



# **DoD Strategy for Cyber Resilient Weapon Systems**

**Melinda K. Reed**

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

**NDIA Systems Engineering Conference  
October 2016**



# Goal



## **Goal: Improve resiliency of weapons system designs to cyber attack\***

- **Action: Develop a new enclosure to the 5000.02\***
  - DTM-118: Cybersecurity and Program Security in the Defense Acquisition System
- **Action: Review system security engineering design processes and methods and recommend standardization or other approaches to improve cybersecurity of designs\***
  - DASD(SE), in partnership with the Services, CIO, other stakeholders have identified multiple activities to improve security of engineering designs. An opportunity exists to collaborate, mature efforts, and move toward common approaches

## **Key Objectives:**

- Determine set of engineering design patterns, standards and methods for cyber resilient weapon systems, addressing both systems in development and systems in sustainment
- Establish a foundation to grow the engineering practices and strengthen engineering agility

**\*extract from Better Buying Power 3.0 Implementation Guidance**

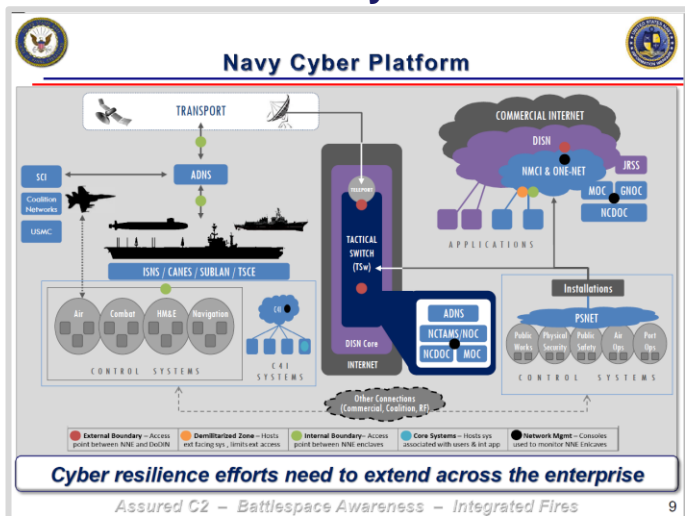


# Military Departments Are Responding



Each MILDEP is moving forward to meet its organizational needs

## Navy



## Army

**Cyber Integrator Application**

Home Cyber Integrator Admin JFAC Portal

| Compliance   |               |          |         |          | Recommended Guidance         |          |      |        |      |          |
|--------------|---------------|----------|---------|----------|------------------------------|----------|------|--------|------|----------|
| Requirements | Documentation | RMF      | Testing | MEC      | Evaluation Criteria          | SWA      | VA   | AT     | EW   | SCS      |
| MSA          | Done          | Done     | Done    | Done     | Requirements Defined         | On Track | Done | Done   | Done | On Track |
| TMRR         | Done          | Done     | Done    | Done     | Contractual Language Defined | On Track | Done | Behind | Done | Done     |
| EMD          | On Track      | On Track | Behind  | On Track | Plan Defined                 | Done     | Done | Behind | Done | Behind   |
| P&D          | NS            | NS       | NS      | NS       | Cost Planned                 | On Track | Done | N/A    | Done | Done     |
| SUS          | NS            | NS       | NS      | NS       | Other                        | Done     | Done | N/A    | Done | Done     |

## Air Force

| LOA1: Mission Threat Analysis                       | LOA2: Integrate into SE Process   | LOA3: Cyber Workforce Development   | LOA4: Enhance Adaptability   | LOA5: Develop Common Security Environment   | LOA6: Assess and Fix Legacy Systems   | LOA7: Intelligence for Cyber Security   | Mission Assurance End State   |
|---|---|---|--|---|---|---|---|
| End-to-end operational process supporting a mission | Incorporates systems security engineering into all phases of the acquisition life cycle | A cyber-savvy workforce capable of integrating cyber security measures into all phases of the acquisition process | Vigorously enhances the adaptability of our weapon systems to rapidly respond to threats | Facilitates the integration of cyber security measures into all phases of the acquisition process | Prioritizes legacy systems to fix existing and future cyber vulnerabilities | Strengthen acquisition cyber security through improved intelligence collection, analysis, and application | High Confidence Missions<br>Resilient Systems<br>Common Processes<br>Educated Workforce |

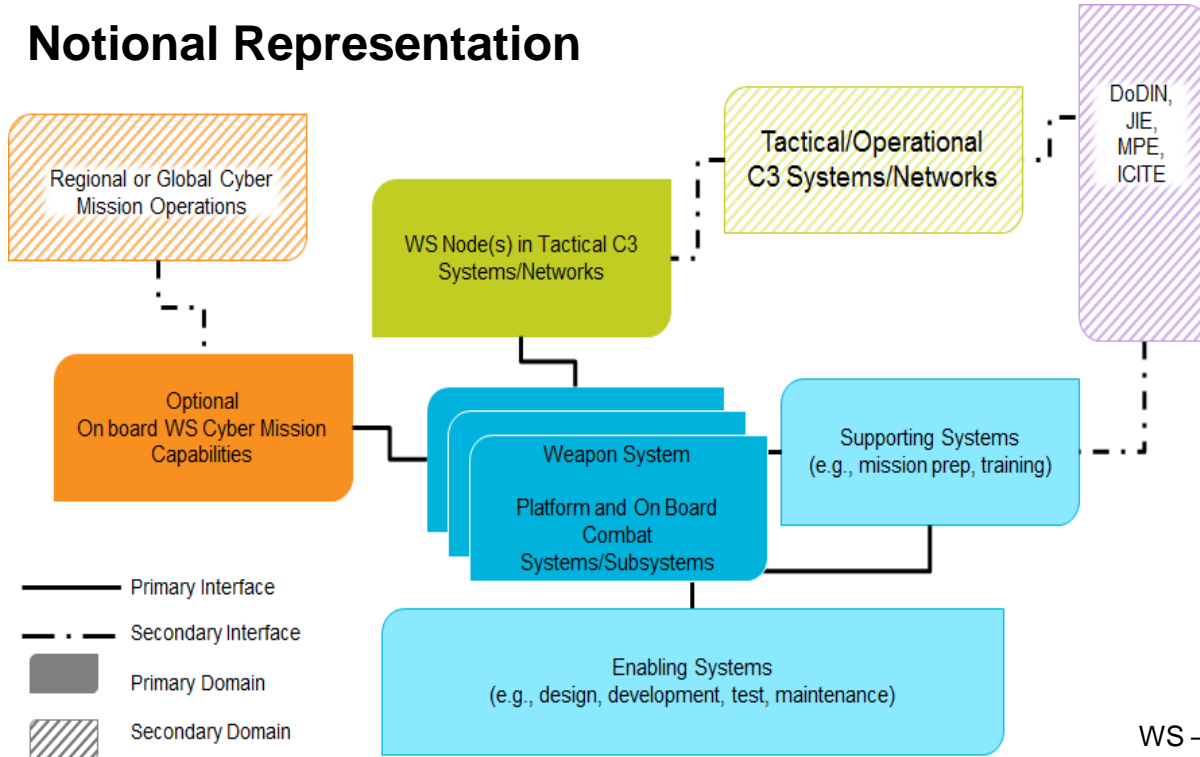
**An Opportunity Exists Across the Services to:**

- Collaborate
- Mature efforts, and
- Move toward common approaches



# Weapon System Complexity

## Notional Representation



**The Engineering approach is driven by the following constraints:**

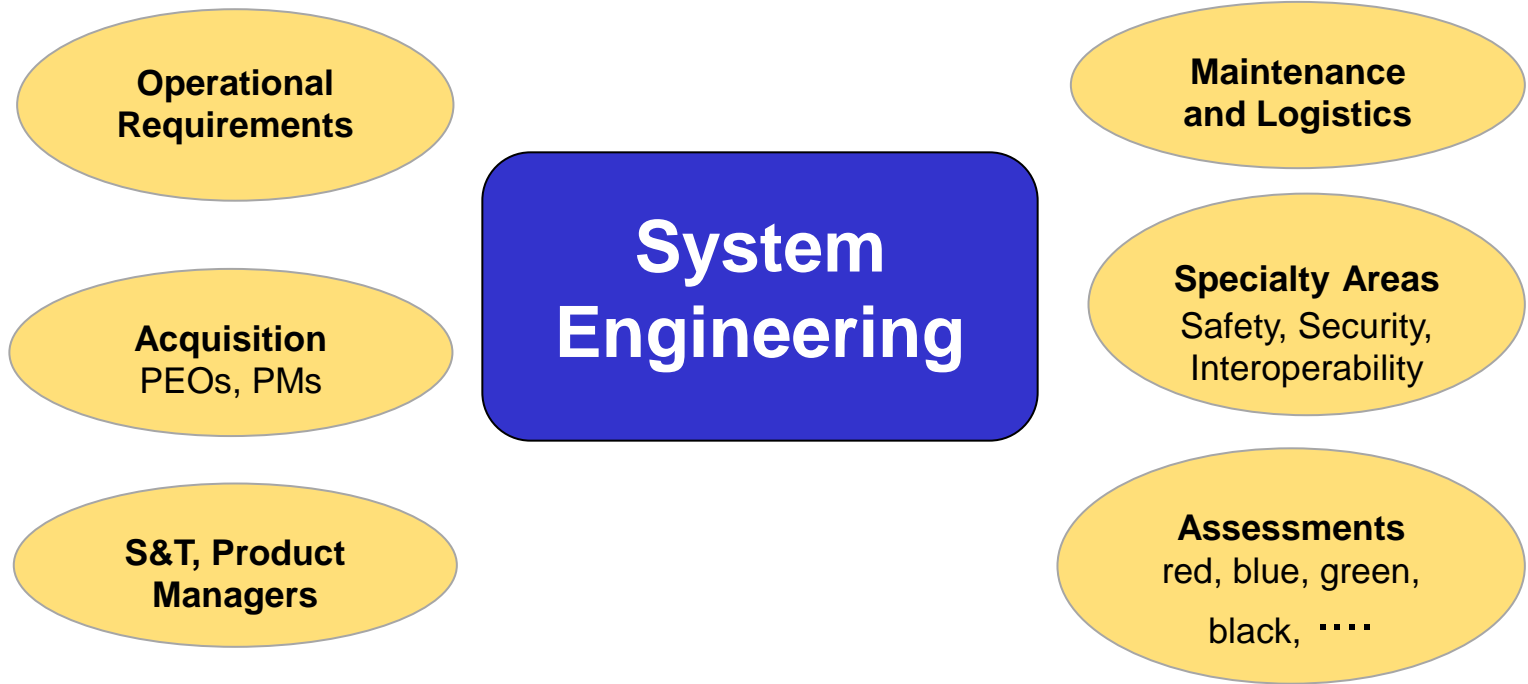
- **Complexity**
- **Performance requirements**
- **Operational**

WS – Weapon System  
 C3 – Command, Control, Communication  
 JIE – Joint Information Environment  
 MPE – Mission Planning Environment  
 ICITE - Intelligence Community Information Technology Enterprise

**Weapon System(s) can be complex – performance requirements and operational environment must also be considered**



# Many Stakeholders Involved in the Acquisition Process



**The Program Manager, with support from the Lead Systems Engineer, will embed systems engineering in program planning and execution to support the entire system life cycle. DoDI 5000.02**



# Recurring Challenges

- **PEOs, PMs are reporting that implementation is problematic**
  - Acquisition programs are seeking clear and specific cyber resiliency guidance
- **Services and Agencies, PEOs/Programs, and Industry partners are each working to determine cyber resiliency solutions**
  - No common implementation of rules or principles. Solutions beginning to diverge.
- **Test community continues to identify vulnerabilities**
  - Findings in legacy systems indicate that cybersecurity must be designed in, not tested in, nor patched in
  - Developmental T&E is shifting left, Engineering needs to lay the foundation for the shift

## Core Recurring Challenges

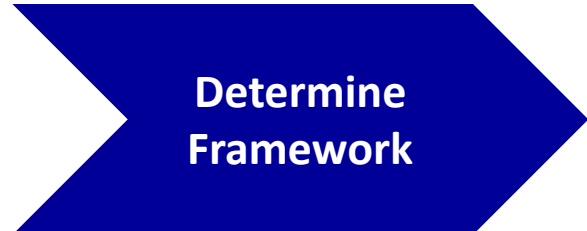
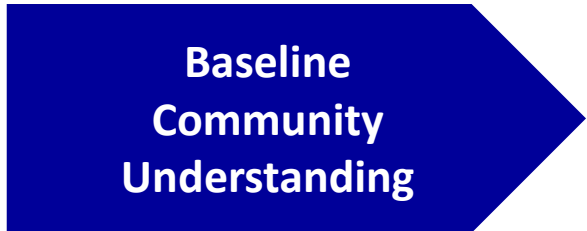
**Design  
Guidelines**

**Implementation**

**Engineering  
Assessment**



# Workshop Series to Facilitate Cross-Cutting Approach



Workshop 1  
August 2016

Workshop 2  
October 2016

Workshop 3  
January 2017

- Establish a baseline understanding of:**
- The landscape of engineering design for cyber resilient weapons systems
  - Strategies for implementation and engineering assessments
  - Areas needing focus

- Review alternative approaches for:**
- Design Guidelines
  - Implementation
  - Engineering Assessment

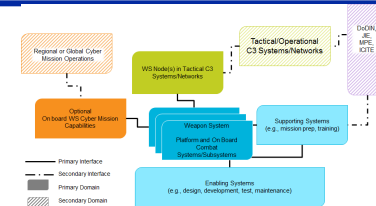
- Discuss**
- Institutionalization
  - Supporting research
  - Partnerships
  - Workforce



# Design Patterns, Standards and Methods



## What system elements or properties do we acquire?



Allocate cybersecurity requirements to the system architecture and design and assess for vulnerabilities. The system architecture and design will address, at a minimum, how the system:

1. Manages access to, and use of the system and system resources;
2. Is configured to minimize exposure of vulnerabilities that could impact the mission, including through techniques such as design choice, component choice, security technical implementation guides and patch management in the development environment (including integration and T&E), in production and throughout sustainment;
3. Is structured to protect and preserve system functions or resources, e.g., through segmentation, separation, isolation, or partitioning;
4. Monitors, detects and responds to security anomalies;
5. Maintains priority system functions under adverse conditions; and
6. Interfaces with DoD Information Network or other external security services.

**Draft DTM 118 “Cybersecurity in the Defense Acquisition System” establishes a threshold for what to address**

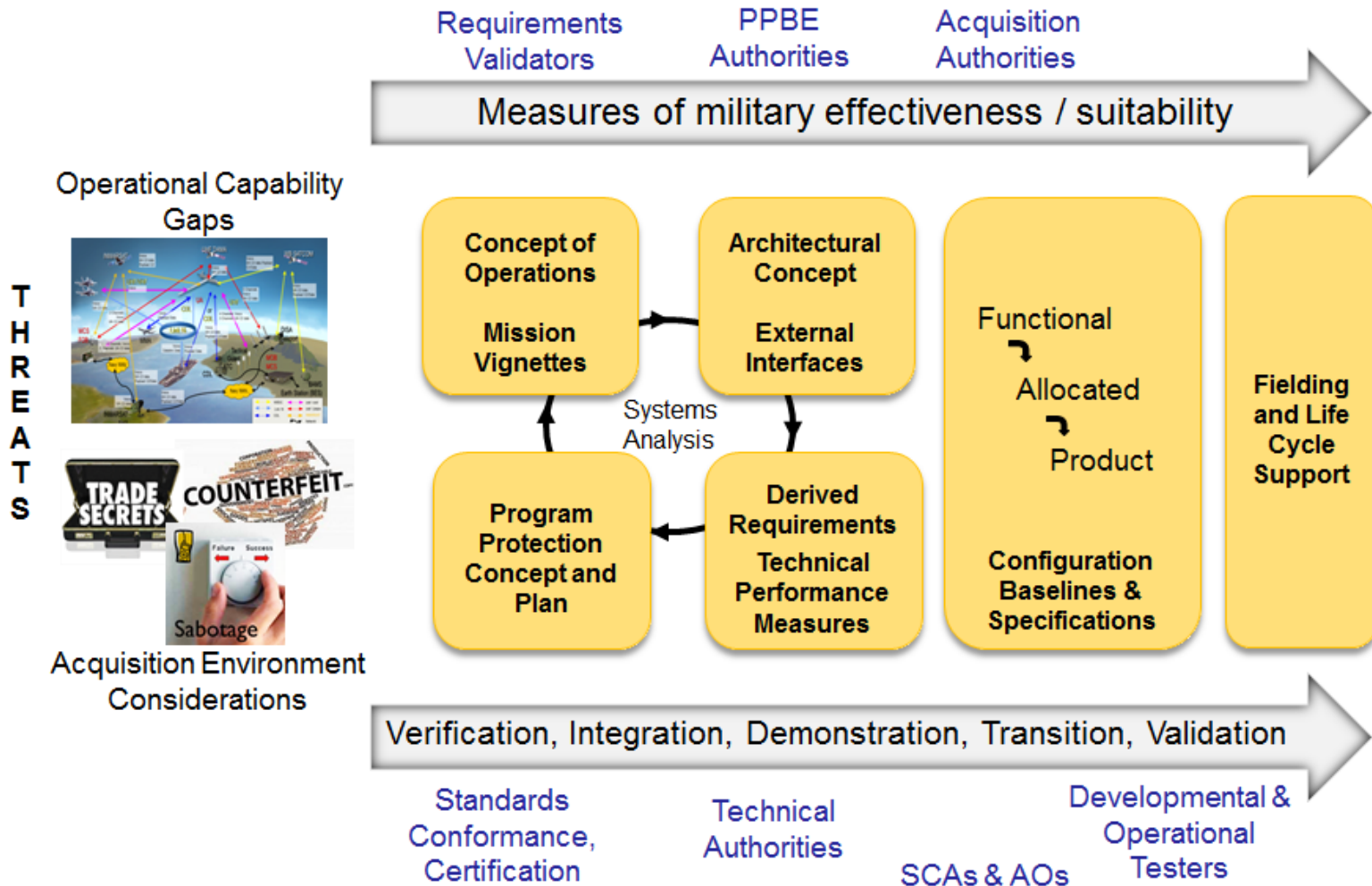




# Implementation Processes, Roles and Relations



## How do we organize and inform design makers?





# Engineering Assessment Standards and Methods



## How do we know approach works?

### Assessing Performance Across the System Life Cycle



### Strawman Goals

1. Structured standards and methods to evaluate requirements for testability, traceability, and de-confliction
2. Traceable evidence for appropriate decisions at every level of design
3. Cumulative evidence through RDT&E, DT, and OT – progressive sequential modeling, simulation, and analysis
4. Operational Behavior Prediction and Recovery: real time monitoring, just-in-time prediction, and mitigation of undesired decisions and behaviors
5. Reusable assurance arguments based on previous evidence “building blocks”

-- Adapted from DoD Autonomy TEVV Investment Strategy



# Next Steps



## Internal Workshops

- Review recommended alternative frameworks and approaches for: **Design Guidelines, Implementation, Engineering Assessment**
- **Develop Way Ahead**
- **Supporting innovation**
- **Partnerships**
- **Empowered Workforce**

## Engage Industry

- **NDIA Committees**
- **NDIA Summit (Proposed)**
- **Other Standards Opportunities**