DoD Systems Engineering Update: Engineering Enterprise Initiatives

Robert Gold

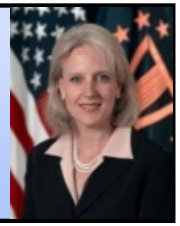
Director, Engineering Enterprise
ODASD, Systems Engineering

Assistant Secretary of Defense for Research and Engineering

NDIA SE Division Meeting | April 22, 2015

DASD, Systems Engineering

DASD, Systems Engineering
Stephen Welby
Principal Deputy Kristen Baldwin



Major Program Support
James Thompson

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

- **Engineering Assessment / Mentoring of Major Defense Programs**
- **Program Support Assessments**
- **Overarching Integrated Product Team and Defense Acquisition Board Support**
- **Systems Engineering Plans**
- **Systemic Root Cause Analysis**
- **Development Planning/Early SE**
- **Program Protection**

Engineering Enterprise
Robert Gold

Leading Systems Engineering Practice in DoD and Industry

- **Systems Engineering Policy and Guidance**
- **Technical Workforce Development**
- **Specialty Engineering (System Safety, Reliability and Maintainability, Quality, Manufacturing, Producibility, Human Systems Integration)**
- **Security, Anti-Tamper, Counterfeit Prevention**
- **Standardization**
- **Engineering Tools and Environments**

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

Engineering Enterprise Strategic Objectives

- **Manage the whole of our engineering activities**
  - Workforce
  - Tools & Environments
  - Systems, domain-specific, and specialty engineering
  - Systems-of-systems
  - Assurance
  - Effectiveness
- **Establish collaboration with technical leads at major engineering activities and industry partners**
  - Foster information exchange
  - Identify and understand common challenges
  - Provide top cover for Component and Industry initiatives
  - Facilitate improvements to the state of practice
  - e.g., federating Software/Hardware Assurance people and organizations under Joint Federated Assurance Center (JFAC)
- **Promote investments in engineering S&T, for example**
  - Automated detection of vulnerabilities and defects in Department SW
  - Detection of binary malicious insertions in operational SW
  - Innovative technologies for rapid inspection and analysis of microelectronics

Understand and Improve DoD's Collective Engineering Enterprise

Engineering Enterprise Organization

Engineering Enterprise
Robert Gold

Systems Engineering Policy, Guidance, and Workforce
Aileen Sedmak

Engineering Tools and Environments: Digital Engineering Design, Engineered Resilient Systems, MOSA
Philomena Zimmerman

Specialty Engineering: R&M, Manufacturing, Value Engineering, System Safety
Andrew Monje

Software Assurance, Joint Federated Assurance Center (JFAC)
Thomas Hurt

Hardware Assurance, Anti-Tamper
Raymond Shanahan

System of Systems
Dr. Judith Dahmann

Standards & Standardization (DSPO)
Greg Saunders, Director
Stephen Lowell, Deputy

NATO/International/Web
Latasha Beckman
Procedures & DIDs
Karen Bond
DAU Liaison/Stdzn Journal/ PA/ASSIST/QPL/WSIT
Timothy Koczanski
Parts Mgmt/Qual Pgm
Donna McMurray
DMSMS/Counterfeit
Alex Melnikow
GIDEP/Anti-Counterfeit
James Stein
Budget Mgr, JSB
Lloyd Thomas
Non-Govt Stds/FARpt11
Trudie Williams

DASD(SE)/EE, Systems Engineering Policy and Guidance

Policy

- **New DoD Instruction 5000.02 released January 7, 2015 (supersedes & replaces the interim version issued on November 25, 2013)**
  - Modifications made to Enclosure 3, Systems Engineering, but no new requirements were added

DoDI 5000.02 (7 Jan 2015)
Enclosure 3 Systems Engineering

1. Purpose
2. Systems Engineering Plan
3. Development Planning
4. Systems Engineering Trade-Off Analyses
5. Technical Risk and Opportunity Management
6. Technical Performance Measures and Metrics
7. Technical Reviews
8. Configuration Management
9. Modeling and Simulation
10. Manufacturing and Producibility
11. Software
12. Reliability and Maintainability
13. Program Protection
14. Open Systems Architectures
15. Corrosion Prevention and Control
16. Environment, Safety, and Occupational Health
17. Insensitive Munitions
18. Item Unique Identification
19. Spectrum Supportability
20. ~~Design Reviews~~
21. Program Support Assessments

merged content

Blue = Sections that contain revisions

DASD(SE)/EE, Systems Engineering Policy and Guidance

- **Guidance**
  - Risk Management Guide for Defense Acquisition Programs 7th Edition (Interim Release) published December 2014
    - Supports the Better Buying Power 3.0 Initiative: Improve our leaders' ability to understand and mitigate technical risk
    - Ensures understanding, implementation, and reporting of risk identification, management, and mitigation across the Department
- **Standards Development**
  - EIA 649-1 - New defense-specific addendum to EIA 649 for Configuration Management published November 2014
  - IEEE 15288.1 – New defense-specific addendum to ISO/IEC 15288 for Application of Systems Engineering (soon to be published)
  - IEEE 15288.2 – New defense-specific addendum to ISO/IEC 15288 for technical reviews and audits (soon to be published)
  - AS 6500 – Manufacturing Management Program standard published November 2014
  - Working with SAE and IEEE/NDIA to develop implementation guidance for above standards

Specialty Engineering Summary of Objectives

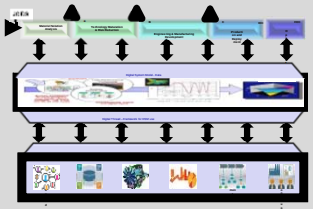
- **Reliability and Maintainability Engineering**
  - Continue Program Engagement
  - Continuous Improvement of Policy and Guidance
  - Enhance DoD and Industry Outreach
  - Enhance R&M Engineering Workforce
- **Manufacturing Engineering**
  - Expand Program Engagement
  - Refine Body of Knowledge
  - Maintain Vigorous Outreach
- **Human Systems Integration (HSI)**
  - SE Focal Point (Joint HSI Steering Committee, HSI Standards Working Group)
- **Value Engineering (VE)**
  - Support DoDI 4245.14 Requirements
  - Foster and Recognize VE Achievement

Engineering Tools and Environments

Engineering Tools and Environments

Digital Engineering Design

- Digital System Model/Digital Thread
- Education
- Policy & Guidance
- Data Rights

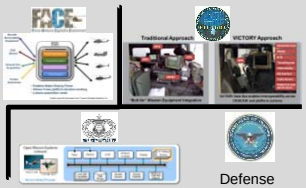


Engineered Resilient Systems

- Trade Space Analysis
- SERC
- CREATE/HPCMO

Modular Open Systems Architecture

- BBP 3.0
- Technical Standards
- SERC



Defense Standardization Council

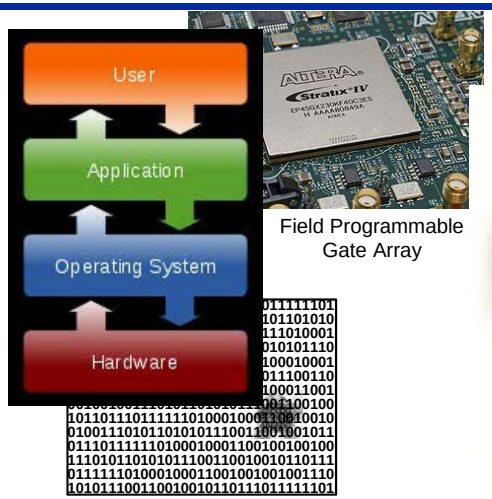
Outreach: AMSWG, NDIA, MBE Summit, INCOSE/JPL

Engineering processes, specialty engineering methods and tools to incorporate the latest digital practices for making informed decisions throughout the acquisition lifecycle.

Software and Hardware Assurance (SwA/HwA) Summary of Objectives

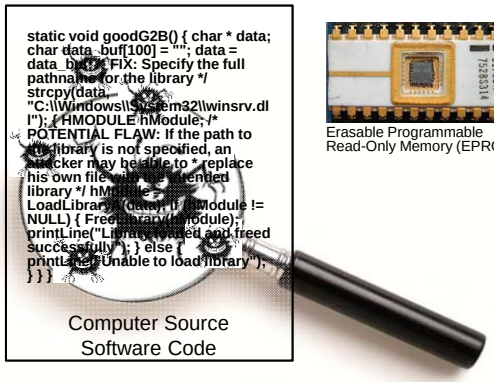
- **Strategic Planning**
  - Facilitate and incorporate activities which establish HwA and SwA as disciplines of SE
  - Participate in forums which help to grow, provide visibility, and establish relationships for the DoD HwA and SwA communities
- **Policy and Guidance Development**
  - Integrate Congressional legislation (NDAA 932, 933, 937) into DoD acquisition policy and guidance
  - Develop community white papers that provide specific focused guidance
  - Integrate DT, OT&E and L&MR functions into HwA and SwA guidance and procedures
- **Support to Program Protection Planning (PPP)**
  - Develop and provide resource materials that mentor, coach, and teach integration of HwA and SwA in program acquisition strategies
  - Provide consistency in policy and guidance documents relevant to developing HwA and SwA strategies in PPPs (DAG, PPP O&G, PPP Eval Criteria, 5000.02, and industry Best Practices)
- **Outreach**
  - Mature the SwA Community of Practice and develop a HwA Community of Practice leveraging existing forums
  - Support HwA and SwA community outreach through collaboration tools (SharePoint, Defense Connect Online and Voice Conferencing)
  - Develop and support HwA and SwA Workforce Training

Joint Federated Assurance Center (JFAC)

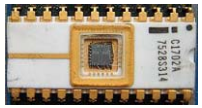


Field Programmable Gate Array

Binary Computer Software Code



Computer Source Software Code



Erasable Programmable Read-Only Memory (EPROM)

Assure Mission SW and HW Security

Intent:

- Congress directed DoD to "…provide for the establishment of a joint federation of capabilities to support the trusted defense system needs…to ensure security in the software and hardware developed, acquired, maintained, and used by the Department." (FY14 NDAA, Sect. 937)

Expected Outcomes/Deliverables:

- Federated cross-DoD awareness and coordination of software and hardware assurance (SwA/HwA) capabilities and expertise
- Development and sharing of SwA/HwA vulnerability assessment best practices, tested tools, and proven processes
- Identification of R&D needs to advance SwA/HwA capabilities for programs in acquisition, operational systems, and legacy systems and infrastructure

Key Participants:

- Sponsor(s): ASD(R&E)/DASD(SE)
- Contributors: CIO, AF, Army, Navy, USMC, NSA, NRO, MDA, DISA, Defense Microelectronics Activity (DMEA)

Approach:

- Establish Federation of HwA and SwA capabilities to support programs in program protection planning and execution
- Support program offices across life cycle by identifying and facilitating access to Department SwA and HwA expertise and capabilities, policies, guidance, requirements, best practices, contracting language, training, and testing support
- Coordinate with DoD R&D for HwA and SwA
- Procure, manage, and distribute enterprise licenses for HW and SW assurance tools

Funding ($M)	FY14	FY15	FY16	Total
ASD(R&E) / RRTO	8.377	3.000	4.000	15.377

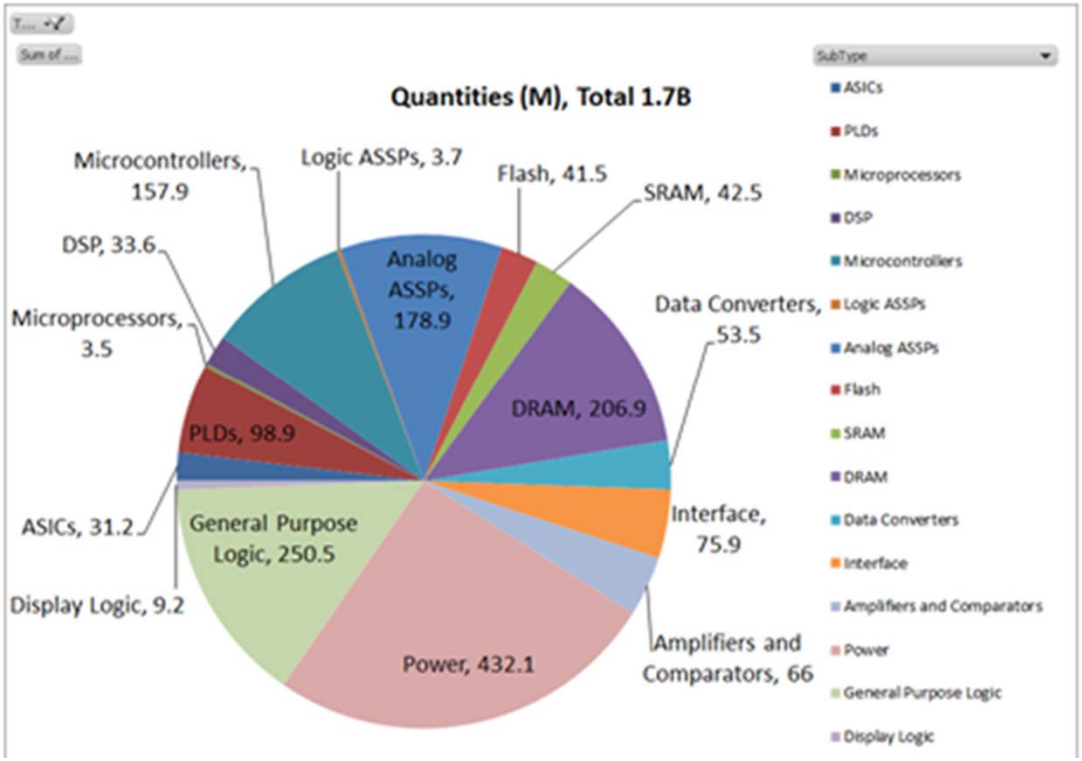
Milestones:

Formed Steering Committee and Working Groups	07-2014
Initiated First Series of Technical Tasks	09-2014
Charter signed by Deputy Secretary of Defense	02-2015
Congressional Report on funding, organization, management, and operations of JFAC signed & submitted	03-3115
CONOPS signed by stakeholders of Federation	08-2015
Capability Assessment, Gap Analysis, Strategic Plan	10-2015
Joint Federated Assurance Center (JFAC) IOC	12-2015

Trusted Microelectronics

- **Application Specific Integrated Circuit policy: DoD end use ASICs can only be procured from a DMEA accredited Trusted supplier**
  - Accounts for <2% of the 1.9B ICs DoD acquires per year
  - No trusted supply chain for other than custom ASICs exists
  - In general order of interest for trust: ASICs, FPGAs, Microprocessors, Logic Application Specific Standard Products, Memories, A-D Converters, Interface Chips

- **What is needed:**
  - A risk-based process for identification and prioritization of all critical ICs to address risk mitigation across life-cycle
  - More effective and affordable risk mitigation countermeasures for ICs
  - Continued collaboration between Government, Industry, and academia

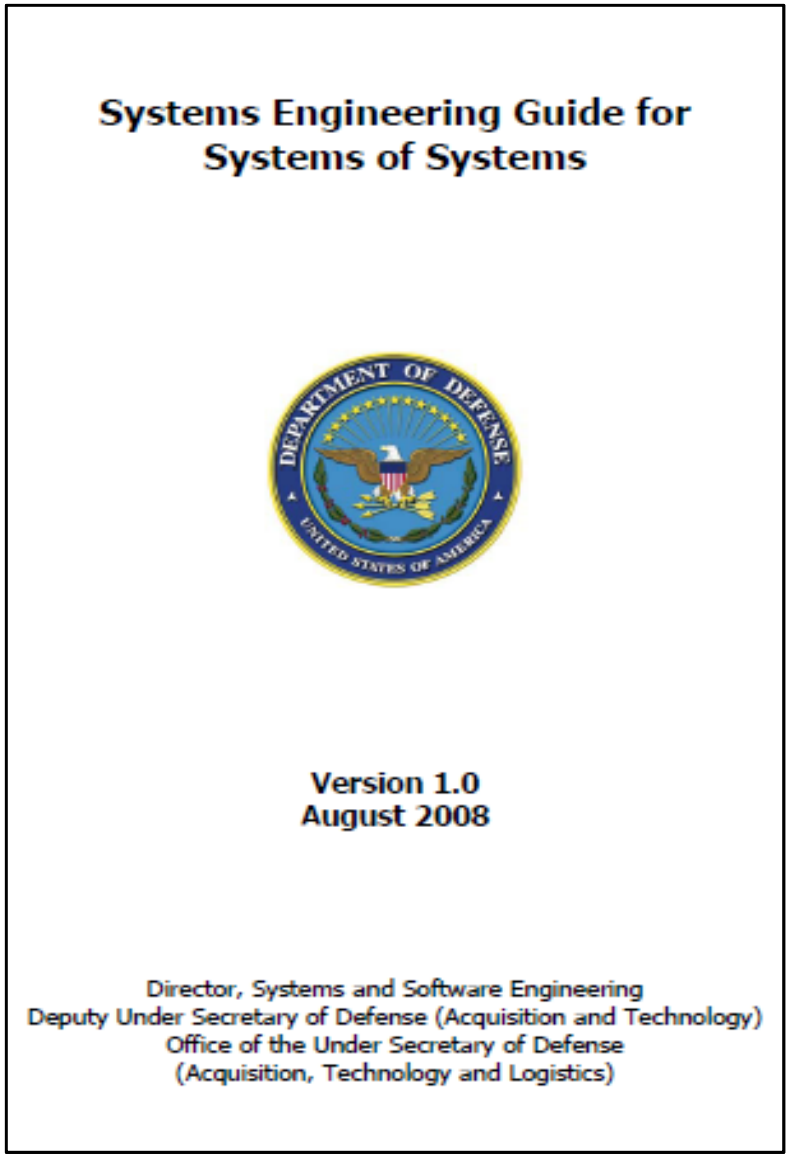


Source: Institute for Defense Analysis

Anti-Tamper (AT) Summary of Objectives

- **DoD Directive for Anti-Tamper is in coordination for approval**
  - Establishes the Executive Agent for AT and other AT roles and responsibilities
- **DoD AT Executive Agent is updating:**
  - AT Technical Implementation Guidebook (TIG)
  - AT Program Managers Guidebook (PMG)
  - AT Security
- **Policy and guidance related to identification of the Critical Program Information (CPI) to be protected is also being updated**
  - DoDI 5200.39 is in coordination for approval
    - Revises the definition of CPI
    - CPI identification and protection must be horizontal and consistent
  - DoDM 5200.39 Working Group underway

Systems of Systems Engineering Summary of Objectives


Systems Engineering Guide for
Systems of Systems

Version 1.0
August 2008

Director, Systems and Software Engineering
Deputy Under Secretary of Defense (Acquisition and Technology)
Office of the Under Secretary of Defense
(Acquisition, Technology and Logistics)

- **Refresh current body of practice based on the last 4-5 years of DoD experiences**
- **Identify 1-3 joint warfighting areas to apply improved practice and lessons learned**

Defense Standardization

- **Defense Standardization Council identified key initial areas where standards are needed to restore discipline and consistency**
  - Systems engineering
  - Technical reviews and audits
  - Configuration management
  - Manufacturing management
  - Logistics support analysis
- **Focus is on supporting Department needs by leveraging voluntary consensus standards**
- **Future focus: Identifying key areas where additional standards can drive acquisition effectiveness and efficiency**
  - Modular Open Systems Architecture
  - Human systems integration
  - Corrosion control and prevention

Systems Engineering: Critical to Defense Acquisition










Defense Innovation Marketplace
http://www.defenseinnovationmarketplace.mil

DASD, Systems Engineering
http://www.acq.osd.mil/se