A Case Study to Examine Technical Data Relationships to the System Model Concept

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Systems Engineering focuses on engineering excellence – the creative application of scientific principles:
- To design, develop, construct and operate complex systems
- To forecast their behavior under specific operating conditions
- To deliver their intended function while addressing economic efficiency, environmental stewardship and safety of life and property

**DASD(SE) Mission:** Develop and grow the Systems Engineering capability of the Department of Defense – through engineering policy, continuous engagement with component Systems Engineering organizations and through substantive technical engagement throughout the acquisition life cycle with major and selected acquisition programs.

A Robust Systems Engineering Capability Across the Department Requires Attention to Policy, People and Practice
DASD, Systems Engineering

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University, FFRDC and Industry Engineering and Research
Modeling and Simulation

Major Program Support
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Mission Assurance
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Specialty Engineering (System Safety, Reliability and Maintainability Engineering, Quality, Manufacturing, Producibility, Human Systems Integration)
Counterfeit Prevention
Technical Workforce Development Standardization

Providing technical support and systems engineering leadership and oversight to USD(AT&L) in support of planned and ongoing acquisition programs
Purpose

• The system model will integrate (a TBD subset of) program data into a complete description of the system.

**Issue**: Current DoD acquisition activities typically generate or maintain a single, integrated authority/artifact (aka system model) for a TBD subset of program data. Further, relevant data between acquisition activities is not accurately unified.

**Vision**: Use of a single model (aka system model) as an evolving, cohesive representation and unifying instantiation of the program under conceptualization, development, manufacture, and/or support:
• will increase efficiency of DoD system acquisition lifecycle activities, and
• increase confidence in decisions made regarding an acquisition program when the single (system) model (data) for that program is used.

**Method**: A system model will be instantiated by using artifacts and processes which already exist, or are already required by DoD acquisition policies, guidance, and best practices.

**Outcome**: It is a framework for “technical communication”. The system model will be used by anyone performing activities related to the program as it evolves across the acquisition lifecycle, including but not limited to defining requirements, trading design aspects, designing, engineering, cost budgeting, staffing, manufacturing, fielding, training, sustaining, and disposing. The resultant system model will integrate program data into a complete description of the system.

• Case Study Purpose
  – Examine the technical data acquired by three major programs
  – Examine the challenges associated with integrating technical data to support the system model concept
Technical Data

Technical Data - Recorded information, regardless of the form or method of the recording, of a scientific or technical nature (including computer software documentation). The term does not include computer software or data incidental to contract administration, such as financial or management information. Source: DFARS 252.227.7013

Product Data - All data created as a consequence of defining (requirements), designing, testing, producing, packaging, storing, distributing, operating, maintaining, modifying and disposing of a product. Source: Army PEWG, based on ANSI/EIA-649-B-2011

Technical Data Package
Includes:
- Drawings / Models
- Lists – Inspection / Test Equipment
- Software Documentation
- Interface Control Documents
- Engineering Product Structure

TDP - A technical description of an item adequate for supporting an acquisition strategy, production, and engineering and logistics support. The description defines the required design configuration or performance requirements, and procedures required to ensure adequacy of item performance. It consists of applicable technical data such as models, drawings, associated lists, specifications, standards, performance requirements, quality assurance requirements, software documentation and packaging details. Source: MIL-STD-31000

Source: DAG Chapter 4
Defining Data Requirements

Sample CDRL

- Statement of Work (SOW)
  - Defines work to be performed
- Contract Data Requirements List (CDRL) (DD Form 1423)
  - Standard format for defining data requirements
  - Attachment to the contract
- OMB Approved Document
  - Data Item Description Document (DID)
  - Each CDRL must reference a DID
Overview of Case Study Programs

- Three programs pre-Milestone C

- These programs were selected based on
  - Availability of and access to technical data
  - Collaboration to manage program technical data and use in developing a system model
    - Communications- Electronic Command Logistics and Readiness Center (CECOM LRC)
    - Naval Surface Warfare Center Port Hueneme Division (NSWC PHD)
Case Study Overview

- DASD(SE) collaboration with
  - CECOM LRC
  - NSWC PHD

- Integrated, managed, and assimilated technical data into a system model for specific SE activities

**SE Activities**

1. Configuration Management
2. Trade-off Analysis
3. Supportability/ RAM-C analysis
4. Predictive and Root Cause Analysis
5. Traceability of all decisions and analysis
Case Study Approach

- Leveraged the system model effort to understand technical data relationships to the system model concept

• Case Study Approach
  - Identified minimum data requirements to enable system model concept
  - Baselined data procured via contracts
  - Reconciled and integrated data from CDRLs and DIDs
  - Utilized integrated COTS product lifecycle management technology
  - Examined challenges
Captured CDRL technical data for each program

Army Surveillance and Reconnaissance System
Navy Electronic Warfare System
Marine Corps Vehicle Missile System

CDRLs/DIDs

Mapped CDRL technical data to Data Taxonomy

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Identified technical data acquired by the programs

Need to further define what data are needed at what phase to support what analysis/activity.
Overarching Findings

- Incomplete understanding of the data’s intended use
- Lacked data validation and use of data to perform analysis
- The information within the technical data deliverables were not integrated
- Inconsistencies found in the data because information is maintained in different systems and managed by different teams
- Decisions and tradeoffs were not traceable to the technical data
- Information was not timely—decisions were already made
Conclusion

• Gov’t did have access to needed data
• Challenges primarily in integrating and using the data in a timely fashion to support decisions
• Required an integrated technology environment

Future Work

– Expand scope to define what technical data are needed throughout the lifecycle
– Further refine the system model definition
– Identify a pilot program to test the “system model”
The Product Data Interactive Tool was developed by CECOM LRC to help programs determine technical data needs.

Functional capabilities in work:
- User friendly Microsoft Access Application
- Identifies technical data and data rights of DIDs
- Identifies data needed to support milestone requirements, technical reviews, and key events
References

• Defense Acquisition Guidebook

• DoD 5010.12-M, "Procedures for the Acquisition and Management of Technical Data"

• DoDI 5000.02, "Operation of the Defense Acquisition System"

• Technical Data Rights Strategy (2012 Army Guide)

• Technology Development Strategy/Acquisition Strategy

• Lifecycle Sustainment Plan

• Intellectual Property Strategy
For Additional Information

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Systems Engineering: Critical to Defense Acquisition

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