NASA Science Data Management

Scientific Data Management Workshop

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NASA Mission

To pioneer the future in space exploration, scientific discovery, and aeronautics research

- **Space Operations Mission Directorate**  Extend the duration and boundaries of human space flight to create new opportunities for exploration and discovery

- **Exploration Systems Mission Directorate**  Direct the identification, development, and validation of exploration systems and technologies

- **Aeronautics Mission Directorate**  Enable a safer, more secure, efficient, and environmentally friendly air transportation system

- **Science Mission Directorate**  Exploring the Earth-Sun system, our own solar system, and the universe beyond
The Science Mission Directorate

Earth Science
Study Earth from space to advance scientific understanding and meet societal needs

Planetary Science
Advance scientific knowledge of the origin and history of the solar system, the potential for life elsewhere, and the hazards and resources present as humans explore space

Heliophysics
Understand the Sun and its effects on Earth and the solar system

Astrophysics
Discover the origin, structure, evolution, and destiny of the universe, and search for Earth-like planets
**Science Computation and Information Management**

**Goal:** *Provide comprehensive and robust infrastructure of data, computing, and modeling resources to maximize scientific productivity and knowledge enhancement*

**Key Challenges:**
- Multitude and diversity of missions
- Volume, richness, complexity, and breath of types of data
- Increasingly interdisciplinary nature of research
- Science cultural diversity
- Evolution: New technology and innovation
- Balancing competing constraints for open access vs. security/asset assurance
Science Data Management

Key Policy Objectives
- Stewardship responsibility for the preservation and utilization of science data assets as a national resource
- Open Data: Universal access and availability to science community, educators, and general public

Key Elements
- Project Data Management Plans: developed at onset of project describing data flows and delivery to public archive
- Timely delivery of data to public archives is a key performance measure throughout life of mission

Approach
- Each science division responsible for its data environment, often through partnerships with other federal agencies and international partners
- Coordination and federation as appropriate under auspices of SMD Chief Scientist
# Science Mission Data Lifecycle

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<th>Mission Operations</th>
<th>Science Data Operations</th>
<th>Research Operations</th>
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<td>Data Capture and Initial Processing</td>
<td>Science Data Processing</td>
<td>Archival &amp; Distribution</td>
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<td>Generate time-ordered science data stream with transmission artifacts removed</td>
<td>Calibration, other corrections, and generation of higher level data products</td>
<td>Ingest data products, metadata and supporting documentation</td>
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<td>Mission Control and Data Handling Facilities</td>
<td>Mission Pipeline Processing Systems</td>
<td>Mission Data Archives</td>
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<td>Science Investigator-led Processing Systems</td>
<td>Science Discipline-oriented Data Archives</td>
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**Key Instantiations:**
- EOSDIS Data Centers
- Planetary Data System
- Astrophysics Science Archive Research Centers
- Heliophysics Data Environment: Solar Data Analysis Facility, Space Physics Data Facility
Lessons Learned/ Best Practices/ Future Vision

- One Size Doth Not Fit All:
  - Top-down mandates not generally effective
  - Organize by science discipline and allow for diversity and tailored implementations

- Clarify roles, responsibilities, requirements, “Rules of the Road” and other guidelines in management handbooks, Announcements of Opportunity, etc.

- Continuous User Involvement:
  - Science-driven around communities of practice
  - External working groups provide guidance and feedback

- Evolve the infrastructure to enhance quality, accessibility, and utilization of science data holdings
  - Provide advanced computational methods, algorithms, data management and analysis techniques, etc. through open calls that engage computer science and technology communities
  - Support archival data exploration for retrieval and analysis of mission datasets, as well as broader fusion and cross-correlation with other observations, datasets, theoretical models, etc.