Developing the Next Generation of Science Data System Engineers

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Science Data System Challenges

- Architect smarter, flexible and scalable data systems:
  - Simplify components with common science data processing functions to ease evolution with emerging technology while maintaining connectivity with archival science data.
  - Standardized public data access interfaces of central & distributed sources.

- Increase science findings and practical applications by enabling cross-discipline use of science data.

- Standardize the fundamentally required content and structure:
  - Common depiction of time, location and accuracy.
  - Increasing complex remote sensors and in-situ sensors from spacecraft, aircraft and space networks.
  - Encompass data complexities of research and application discipline communities.

Data System Engineer Challenges

- Play an increasing role in developing metadata and data products.
  - Adapt data processing and integration of science algorithms to an evolving computer industry.
  - Depicting discipline specific attributes for multiple types of observational data.

- Utilize attributes that can become common across science disciplines and observation systems.

- Working with increasingly complex science data, multiple datasets and diverse sources requires a skilled workforce.

- Take technical training focused in data science and new technologies.

- Develop next generation science data systems that can serve multiple science disciplines, diverse observational data and model output.

Duties/Skills

- Works in-depth on a data system component development or operation
- Server with specific science or instrument team
- Offers cross-training in science and computer technologies
- Develops and operates specific components of an instrument data system
- Integrates and tests instrument algorithms
- Manages mission science data collections
- Participates in professional societies
- Works on collaborative US agency programs
- Leads technical activities of interdisciplinary engineers developing an instrument or data system component
- Oversees data center development, tracks costs and schedule, technical constraints
- Leads standards development efforts
- Serves as an instructor or data management program
- Serves as NASA representative to other US Agencies
- Oversees development for a mission or multi-mission science data system
- Plans and administers projects of national or international importance.
- Establishes long-range agendas for development of large new unusually complex systems
- Responsible for resource requirements, policies, procedures and budgets
- Leads International projects

Knowledge

- Looking for degrees in the following areas:
  - Physical Science
  - Astronomy, Astrophysics
  - Geology
  - Hydrology
  - Meteorology
  - Oceanography
  - Physics
  - Computer Engineering
  - Software data storage
  - Human Resources Management
- Problem Solving
- Responsible for resource requirements, policies, etc.
- Flexibility
- Physical science algorithms, modeling components, Geographic Information Systems
- Standard data formats (CCSDS, HDF, CDF, FITS)
- Knows how to integrate new technologies into current systems.
- Thorough knowledge of:
  - Science Data structures
  - Programming languages
  - Operating systems
  - Applications techniques
  - Service oriented architectures
  - Off-the-shelf and open source software (e.g., RDMS, GIS)
  - Hardware systems
  - Knows science and engineering concepts, practices:
    - Levels of processed data (0, 1, 2, ...)
    - Orbital mechanics, instruments
    - Map projections (Lat/lon, RA/DEC)
    - Instrument calibration techniques/algorithm
    - Validation techniques
    - Physical science algorithms, modeling systems, Geographic Information Systems
    - Standard data formats (CCSDS, HDF, CDF, FITS)

Pathways and Perspectives

- Project Management expertise
- Partnering/Teaming
- Focus
- Hydrology
- Serves with specific
- Software data storage
- Human Resources Management
- Problem Solving
- Responsible for resource requirements, policies, procedures and budgets
- Leads International projects

Suggestions on how to find a career path:

- Confident, don’t be afraid to change,
- Challenge yourself, don’t be afraid to change,
- But the following fields of expertise are also useful:
  - Remote Sensing
  - Mathematics
  - Physical geography
  - Human geography
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  - Remote Sensing
  - Mathematics
  - Physical geography
  - Human geography

Career Track Guidance

Suggestions on how to find a career path:

- Seek out a career path that fits your goals and will be most satisfying to you:
  - Your individual interests, skills, and training will dictate the path you should follow.
  - Over time, modify your path based on personal interests, values, goals, experiences, and new opportunities that present themselves.

Science & Technology Development

- Instrument Software Data Systems
- Flight & Ground Data Systems
- Systems Engineering
- Data & Information Management
- Systems Thinking
- Integration
- Collaboration
- Distributed data systems
- Flexible science data storage, data formats, data policies and standards
- Data science data storage, data formats, science metadata
- Recognized Subject Matter Expert
- Science Domain
- Data Center systems and operations
- Data Management
- Data Manipulation and Services
- Extensive understanding of instrument and physical science discipline data formats, analytical methods, computations science
- Extends discipline knowledge boundary
- Project Management expertise