



Understanding and Delivering the System Model

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**Office of the Deputy Assistant Secretary of Defense
for Systems Engineering**

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DASD, Systems Engineering Mission



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

- ***US Department of Defense is the World's Largest Engineering Organization***
- ***Over 99,000 Uniformed and Civilian Engineers***
- ***Over 39,000 in the Engineering (ENG) Acquisition Workforce***



DASD, Systems Engineering



DASD, Systems Engineering
Stephen Welby
Principal Deputy Kristen Baldwin



Systems Analysis
Kristen Baldwin (Acting)

Addressing Emerging Challenges on the Frontiers of Systems Engineering

Analysis of Complex Systems/Systems of Systems

Program Protection/Acquisition Cyber Security

University, FFRDC and Industry Engineering and Research

Modeling and Simulation



Major Program Support
James Thompson

Supporting USD(AT&L) Decisions with Independent Engineering Expertise

Engineering Assessment / Mentoring of Major Defense Programs

Program Support Reviews

OIPT / DAB / ITAB Support

Systems Engineering Plans

Systemic Root Cause Analysis

Mission Assurance
Vacant

Leading Systems Engineering Practice in DoD and Industry

Systems Engineering Policy & Guidance

Development Planning/Early SE

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



Problem Statement



ISSUE: Current DoD acquisition activities do not develop, 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 adequately shared.

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.



DAG Chapter 4 and Modeling, Simulation and Analysis Fundamentals



- **Section 4.1 Introduction**
- **Section 4.2 Systems Engineering Activities in the Life Cycle**
- **Section 4.3 Systems Engineering Processes**
- **Section 4.3.19 Tools, Techniques, and Lessons Learned**
 - 4.3.19.1 Modeling and Simulation - Models and simulations are SE tools used by multiple functional area disciplines during all life-cycle phases. Modeling is essential to aid in understanding complex systems and system interdependencies, and to communicate among team members and stakeholders. Simulation provides a means to explore concepts, system characteristics, and alternatives; open up the trade space; facilitate informed decisions and assess overall system performance.



DEPARTMENT OF DEFENSE
ACQUISITION MODELING AND SIMULATION WORKING GROUP
Systems Engineering Modeling, Simulation, and Analysis Fundamentals

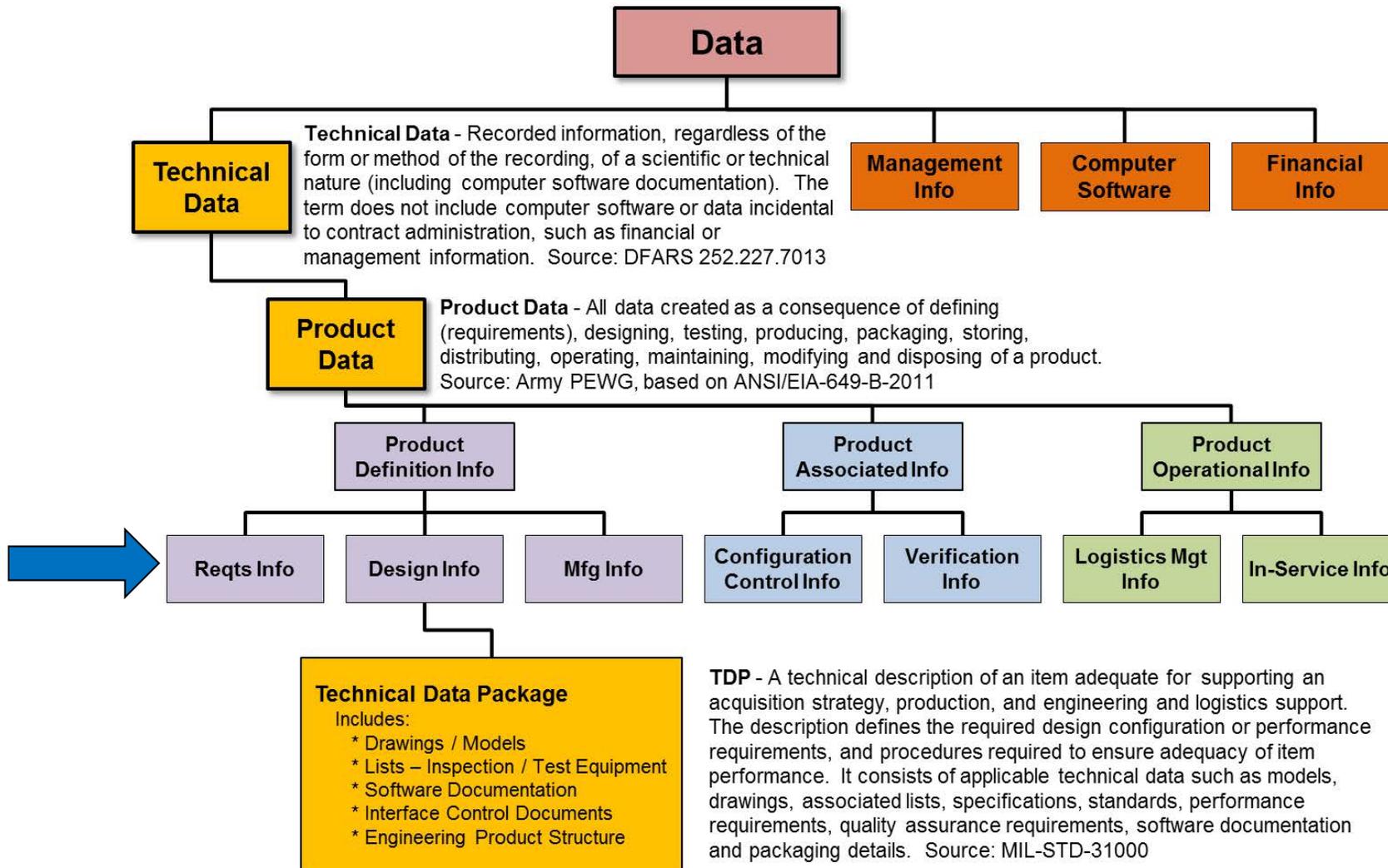
1. The responsibility for planning and coordinating program modeling and simulation efforts belongs to the Program Manager and may be delegated to the Program Systems Engineer and other program staff as appropriate.
2. Modeling and simulation efforts are included in the systems engineering effort as part of program/project, analysis of alternatives, risk management and cost and schedule planning. Modeling and simulation efforts include identifying metrics that relate the use of modeling and simulation to cost savings and risk reduction.
3. Systems engineers use models to define, understand systems of systems interactions, communicate, assess, interpret, and accept the project scope; to produce technical documentation and other artifacts; and to maintain "ground truth" about the system(s).
4. Programs should identify, develop, and maintain a system model to support acquisition.
 - a. The scope of the system model should support the program objectives.
 - b. Unless impractical, the program should develop the system model using standard model representations, methods, and underlying data structures.
 - c. The system model is a product of both system and design engineering efforts. The program should construct the model by integrating data consumed and produced by the modeling and simulation activities across and related to the program. The program should confirm the model baseline at appropriate technical milestones.
 - d. The program should construct depictions of system concepts developed in support of technical reviews using the system model as source data.
 - e. The system model should include, but should not be limited to, parametric descriptions, definitions of behaviors, internal and external Interfaces, cost inputs, and traces from operational capabilities to requirements and design constructs.
 - f. The system model should be a part of, and should evolve with, the program development baseline. The system model should be integrated throughout the program life cycle and across domains within a program's various phases through disposal.
 - g. The system model can provide source data for the program to use to construct executable models to support system trades; optimizations; design evaluations; system, subsystem, component, and subcomponent integration; and other analysis such as cost estimations.
 - h. The program should update the system model throughout the program life cycle. This includes the feedback from empirical tests. Capturing these updates to the system model will provide continuity among the program modeling and simulation users and activities. During the development and construction of models and simulations, the program should ensure the models will be applicable to other program areas such as training and testing.
5. The development of models, construction of simulations, and use of these assets to perform program definition and development activities (to include pre-MDD, and pre-milestone A) requires collaboration among all project stakeholders.
6. Proper use of modeling and simulation throughout the acquisition life cycle is critical for program success. The program should provide sufficient training tailored to the user community to support the appropriate use of modeling and simulation. The program should identify metrics and track the metrics to support the linkage between the training and increased support to the program.
7. Modeling and simulation provides critical capabilities to effectively deal with issues including but not limited to interoperability, joint operations, coalition operations and systems of systems across the entire acquisition life cycle.
8. Models employed in acquisition activities should be credible, and the program should use the models while acknowledging a level of risk appropriate to the application (see DoD Instruction 5000.61, DoD Modeling and Simulation (M&S) Verification, Validation, and Accreditation (VV&A)).

Version 2.5, July 2013

www.acq.osd.mil/se/docs/SE-MSA-Fundamentals.pdf



DAG Ch 4: Technical Data Management Process





Who Are the Stakeholders?

Systems Engineering

Analysis

Sustaining

Training

Decision Making

Test and Evaluation

Program Management

Source Selection

Business Management

Systems Architecting

Senior Leadership

Program Protection

Life Cycle Logistics

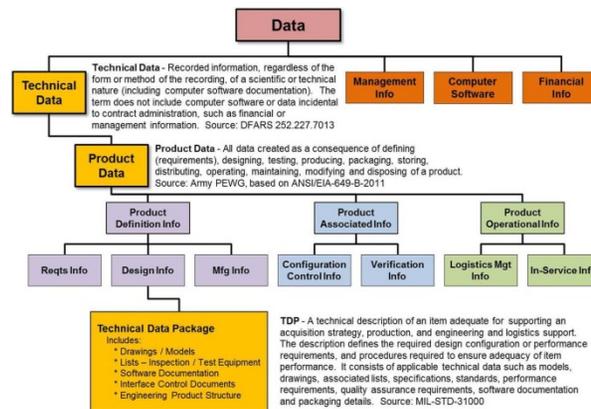
Affordability

Production

Human Systems Integration

Design

Documenting



Need to identify the value propositions to/from stakeholders and others that contribute to system model

- *Participants need tangible benefits for making contribution – carrot not stick*



What Is In Work?

- **Approaches to building the template; aka ‘the structural view’**
 - Via Program Manager/Staff needs
 - Acquisition via system model vs. acquisition via documentation
 - Via activity performers
 - Identify the activities supported by model / simulation
 - Via acquisition decision maker information needs
 - Process, milestones, reviews (policy is back burner)
 - Via Tool vendors
 - What do they already support?
- **Identify stakeholders**
 - Identifies who, and what is important in the exchange



What Is In Work?



- **Socialize and educate**

- Working on opportunity basis with Services, Agencies, Industry groups, etc.
- Remember – modeling and simulating are tools within SE toolkit
 - so make the modeling and simulating education/training part of SE education/training

- **Find the example activities**

- Engineered Resilient Systems
- Service/Agency successes in Programs of Record, and support activities



For Additional Information



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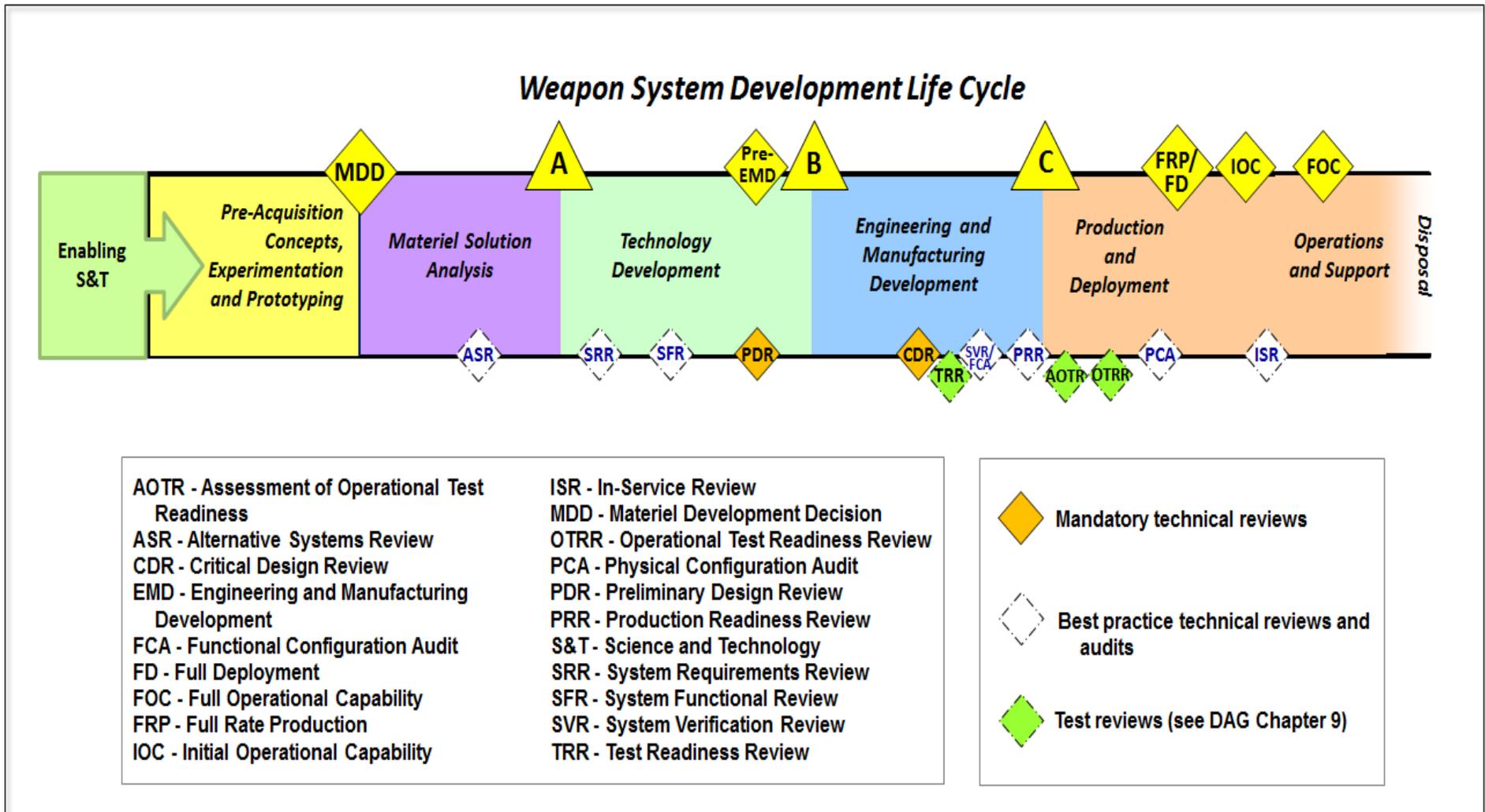
Systems Engineering: Critical to Defense Acquisition



Innovation, Speed, Agility
<http://www.acq.osd.mil/se>



DAG Ch 4: Weapon System Development Life Cycle





DAG Ch 4: Various Applications of Modeling and Simulation



Modeling and Simulation in the DoD Acquisition Life Cycle "Weapon System Development"

