2021 AA&S CONFERENCE

National Airworthiness Council (NAC) Keystone Panel

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Agenda

- NASA Digital Transformation Initiative
- Flight Demonstrations and Capabilities
- Issues
- ARMD Flight Data Portal
- Lessons Learned
- Summary

Digital Transformation at NASA

Digital Transformation (DT) Initiative

- Provides a coordinated effort to achieve purposeful agency DT
- Led out of the Office of the Chief Technologist (OCT) in partnership with the Office of the Chief Information Officer (OCIO)
- Conducted as a research program … flexible … follow the learning
- All areas are included:
  - Engineering
  - Science
  - Research
  - Operations
  - Administration

It is assumed DT will never be complete

Flight Demonstrations and Capabilities

Aeronautics Research Mission Directorate (ARMD)
Flight Demonstrations and Capabilities (FDC)

- Conducts complex and integrated small-scale flight research demonstrations in support of ARMD programs
- Operates, sustains, and enhances specific flight research and test capabilities necessary to address and achieve:
  - ARMD Strategic Plan and program/project activities
  - Other NASA mission directorate activities
  - National strategic needs

FDC has recognized/acknowledged that the issue of test data management and availability is an agency capability, not only a local capability

Test Data Management Issues

- NASA's contributions in aeronautical research and discovery are well documented in numerous publications
  - Access to the data behind the publications is often difficult to obtain and use
- ARMD projects operate in a more distributed and collaborative environment
  - Multiple test data repositories exist
    - Each has unique data management, records management, and IT security solutions
    - End of life issues: One example, the NASA Armstrong Flight Data Archive System (FDAS), in use since the early 1980s
  - Limited access to and awareness of the existing data
  - Descriptive information required to make data usable is often not stored with the data and has been/may be lost over time
- Upcoming X-plane projects
  - Require secure flight data archive that allow NASA civil service, contractors, and partners to remotely access flight data
  - Require all information to interpret test data to be readily accessible
  - Require appropriate controls and restrictions to properly protect International Traffic in Arms Regulations (ITAR), Export Administration Regulations (EAR), Controlled Unclassified Information (CUI), company proprietary, and pre-patent information

ARMD Flight Data Portal Project

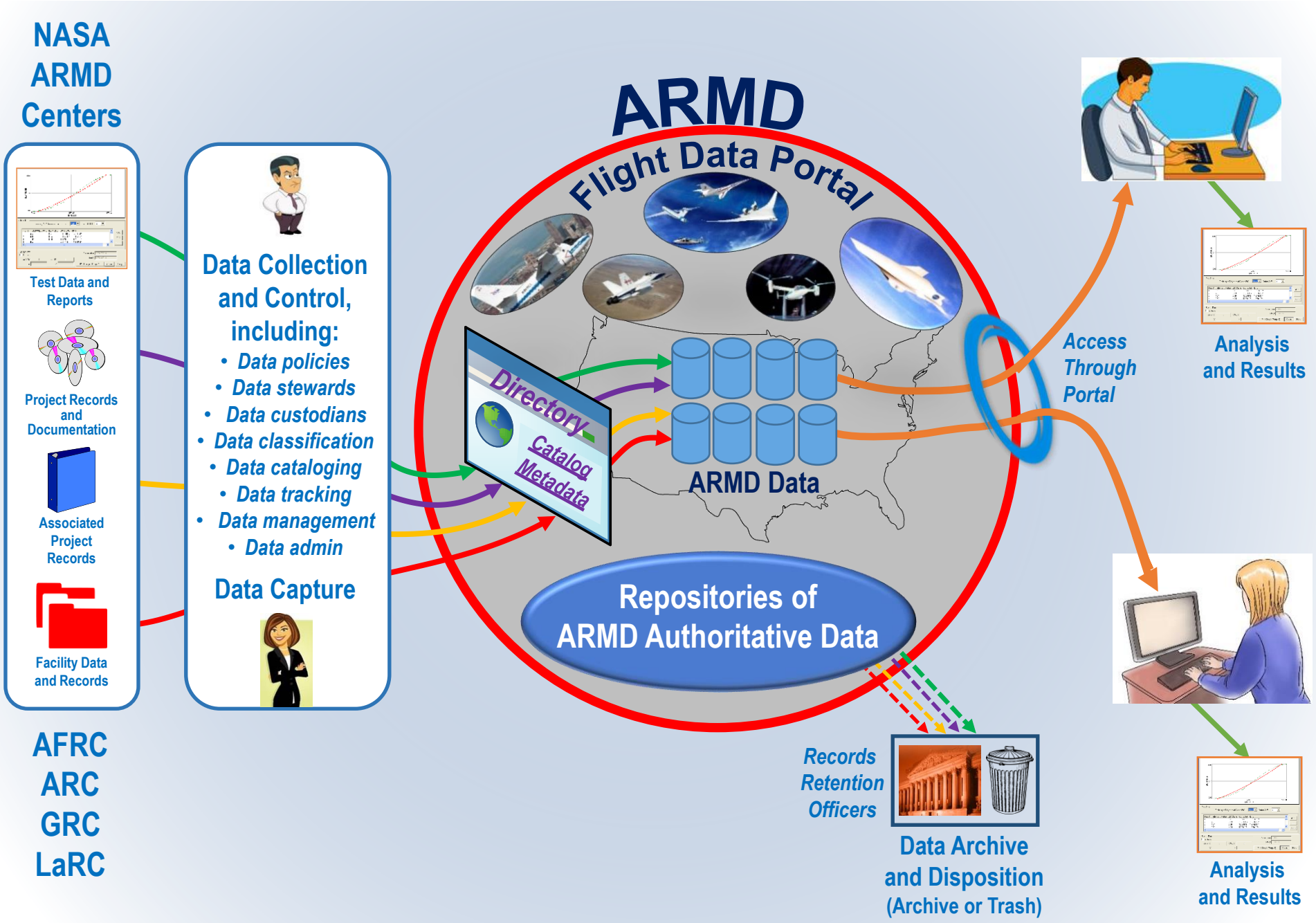
To address these issues, the FDC project initiated the ARMD Flight Data Portal (AFDP) project:

- One of FDC Capabilities Challenges, designed to directly support FDC goals
- Support the larger NASA initiatives in DT as it pertains to data discovery and availability through a service-based architecture
- Enhance flight research and test capabilities by improving the management of ARMD flight test data
- Initiated in June 2016

ARMD Flight Data Portal Goals

- Provide the agency with a user-friendly, web-based integrated portal for effective storage and retrieval of test data and associated mission-related information
- Provide the agency with a collaboration apparatus for ARMD test data
- Provide access control to data through the application of appropriate security methodologies
- Provide a system that is sustainable and maintainable
  - Custom loosely coupled software solution based on open-source technologies
    - Java-based open-source technologies
    - May be run on bare-metal, virtual machines, or in a cloud
- Out of scope:
  - General public access
  - Handling of classified data

ARMD Flight Data Portal Operational View



Phase I – Limited Initial Operating Capability

- X-57 project support as pilot program
- Security
  - Access control and authentication to AFDP system via NASA Launchpad/SiteMinder
  - NAMS workflow to access AFDP system
  - Access control structure in place to support securing CUI data to include
- Initial metadata schema and implementation
- Portal with “full” graphical user interface (GUI) for select user profiles
  - Basic search capability via flight, record type, metadata keyword
  - Front-end interface for Flight Test Data Processor (FTDP)
- Flight Test Data Processor (FTDP)
  - FDAS replacement
  - Limited data toolset to include AFRC FDAS-like synchronization of different sample rates and time slice selection of parameters
  - Scripting of data analysis/access
  - HDF5 flight data file format in repository – replaces CMP4 completely
  - Output file formats (to user) in HDF5 only
- User's guide and training manuals/videos to use Portal/EA and FTDP
- Data/AFDP use process
- Identify high-value future use cases/needs and data analysis tools for implementation in future phases via user focus group(s)

Future Phases

- Feature-driven approach with a six-month development cycle
- Prioritize and support additional flight test data (FTD) formats
  - Multi-source time slice capability
  - Integrate ARMD flight data repositories from AFRC, LaRC, GRC, and ARC
- Add document repository to include flight test-related data
  - Flight data, annotated flight cards, parameter list with description, flight reports/summaries
  - Supported document repository links to drawings, flight test plans, photos, videos
- Expand metadata standard to include custom optional fields as required by other centers
- Advance search capability
  - Intelligent search based on users' behavior and trending searches
- Web-based data analysis and visualization tool sets to include at least three high-value tools as identified by user focus group (e.g., X-Y plotting, parameter magnitude search)
- Port legacy AFRC flight data to HDF5 format and storage of that data in the AFDP system
- Processes to allow vetted external partners to access the portal

Lessons Learned

Make vs. Buy

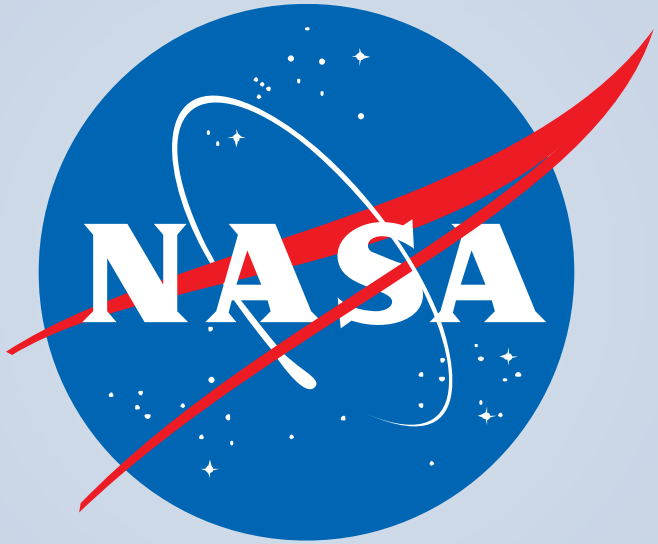
- Development of needs, goals, and objectives early
- Develop the pros and cons of in-house development vs. COTS
  - Pros: software ownership, avoids vendor lock-in, custom feature development
  - Cons: high initial cost, requires DevOps support staff long term
- Conduct early trade studies of Commercial Off The Shelf (COTS) solutions
  - None satisfied the FDAS replacement capability requirement
- Acknowledge your best solution may not be the least expensive

Developing the Systems Engineering (SE) Approach

- Project desired to use Agile SE approaches
  - Can allow a greater level of communication between development team and stakeholders during system development
- Requirements to work within current NASA SE processes and structure
  - Tailored a hybrid Waterfall-Agile (WAgile) approach
  - Increased workload
  - Introduction to the wider community of agile concepts

Summary

- NASA has a DT Initiative
- In support of the DT Initiative, the AFDP is transforming the way data are archived
  - Enables enterprise-level data discovery, accessibility and protection of flight test data
  - “One-stop shop for customers who need flight test data”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