repeat for second rover
Information Life Cycle and Design of Mars Exploration Rovers

- Mars Exploration Rover design was dependent on:
  - Reuse of Mars Pathfinder design and Athena Rover payload
  - On-line information system to capture, manage, and preserve new digital design files
Information Life Cycle and Design of Mars Exploration Rovers, cont'd

- Designed information life cycle workflow to emulate migration path of information from creation to preservation
- Developed on-line system to manage information beginning in project formulation through project completion
Mars Exploration Rover Project
Information Life Cycle

Primary Use

Create

(Phase 2)

Capture

(Phase 3)

Maintain

(Phase 4)

Preserve

(Phase 1)

(Phase 6)

Secondary Use

disseminate

validate

appraise

reuse

reuse
Information Life Cycle: 
Reuse (Phase 1)

Rover Project team needed to quickly access and reuse past project information

- Reviewed mars project archival collections in hard copy and digital formats and identified pertinent materials
- Captured digital information in on-line, web-accessible system
  - Collected native files whenever possible
- Created physical repository for hard copy and a/v materials
Information Life Cycle:
Create (Phase 2)

- More than 95% of Rover Project files in digital formats
- Files are in institutionally supported, standard native and web-viewable formats
  - MS Office files, PDF, HTML, CAD, JPEG, GIF, TIFF, MPG, AVI, RM, etc.
Information Life Cycle: Capture (Phase 2) cont’d

- Project information system environment built on standard institutional tools and components
  - Digital library tailored to include additional descriptive records management and archive metadata
- Project teams trained on how to use systems and what information needed to be captured
Information Life Cycle:
System Architecture – Capture (Phase 3)

Project Information System Components:
- HTML Pages
- Digital Project Library
- Science Documents
- Engineering Database
- Drawings
- E-mail Archive

Other Information Resources:
- External Project Website
- Parts Database
- Project Team Websites
- PFR System

MER Project Website

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Information Life Cycle: Capture (Phase 3)

- Digital Project Library architecture
- Intuitive system design readily adopted by users
Information Life Cycle: Digital Library - Capture (Phase 3)

User View

Project User

Submit

Search & Retrieve

Institutional User

Archives Management View

Work Area

File Deposit

Controlled Docs. & Recs.

Heritage Collections

Archive

QA

• Document
• Metadata

Supersede, Obsolete, Archive

In-process appraisal

Archive Process

Release
Information Life Cycle:
Metadata - Capture (Phase 3)

Add File

Required Fields

Title: Mars Exploration Rover - Spacecraft Functional Requirements
Document: C:\Documents and Settings\rei
Max Versions: 150
Author: Richard Welch
Cover Date: 03/15/2001

Optional Fields

Summary: Rover Functional Requirements Document (FRD)
Description: This document is part of a rover design series that includes requirements, design, specification, and test documentation.
Information Life Cycle:  
- Metadata - Maintain (Phase 4)

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Information Life Cycle: Why Archive Project Information?

- To support project activities throughout its life cycle and to enable reuse of information by future projects
- Institutional and Project Archive Requirements:
  - NASA/Caltech/JPL archive requirements
  - Provide material needed to construct a Project history
  - Assist with analysis of in-flight anomalies
  - Enable the generation of lessons learned
  - Support proposal work, studies, project start-up by providing reusable information and examples
  - Save the institution time and resources through information reuse
Information Life Cycle: 
In-Process Appraisal (Phase 5)

- In-process archival appraisal involves:
  - Reviewing Project information stored in the Project’s information systems to determine what should be preserved. Appraisal process occurs throughout the Project’s life cycle, especially at phase transitions (e.g., concept study > formulation > design > build > launch > operate).
  - Filling-in gaps where information is missing
  - Tagging archival information to facilitate exporting
Information Life Cycle:
In-Process Appraisal (Phase 5) cont’d

• Questions to ask during in-process archival appraisal:
  – Is the information the outcome of planning, designing, managing, and monitoring by the Project?
  – Is the information critical in supporting administrative, technical, and scientific processes throughout the Project’s life cycle?
  – Does the information have technical, administrative, or legal reuse value?
  – Is the information in a useable format?
Information Life Cycle: Archival Information Types

- Information needed to construct a Project history
  - Documentation that captures decision rationale, trade-offs, studies, risk assessment, descoping, replanning, and significant milestones, including
    - Action items
    - E-mail
    - Monthly/quarterly management reports and reviews
    - Design reviews
    - Plans
    - Outreach materials
Information Life Cycle: Archival Information Types

- Information that is useful to analyze in-flight anomalies/failures:
  - Requirements
  - Problem/Failure reports
  - Reliability analyses
  - Hardware drawings and specifications
  - As-built lists
  - Engineering change requests
  - Design description documents
  - Test and integration data, notes, scripts
  - Vendor design data packages
Information Life Cycle: Preserve (Phase 6)

Users upload files

Archivist reviews documents

Technical, programmatic, or institutional value?

Yes

Write files to CD-ROM

No

Dispose/delete from server

Distribute CD-ROM archive set

Institutional Archive Repositories

Vellum Files

Project Library Archive

JPL Archives
Information Life Cycle: Preserve (Phase 6) cont’d

- Project Archivist responsible for developing Archive Plan and agreements with institutional systems providers for transfer of MER archival information
- Files are transferred to institution for long-term storage at end of project
  - Will be mapped to NASA file categories, migrated to other formats/media, and eventually transferred to NARA
Conclusion

- Life cycle management of MER Project information was an essential key to the successful launch of the MER Project rovers.
- Incorporating digital information archive requirements early in the project life cycle resulted in:
  - Design of information system that included archive metadata
  - Reduced the risk of information loss through in-process appraisal
  - Easier transfer of project information to institutional online archive
  - Project appreciation for preserving information for re-use by future projects
The rewards...

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http://mars.jpl.nasa.gov