Driving Technical Excellence into Programs

Raytheon Systems Engineering and Software Symposium

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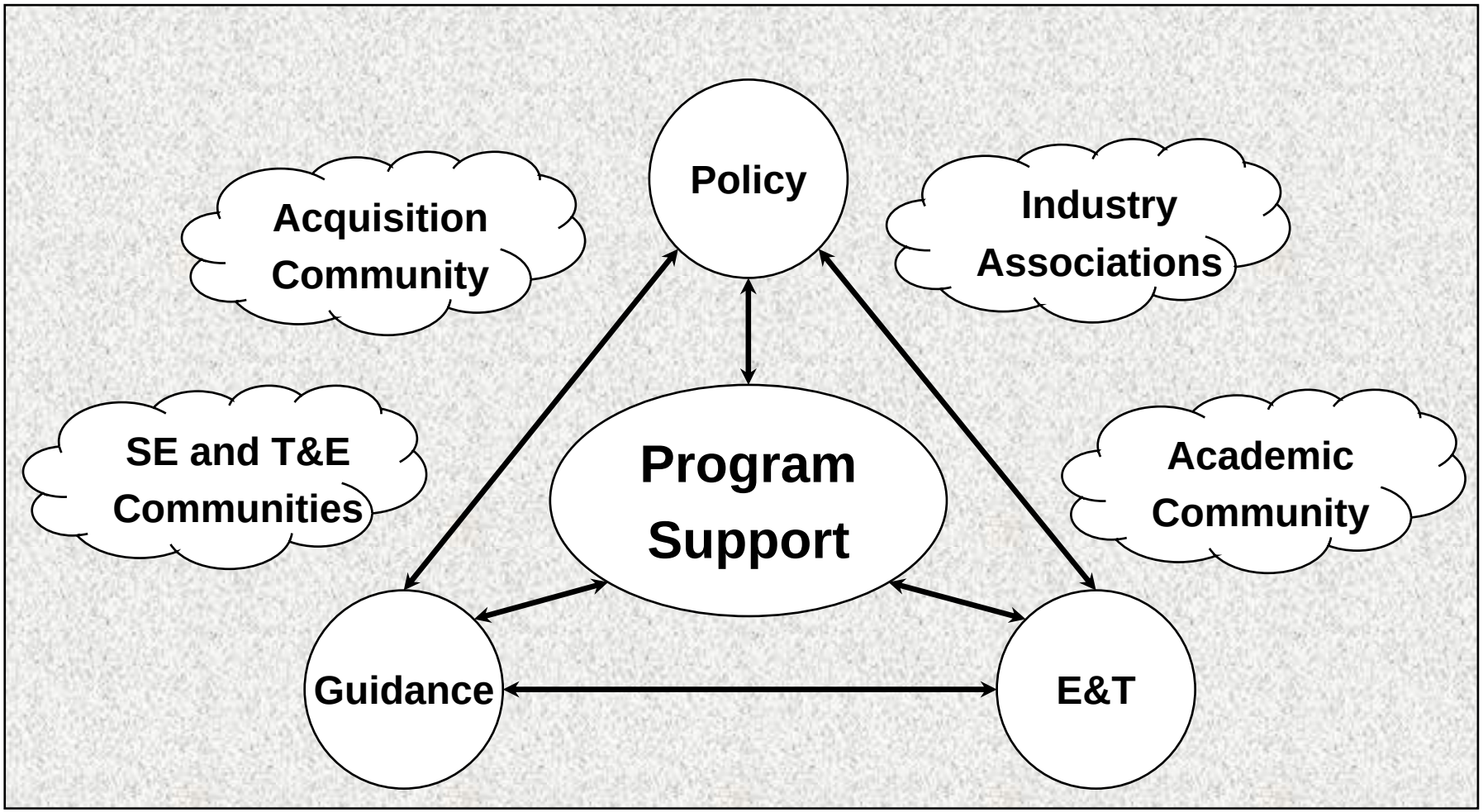
What We Have Done To Revitalize Systems Engineering

- Established SE Forum—senior-level focus within DoD
- Issued Systems Engineering (SE) policy
- Issued guidance on SE and Test & Evaluation (T&E), integrating Developmental T&E with SE focused on effective, early engagement of both
- Instituted system-level assessments in support of OSD major acquisition program oversight role
- Working with Defense Acquisition University to revise SE, T&E, and enabling career fields curricula
- Leveraging close working relationships with industry and academia

Necessary but not sufficient!

Systems Engineering Revitalization Framework



Driving Technical Excellence into Programs!

Driving Technical Rigor Back into Programs "Portfolio Challenge"

- Defense Systems was tasked to:
  - Review program's SE Plan (SEP) and T&E Master Plan (TEMP) for major acquisition programs (ACAT ID and IAM)
  - Conduct program support reviews (PSRs)
- Portfolio includes:
  - Business Systems
  - Communication Systems
  - C2ISR Systems
  - Fixed Wing Aircraft
  - Unmanned Systems
  - Rotary Wing Aircraft
  - Land Systems
  - Ships
  - Munitions
  - Missiles

Systems Engineering and T&E Support to Over 150 Major Programs in Ten Domains

Driving Technical Excellence into Programs

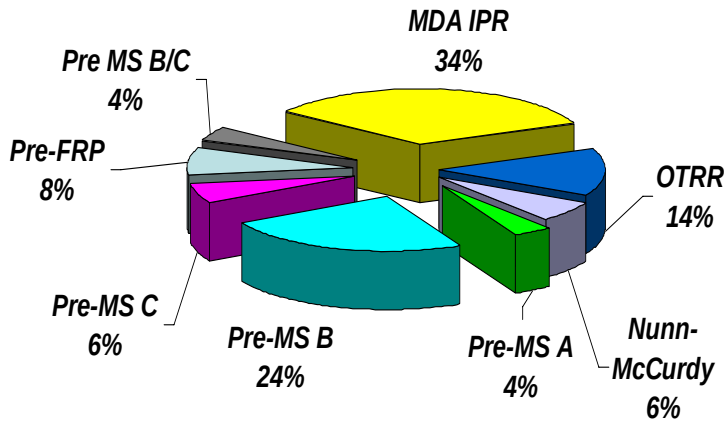
Topic	Systems Engineering	Test & Evaluation	Risk Management	Exit Criteria	Acquisition Strategy
Focus Areas	Requirements	V&V Traceability	Risk ID	Mission Systems	Mission Capability
	Organization & Staffing	Test Resources	Risk Analysis	Support	Resources & Management
	Technical Reviews	Test Articles	Risk Mitigation Planning	Manufacturing	Technical Process
	Technical Baseline	Evaluation	Risk Tracking	R & M	Technical Product
	Linkage w/ Other Program Mgmt & Controls	Linkage w/ Other Program Mgmt & Controls	Evidence of Effectiveness	Net Centric	Enterprise Environment
Product	SEP	TEMP	RM Plan	Phase Exit Criteria	ASR/APB

Examples

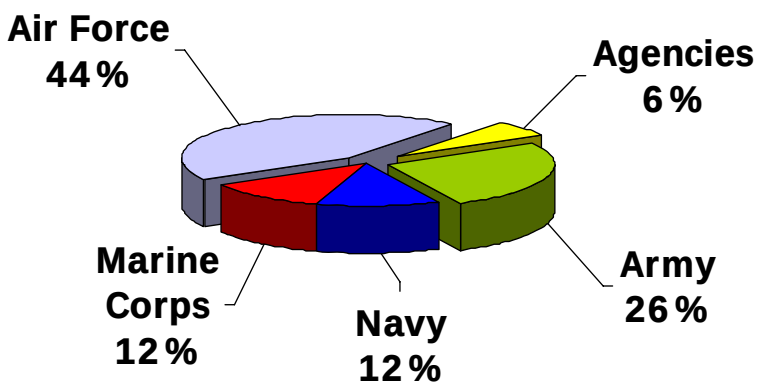
Program Support Review Activity
(since March 2004)

- PSRs/NARs completed: 33
- AOTRs completed: 7
- Nunn-McCurdy Certification: 3
- Participation on Service-led IRTs: 4
- Technical Reviews: 3
- Reviews planned for rest of FY06
  - PSRs/NARs: 12+
  - AOTRs: 2
  - Nunn-McCurdy: 2

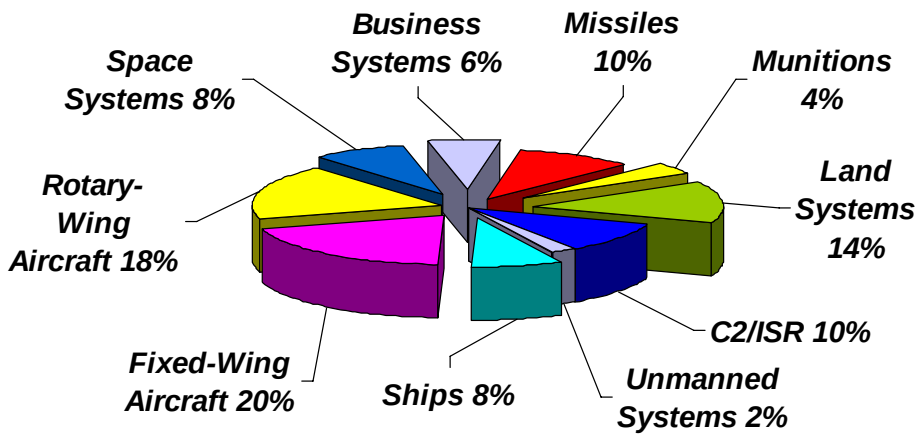
Reviews by Program Event



Service-Managed Acquisitions



Programs by Domain Area



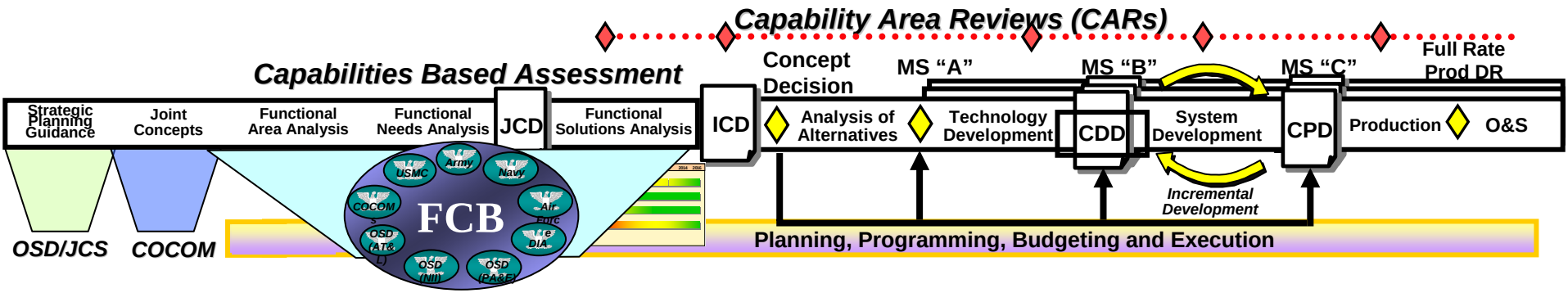
Representative Issues*

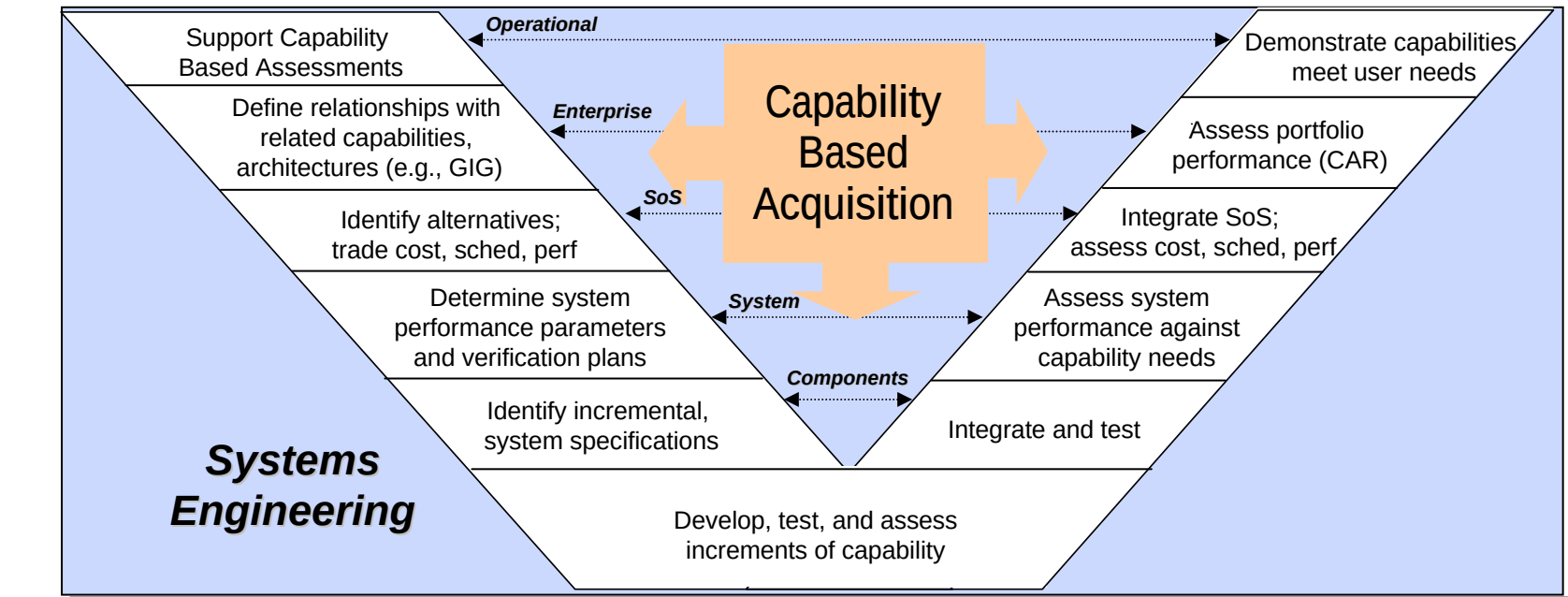
- Program Requirements
  - Changing requirements without coordinating with program manager nor considering dependent program offices
  - Missing Joint CONOPs
  - Poorly addressing Interoperability with Joint Forces
- Event-driven Technical Reviews
  - Missing System Functional Review and Preliminary Design Review during System Development and Demonstration Phase
  - Not conducting Production Readiness Review prior to Low Rate Initial Production decision
  - Missing or poorly defined entry / exit criteria

Compelling Need to Engage with Programs Early in Process

* Based on systemic analysis of 14 PSRs to date

Systems Engineering Engagement

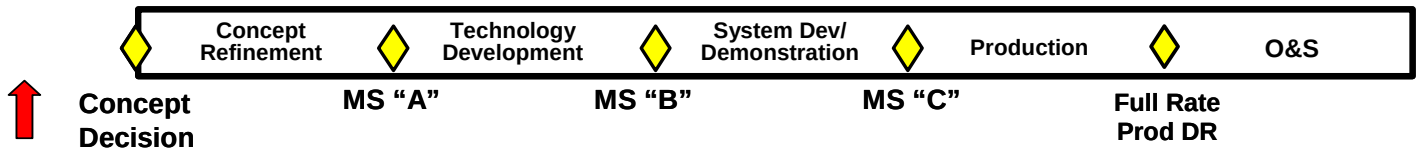




Acquiring Capabilities: What Have We Learned?

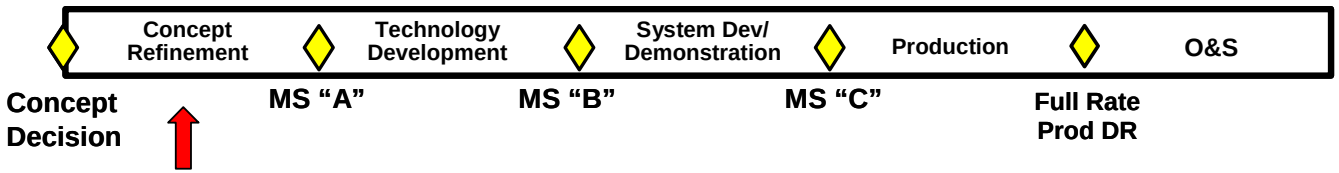
- Early involvement in requirements determination is critical
  - Identify range of solution opportunities
  - Shape key performance parameters based upon analysis of affordability, risk, urgency of need
- Capability needs will be satisfied by groupings of legacy systems, new programs, and technology insertion—systems-of-systems
  - Solutions will cross organizational and funding “stovepipes”
  - Acquisition must focus early (pre-MS B) on integrated design feasibility, full lifecycle considerations, and technology maturity
  - Solutions must integrate with other related capabilities and enterprise architectures (e.g., Global Information Grid)
- Management oversight of capabilities has ripple effects on individual programs
  - Broad context and knowledge of interrelationships are critical to decision-making

Key Knowledge Prior to Concept Decision



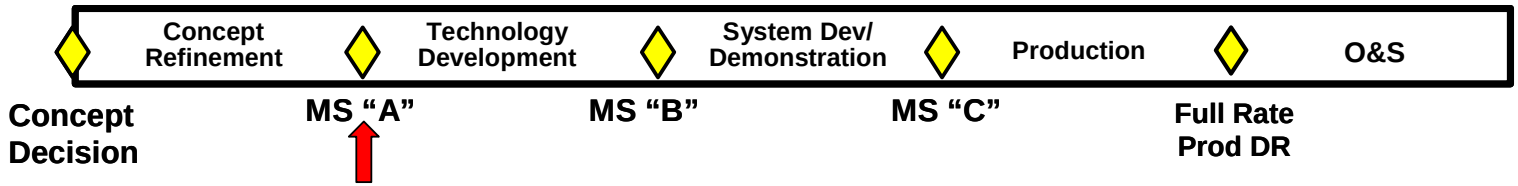
- What is the capability gap?
- What scenarios does the capability affect?
- How does the need fit with within current force structure?
- What is the set of solution options to meet the capability need? (Technology insertion, upgrade, COTS / GOTS, new system / system of systems, non-materiel options)
- What is the design feasibility? (Technology maturity, reliance on other systems / interfaces, has the solution ever been done before)
- Are resources available? Is the solution affordable?
- Which performance parameter is driving the solution?
- What is the best development strategy? (Single development, incremental, combination)

Key Knowledge Prior to Milestone A



- What is the development strategy? (Best design approach)
- What are key interfaces and related systems? Have impacts and relationships been addressed?
- What are the emerging key performance parameters (Trade between cost, time and requirements)
- What is the level of technology maturity? (Where is risk reduction needed, what are options if technology does not mature?)
- What are the acquisition strategy options? (What suppliers exist, incremental steps)
- What is the verification and validation strategy? (Modeling and simulation, incremental testing activity)
- What are the supportability drivers?

Milestone A: Key Decision Criteria



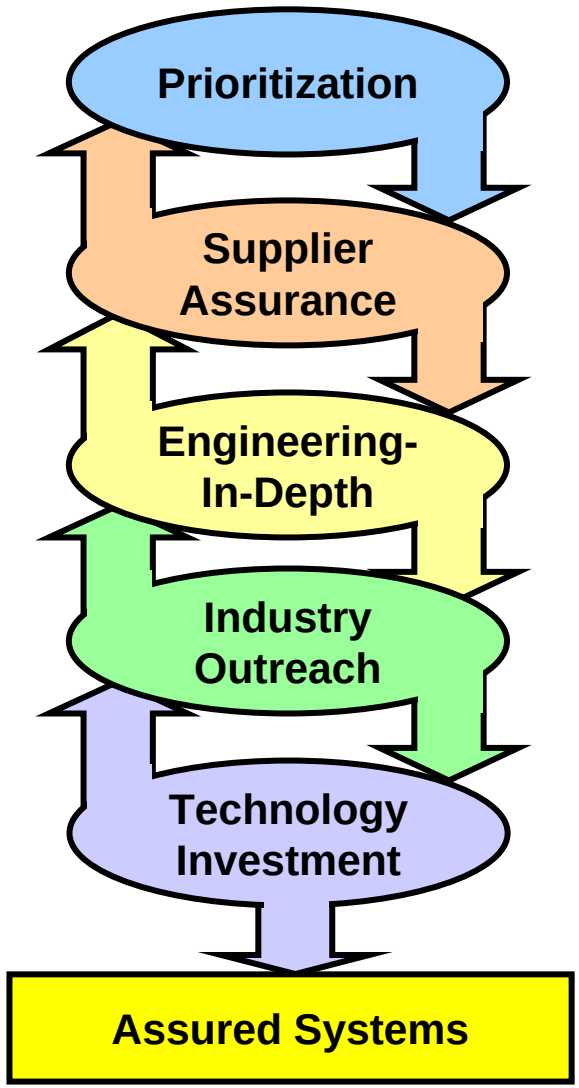
- Requirement is reasonable (Draft KPPs)
- Solutions can be delivered within time and budget constraints
- Strategy addresses impacts to related systems
- Technologies are either mature, or will be demonstrated
- Engineering and test issues have been identified; and activities are in place
- Funding has been budgeted
- Sources of needed development support have been verified

Software Assurance (SwA) Problem

- Scope: Software is fundamental to the GIG and critical to all weapons, business and support systems
- Threat agents: Nation-state, terrorist, criminal, rogue developer who:
  - Gain control of Information Technology, National Security Systems, and Weapon Systems through supply chain opportunities
  - Exploit vulnerabilities remotely
- Vulnerabilities: All Information Technology, National Security, and Weapons Systems (including systems, networks, and applications)
  - Intentionally implanted logic (e.g., back doors, logic bombs, spyware)
  - Unintentional vulnerabilities maliciously exploited (e.g., poor quality or fragile code)
- Consequences: The enemy may steal or alter mission critical data; corrupt or deny the function of mission critical platforms

What Does Success Look Like?

- The requirement for assurance is allocated among the right systems and their critical components
- DoD understands its software supply chain risks
- DoD systems are designed and sustained at a known level of assurance
- Commercial sector shares ownership and builds assured products
- Technology investment transforms the ability to detect and mitigate software vulnerabilities



NDIA System Assurance Committee Charter

- Extend community to engage in system assurance strategy to start bridging the gap between:
  - Weapons systems and the enabling technologies communities
  - Traditional DoD industrial base and commercial industry
  - DoD and critical infrastructure (e.g., telecom, finance, energy, medical)
- Vet and comment on recommendations coming out of DoD strategy
- Develop a System Assurance Handbook
- Leverage standards activities
- Chairs
  - Paul Croll, NDIA SED
  - Kristen Baldwin, OUSD(AT&L)
  - Mitchell Komaroff, OASD(NII)

Government-Industry Handbook on System Assurance

- How do you allocate requirements for assurance
  - Identification of critical components
  - Sensitivity analysis
- Robust design and life cycle considerations
  - How do you engineer for system assurance?
  - Leveraging dependability (reliability, availability, and maintainability)
- Demonstration of Assurance properties
  - Verification and Validation
  - Certification and Accreditation
  - Test and evaluation
- Supporting engineering practices
  - Risk management
  - Configuration management

Identify Opportunities to Enhance Systems Engineering Guidance to Reflect System Assurance Practices

Striving for Technical Excellence

- All programs shall develop a SE Plan (SEP)
- Each PEO shall have a lead or chief systems engineer who monitors SE implementation within program portfolio
- Event-driven technical reviews with entry criteria and independent subject matter expert participation
- OSD shall review program's SEP for major acquisition programs (ACAT ID and IAM)

- Technical planning
- Technical leadership
- Technical execution

Technical excellence

Strong technical foundation is the value of systems engineering to the program manager

Way Ahead for Systems Engineering…

- OSD's fundamental role is to set policy, provide relevant and effective education and training, and foster communication throughout the community—much has been accomplished

- OSD cannot do everything…nor should we

- Services, Agencies, and Industry must take ownership of the institutionalization of Systems Engineering across all programs—ACAT I to ACAT IV

… It's Beginning!