OSD / Tri-Service WebCast

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*DoD Systems and Software Engineering*

Mr. Mark Schaeffer
Systems and Software Engineering
Mission Statement

- Promote the application of sound systems and software engineering, developmental test and evaluation, and related technical disciplines across the Department's acquisition community and programs
- Raise awareness of the importance of effective systems engineering and drive the state-of-the-practice into program planning and execution
- Establish policy, guidance, best practices, education, and training in collaboration with academia, industry, and government communities
- Shape acquisition solutions and promote early technical planning
- Provide technical insight to program managers and leadership to support decision making

Evolving System Engineering Challenges
State of Systems Engineering
Director, Systems & Software Engineering

Mark Schaeffer  SES

Director, Systems & Software Engineering

Deputy Director
Enterprise Development
Bob Skalamera  SES

Deputy Director
Developmental Test & Evaluation
Chris DiPetto  SES

Deputy Director
Software Engineering & System Assurance
Kristen Baldwin  SES

Deputy Director
Assessments & Support
Dave Castellano  SES

CORE COMPETENCIES

• SE Policy
• SE Guidance
• SE in Defense Acquisition Guidebook
• Technical Planning
• Risk Management
• Reliability & Maintainability
• Contracting for SE
• SoS SE Guide
• SE Education and Training
• DAU SE Curriculum
• SPRDE Certification Rqmt
• Corrosion
• R-TOC
• Value Engineering

CORE COMPETENCIES

• DT&E Policy
• DT&E Guidance
• T&E in Defense Acquisition Guidebook
• TEMP Development Process
• DT&E Education and Training
• DAU DT&E Curriculum
• DT&E Certification Rqmt
• Joint Testing, Capabilities & Infrastructure
• Targets Oversight
• Acq Modeling & Simulation
• Energy
• DSOC/Acq Tech Task Force

CORE COMPETENCIES

• SWE and SA Policy
• SWE and SA Guidance
• SoS, SA Guides
• SWE and SA Education and Training
• DAU SW Acq Curriculum
• Continuous Learning Modules for SWE, SoS, SA
• Software Engineering
• Acquisition Support
• Software Engineering Institute (SEI)
• Process Improvement
• CMMI Sponsor
• DoD/National Software Investment Strategy

CORE COMPETENCIES

• Support of ACAT I and Other Special Interest Programs (MDAP, MAIS)
• Assessment Methodology (Program Support Reviews - PSRs)
• T&E Oversight and Assessment of Operational Test Readiness (AOTR)
• Systems Engineering and Developmental Test Planning and Support
• Lean/6-Sigma Training/Cert

Acquisition program excellence through sound systems and software engineering
Systems Engineering Revitalization Effort

- Issued Department-wide Systems Engineering (SE) policy
- Issued guidance on SE, T&E, and SE Plans (SEPs)
- Integrated DT&E with SE policy and assessment functions--focused on effective, early engagement of both
- Working with Defense Acquisition University to revise curricula (SPRDE, T&E, PQM, LOG, PM, ACQ, FM, CONT)
- Established SE Forum to ensure senior-level focus within DoD
- Leveraging close working relationships with industry and academia
- Instituted system-level assessments in support of DAB, OIPT, DAES, and in support of programs
- Instituted a renewed emphasis on modeling and simulation in acquisition
Establishing a DoD Software Center of Excellence

DoD Software Center of Excellence
- Support Acquisition Success
- Improve State-of-the-Practice of Software Engineering
- Leadership, Outreach and Advocacy
- Foster Resources to Meet DoD Needs

Software Focus Areas
- Identification of issues
- Creation of partnerships
- Consolidation/execution of initiatives
Looking Ahead

Through the Systems and Software Engineering Center of Excellence, continue to:

- Evolve Policy, Guidance, Education & Training, and Outreach
- Execute Program Support Reviews to support OSD leadership at Milestone reviews and individual programs & PMs
- Develop the foundation for software and system assurance policies and strategies to improve the state of practice
- Revitalize DT&E efforts to increase the likelihood of successful IOT&E
- Strengthen early and continuous lifecycle involvement of SE at system and System of Systems levels, beginning at Concept Decision/Milestone A
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SE View from Army

Mr. Douglas K. Wiltsie
SE View from Army
23 February 2007

Douglas K. Wiltsie
Assistant Deputy
Acquisition and Systems Management
Office of the Assistant Secretary of the Army
Acquisition Logistics and Technology
Sec. Bolton’s Challenges

• Systems Engineering:
  – Does not help us politically
  – Does not stabilize funding
  – Does not belong in the Requirements Process
  – Does not clearly address System of Systems
Army System Engineering Policy

The **Army System Engineering** program and policy approved (13 June 2005)

- Requires a SEP for each program
- Establishes a System Engineer within each program and PEO
- Establishes Army System Engineering Forum (ASEF)
- Establishes peer review at all major technical reviews
- Establishes the PEO as the SEP approval authority
Current Focus

• System Engineering is being done in Army programs; we need to ensure that it is consistent across the PEOs

• Training is widely available but standards need to be established; we need to identify what’s available and tailor to PEO/PM needs

• Requirements are done outside of the SE process; engage TRADOC on C4ISR migration and identify new processes for SoS development

• Integrate Science and Technology into Systems Engineering revitalization
Army System Engineering Forum

- Chartered to revitalize SE
- PEO Chief Engineers, RDECOM, TRADOC, ATEC, UAH, SEI
- Identify and resolve common issues across and above PEOs and PMs
  - Training for effective SE
  - Inject SE into the requirements process
  - SE for SoS/interoperability across programs
- Share lessons learned, best practices using Army Knowledge Online (AKO)
- Develop effective Guidance across PMOs and RDECOM S&T Programs
Capability Based Acquisition

Army is transitioning to more and more Capability Based acquisition.

- Software blocking – Ensures end to end operability for all current and future battle command
- Future Combat System- 1st Army System of Systems capability based acquisition focused on developing and procuring a brigade level set of equipment
- Army Missile and Space – Develops the requirements and products to provide Air and Missile Defense capability
- Joint Network Node (JNN) to Warfighter Information Network-Tactical (WIN-T) – Current AOR network interoperability with future network.
- Counter rocket and mortar – continual evolution of requirements
- Counter Improvised Explosive Devices – evolving/changing requirements and environments.
- Force Protection
Introduction: The Paradigm Shift

“MEGA SYSTEM”

Well Bounded System

Must Change
Perspective
Boundaries
Process
People (KSAs)
Tools

Transform to provide multiple innovative overmatching capability options to the customer
Evolve supporting processes into an integrated, cross commodity, cross community SOS environment.

Delivery of Right Capabilities on Schedule on Budget
Goal: Provide Consistent and Appropriate Levels of Training Across the Army Acquisition Community

- Survey training opportunities and certification requirements
- Establish Technical Authority level SE Training
- Establish PM/DPM SE Level Training
  - SE Management
  - Incorporate SE into PM structure
- Establish Technical Level SE Training
  - Focus on implementation and execution of SE
  - Focus on PM SE
  - Lead to certain level of certification
- Consider University Consortium for SE through University of Alabama, Huntsville (UAH)
Goal: To Integrate SE into the Requirements Development Process, Especially for Complex Interdependent Programs

- Establish methods to support requirements generation at the System of Systems or Enterprise Level and help define the trade space
  - ASA(ALT)/TRADOC Capability Engineering Framework (CEF) Initiative for engineering the requirements/acquisition interface
  - Program Execution Working Group for cross PEO/TRADOC SE for C4ISR migration
  - Software Blocking

- Stepping stone to Joint System of Systems requirements

- Generation Process (e.g. SIAP, SIGP, JBMC2, NCOE)
  - Without Joint Level overarching requirements, System Level requirements could be met and still not meet Joint Requirements
Army Strategic S/W Improvement Program

**Goal:** To dramatically improve the acquisition of software intensive systems

**Objectives:**

- Foster migration to a model-based system and software acquisition process improvement
- Institutionalize broad-based oversight, management, and technical expertise
- Apply an integrated system and software engineering approach to programs and improvement
- Systematically incorporate lessons learned, best practices, and new technology into policies, practices and processes
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DoN System Engineering Revitalization

Mr. Carl Siel
ASN (RDA)
Chief Systems Engineer

DoN System Engineering
Revitalization

23 February 2007

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Topics

- Capability Based System Engineering
- System Engineering Planning
- System of Systems Engineering
- Net-Centric Integration and Interoperability Management
- Large Scale SoS Capability Assessment
- Software Process Improvement
- System Engineering Human Resource Management
Capability-Based System Engineering

Requires Alignment of Multiple Processes, Process Owners and Products
System Engineering Planning

- **Upfront and early involvement in SE Planning**
  - With PMO’s and respective SYSCOM engineering communities
  - Ensure appropriate SE practices, based on program maturity & complexity

- **Cross-SYSCOM SEP LSS process underway**
  - Streamline development, review and approval processes

- **Planning is occurring, need to ensure real execution**

- **Encouraging SYSCOM-wide engineering processes**
  - System Engineering Technical Review (SETR) Process
Systems Engineering Technical Review Timing

Phases:
- Concept Refinement
- Technology Development
- System Development & Demonstration
- Production & Deployment
- Operations & Support

Work Efforts:
- Concept Decision
- Design Readiness
- Design Readiness Review
- System Integration
- System Demonstration
- Full Rate Production & Deployment
- FRP / IOT&E
- FRP Decision Review
- Production & Deployment
- Production & Deployment
- Production & Deployment
- Production & Deployment
- Production & Deployment
- Operations & Support
- Sustainment
- Disposal

Activities:
- Pre Systems Acquisition
- Systems Acquisition
- Sustainment

Technology:
- TRA
- TRA

Instruction & References:
- Reviews
  - ITR
  - ASR
  - SRR
  - IBR
  - SFR
  - PDR
  - CDR
  - TRR
  - FRR
  - OTRR
  - SVR/PRR
  - PCR
  - ISR

Technical Baseline:
- Preferred System Concept
- System Specification / CDD
- System Functional Baseline
- Product Baseline
- Product Baseline

Cost Validation:
- Analogy / Parametric
- Analogy / Parametric
- Analogy / Parametric
- Analogy / Parametric
- Analogy / Parametric
- Analogy / Parametric
- Analogy / Parametric
- Analogy / Parametric

Greater Cost Estimation Uncertainty
Moderate Cost Estimation Uncertainty
Lower Cost Estimation Uncertainty

Technology Readiness Assessment
Technical Reviews
Program Reviews

ITR - Initial Technical Review
ASR - Alternative System Review
SRR - Systems Requirements Review
IBR - Integrated Baseline Review
SFR - System Functional Review

PDR - Preliminary Design Review
CDR - Critical Design Review
TRR - Test Readiness Review
FRR - Flight Readiness Review
OTRR - Operational Test Readiness Review

SVR - System Verification Review
PRR - Product Readiness Review
PCR - Physical Configuration Review
ISR - In Service Review

Sys Eng with DoN Status Report (workup) (21 Oct 05)
Naval SoSE Guidebook

- Developed to support Mission level capability-based acquisition decision making
- Presents best practices for capability-based acquisition and systems engineering
- Provides processes, methods, and tools to aid interoperable and integrated systems
- Particularly suited to System of Systems or Family of Systems
- Supports Naval or Joint Force Operations
- Version 2 is available
  
  https://ncee.navy.mil  
  (Requires CAC)
Net-Centric Integration & Interoperability (I&I) Management

- Establish a management structure and plan for managing net-centric I&I of Naval Power 21 (NP21) systems and platforms
- Describe the procedures, processes and authorities of the acquisition community for the design, development, testing and fielding of NP21 systems
  - Information Support Plans (ISP)
    - Standardize development, review, approval, and submission as the means to coordinate I&I activity
    - Compliance with standards, consistency with interface systems
  - Net Ready Key Performance Parameters (NR-KPP)
    - Address the technical aspects to support operational and requirements communities
  - Architectures
    - Increase their usability
  - Capability Package Assessments
    - Conduct large scale, net-centric, SoS evaluations to assess overall mission performance
Large Scale SoS Capability Assessments

DODAF Mission Architecture

Mission Threads

Test Scripts

Near / Mid / Far Term Capability Assessments

Experimenting

DT

OT

(System and SoS)

OPEVAL (System and SoS)

Deployment Preps Post OPEVAL (SoS)

In Service Fleet Exercises (SoS)

I&I Capability Package Assessments

Infrastructure
(Fn/OA Exp, DEP +,..., Models, Simulations)

Procedures / Practices
(Fn/OA Exp, etc)
Integrated SoS/Mission Assurance

System Focus
DoD 5000

SoS/Mission Focus
DoD 5000

Mission Focus

Concept Refinement & Technology Development
System Development & Demonstration
Production & Deployment
Operations Support

Technical Baseline
System Specification
Allocated Baseline
Product Baseline
Production Baseline

Preferred Concept

Prototype
M&S

Early OA
Tech Demos
EDM Demos
System Demos

Follow-on DT/OT&E
Incremental Improvements

System A
System B
System C
System D

SoS – initiated Spiral
Software Process Improvement

INPUTS

- Lack Of Government SW Expertise
- New Requirements- No New Cost, ASN/RDA SW Policies
- CMM Level Improvements
- SW Certification
- ASN (RDA) Software Policies
- Non-standard Interfaces
- Resistance To Change
- Immature Costing Models
- External Drivers
- Processes For Requirements/Budget Determination
- Non-standard Processes
- Enterprise Licenses
- OA & Standards/IDDs
- Industrial Base Concerns

OUTPUTS

- Centralized Software Policy
- Integration of Software Engineering / Systems Engineering practices
- Career requirements and Comprehensive Education Strategy for Software Engineering & Acquisition
- Guidebook for Program Managers during full acquisition lifecycle

Phase I
Understand "As Is" Situation

Phase II
Envision things To change

Phase III
Document changes Establish process

Phase IV
Exercise Process (Pilot Programs)

Phase V
Institutionalization

INPUTS:
- SAM
- SSE
- SWDT
- BI
- HR

OUTPUTS:
- Software Process Improvement
- Software Process Improvement
Maintaining a healthy engineering capability, aligned to the needs of the DoN Acquisition Enterprise (NAE), is fundamental to the delivery of new systems and to support those already in service – HQ, SYSCOM’s, PEO’s, Warfare Centers, System Centers, In Service Centers (Shipyards, Depots, etc)

Establish skills, training, job assignment, and certification hierarchy – General system engineering practices – Component and System engineering – Platform (Air, Land, Sea, Shore Sites) and Net-Centric System engineering – Enterprise System engineering

Ability to track and account current engineering personnel and postulate future needs
SE Human Resource Competency

Mission Capability Strategic Plan
Near / Mid / Far
Technology shifts overtime

- Workload predictions
- Strategy > Rule #1 > Don’t Force ___ your thinking
- Numbers / Demographics

Expectations

In depth knowledge / Broad based knowledge
- Expert Ability to Exercise
- Increasing Breadth
or
- Increasing Depth
- Ability to Exercise

“Lust to Dust”

ST / SL / SES

Senior

14/15
14/15

Skills & Knowledge

Advanced
Currency
Base

Mid Level

11/12
11/12

Skills & Knowledge

Advanced
Currency
Base

Entry

5/7

Skills & Knowledge

Advanced
Currency
Base

Training
Job Assignment
Certification

Training
Job Assignment
Certification

Training
Job Assignment
Certification

Training
Job Assignment
Certification

Training
Job Assignment
Certification

Training
Job Assignment
Certification

Training
Job Assignment
Certification

Formal
• DAU, NPS, Uni Informal
• Conferences
Details volunteer
Rotation volunteer
Direct assessment
“Pools”
DAW IA
PE License
Warrant (Like Contracts)
Conclusion

- Capability Based System Engineering
- System Engineering Planning
- System of Systems Engineering
- Net-Centric Integration and Interoperability Management
- Large Scale SoS Capability Assessment
- Software Process Improvement
- System Engineering Human Resource Management

QUESTIONS?
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Air Force “Pre-Acquisition” SE

Mr. Terry Jaggers
Air Force “Pre-Acquisition” SE: Technical Planning and Investment to Inform the Decision-Making Process

Mr. Terry Jaggers, SES
Chief Engineer
Office of the Assistant Secretary of the Air Force (Acquisitions)
23 February 2007
Early Decisions: Key Life Cycle Cost Drivers

Cumulative LCC

Cost to Fix

100%
1000X
100X
10X
X

Cost to Identify & Resolve a Defect, and Incorporate Change

Percent of Baseline LCC Incurred
Percent of Baseline LCC Committed

Adapted from Boeing study on ICBM Life Cycle Cost, 1973

Adapted from Boeing study on ICBM Life Cycle Cost, 1973
Benefit of Early SE Investment
Notional Cost Profile

- Peaks at CD, A, and B represent “push” for MS/KDP documentation
- Knowledge transfer not institutionalized
- Higher initial levels beyond B and C needed to fix problems

- Lower peaks; less falloff; enhances knowledge transfer
- Higher post-C level supports modernization/sustainment efforts
- Less total area under the curve
SE as Requirements Transformation Mechanism: First Steps in “Big A”
For More Information…

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