

Realization of Systems Engineering For the Future

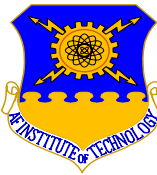


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The views expressed in this briefing are those of the author and do not necessarily reflect the official policy or position of the Air Force, The Department of Defense or the U.S. Government.



Overview



- Background
- Systems Engineering Challenges
- Key Enablers
- The Way Ahead



Background



- Five Years Ago Revitalization of Systems Engineering Established
- Current Feedback Indicates this has “...not eliminated cost and schedule problems for major weapons development programs.”*
- Shortages in Qualified Systems Engineers
- We are NOT meeting the Challenges of Current Systems or Projected Systems of the Future

* GAO Report “Major Weapon Systems Continue to Experience Cost and Schedule Problems Under DoD’s Revised Policy”, April 2006.



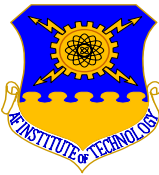
Systems Engineering Challenges



- Inconsistent Application of SE
- Need More Qualified SE
- Product Complexity/Product Control
- Poor Requirements Up Front
- Where Does Sustainment Fit In?
- Loss of Historical Information
- Systems Engineering Research



Inconsistent Application of SE



- Multiple Definitions of SE Exist
- Harmonization of SE Stds is Not Occurring “Fast” Enough
- SE Stds’ Architecture needed to see Big Picture
 - Consistent Definition at Beginner/Intermediate/Expert Levels
 - Simple to Complex Program Guidance
 - Domain Guidance
- Agreement on SE Processes Definitions Needed by
 - Industry Associations (INCOSE, NDIA, IEEE, GEIA)
 - Standard Committees (ISO, EIA, IEEE)
 - Other Stakeholders (OSD, Academia, SEI)
- Update and Implementation of SE Continual Improvement Methodologies to Improve Consistency

Standardized Definition of SE Processes is Key!!



Need More Qualified SE



- Current Activities Ineffective in Impacting Issues*
- Need Innovative Approach
 - Identify Potential Early and Encourage Development
 - Introduce Systems Thinking Early**
 1. Thinking Broadly, Big Picture
 2. Curiosity, Questioning
 3. Open-mindedness
 4. Strong Interpersonal Skills
 5. Thinking Outside the Box
 6. Strong Communication Skills
 7. Tolerance for Uncertainty
 8. Multi-taskers
 - Create Choices In Undergraduate Programs
- Emphasize SE Development in Workforce
 - Identify SE Core Competencies and Performance Accountability
 - Create Programs to Develop High Potential Employees
 - Potential Graduate Degrees
 - Target Life and Work Experiences Through OJT

Innovative Academic Roadmap Needed Now

* NDIA “Top Five SE Issues within DoD and Defense Industry”, July 2006

** Davidz, “Enabling Systems Thinking to Accelerate the Development of Senior SE”, 2006



Product Complexity/Product Control

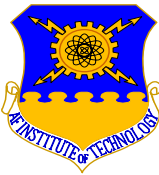


- Complexity of the Product is Inverse to Ease of Control
 - As Systems Become More Complex their Development is Harder to Control
- Need to Identify SE Tools to Simplify the Control Aspects of Future Programs
- Technical Management Processes must keep Pace with Increasing Complexity

Collaborative Environments must be Integrated Through-out Systems Life



Poor Requirements Up Front



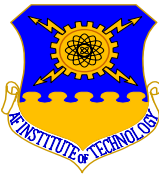
- Not a New Problem*
- Need Cause and Effect Analysis to Identify all Pitfalls
- Need Design Solution Accepted by All with Recommended Changes to Existing Policies and Procedures
- Need Methods to Highlight Risk and Complexity
- No Connection Between Identifiers/Developers of Capability AND the Cost/Schedule Estimators UP FRONT

**Bridges of Accountability
Between Technical and Business**

* NDIA “Top Five SE Issues within DoD and Defense Industry”, 2004 and 2006.



Where Does Sustainment Fit In?

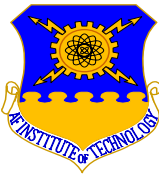


- Build Now - Fix Later Never a Planned Strategy
 - Not Efficient Enough for the Future
 - Future Reduction of Personnel and
 - Lower Operating/Sustaining Budgets Expected
- Information on SE Sustainment Application Needed
 - Guidance for SE Sustainment Monitor Activities
 - Guidance for SE Sustainment Modification Activities
 - Guidance for SE Concept/Technology/Development Activities Focused on Sustainment
- Change Title and Requirement for IOC to Initial Operational/Support Capability (IOSC)
 - Elevate to Milestone D

**Special Emphasis on Sustainment from Start
Resurgence of Acquisition Logistics**



Loss of Historical Information

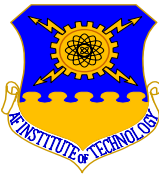


- New Information Management Process in ISO 15288
 - Information stored in System Electronic Database
- Adapt Mindset of Reuse to Other SE Issues
 - Decision Analysis & Results Data
 - Decisions and Paths Followed
 - Methods Used Lessons Learned
 - Time Tables of Changes With Initiator Identified
- Program Linkage Maintained Throughout Lifecycle

**System Electronic Database Transfers With
Program/Engineering Responsibility through System Life**



Systems Engineering Research



**SE Research* will Help get us there
We Need Champions!**

- Complexity/Risk Impacts Pre Program
- Expansion of SE Indicators, Incorporation of Risk/Complexity into EVMS
- Early Incorporation of Technology/Planning
- SE Friendly Contracting Solutions
- Evolution of SE Process Areas
- M&S Tools and Management Environments (Toolsets)
- Domain Specific Complexity Studies (e.g. SW Measures Other than SLOC)

* Castellano Briefing, "Emerging Research Ideas Stemming from Systemic Analysis of DoD Programs", June 2007 And Masterson Briefing, "Systems Engineering Research Needs", July 2007



SE Challenges & Recommendations Summary



Inconsistent Application of SE

Need More Qualified SE

Product Complexity/Product Control

Poor Requirements Up Front

Where Does Sustainment Fit?

Loss of Historical Data

Systems Engineering Research

Agreed Standardized
SE Definition

Innovative Academic
Approach

Collaborative Environment

Bridges of Accountability

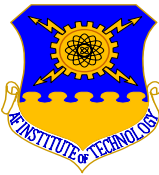
Focus on Sustainment &
Acquisition Logistics

Electronic System Database

Champions Needed



Key Enablers

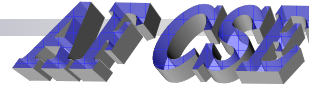
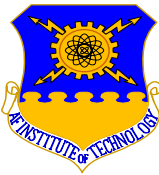


- Systems Thinking for all Functionals to:
 - Learn Technical Basics of System, Participate in Risk Assessments and Bring Their Strategies to Table to Develop Overall Program Acquisition Strategy
- Institute an Systems Electronic Database for Life
 - Decision Analysis and Results; Risk Assessment and Measures,
 - Functional Strategies, SAMP, ASP, RFP, SSP
 - All Functionals Identify and Share Changes to Program Baselines
- Discipline, Discipline, Discipline...

Systems Engineering is NOT Just for Engineers!!!



The Way Ahead



1. Complexity will Increase in Future Systems
2. An Integrated and Coordinated Effort is Needed Now
3. First Step is to Get SE Processes Defined/Accepted
4. Second Step is to Hold a SE Vision Forum/Workshop
 - Attended by All SE Associated Organizations
 - Purpose to Define the Way
 - Generate and Execute A Realization Plan for Global Systems Engineering for the Future

Volunteer to Participate so You Can be Heard!