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 remotes 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.

Career Path at NASA/GSFC

Engineer
- Works in-depth on a data system component development or operation
- Serves with specific science or instrument team
- Offers cross-training in science and computer technologies

Journeyman Engineer
- 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

Senior Engineer
- Leads technical activities of interdisciplinary engineers developing an instrument or data system component
- Oversees data center development, tests costs and schedule, technical constraints
- Leads standards development efforts
- Serves as an instructor or data management
- Serves as NASA representative to other US Agencies
- Participates in International projects

Principal Engineer
- 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

Pathways and Perspectives

Mission & Organization Awareness
- Goal, Strategy & Policy
- Software Standards
- Adherence e.g. CMMI, Discipline Standards Awareness e.g. CCSDS, ISO19115, HDF

Personal Mastery
- Soft skills
- Mission specific technical skills
- Interpersonal skills
- Oral/Written Communication
- Influencing/Negotiation
- Partnering/Teaming
- Political Savvy
- Presentation/Marketing Skills
- Organizational Representation & Leadership
- Working within a Team

Duties/Skills

Very often our candidates have been contractors

Knowledge
- Looking for degrees in the following areas:
  - Physical Sciences
  - Astronomy, Astrophysics
  - Geology
  - Hydrology
  - Meteorology
  - Oceanography
  - Physics
  - Computer Engineering
- But the following fields of expertise are also useful:
  - Remote Sensing
  - Mathematics
  - Physical geography
  - Human geography

Superior

Strategic vision
- Change Management
- Risk Management
- External Awareness

Outlook Oriented
- Customer Orientation
- Decisionmaking
- Problem Solving
- Quality Principles
- Resource Management & Stewardship
- Technology Management
- Creativity & Innovation
- Results Orientation
- Process Oversight
- Management
- Program Development, Planning & Evaluation

Coach/mentoring
- Team Building
- Conflict Management
- Human Resources Management
- Diversity Awareness
- Situational Awareness

Suggestions on how to find a career path:
- Based on personal interests, values, goals, and current systems.
- Partner a mission or multi-mission science data system.
- Look at existing systems, Geographic Information Systems techniques/algorithms software
- Work in a discipline
- Head standards development efforts.
- Gain expertise in science disciplines, diverse observational datasets
- Open source software
- Work with instrument algorithms
- Tests instrument algorithms
- Software data storage
- Instrument calibration
- Operations
- The past few years
- Reviews science data, data formats, science metadata
- Recognized Subject Matter Expert
- Science Domain
- Data 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
  - Software engineering design and development methodologies
  - Agency information processing policies and standards
  - Science data system architectures, science data storage, data formats, science metadata
  - Recognized Subject Matter Expert
  - Science Domain
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