Mission Engineering

Robert Gold

Office of the Deputy Assistant Secretary of Defense for Systems Engineering

19th Annual NDIA Systems Engineering Conference

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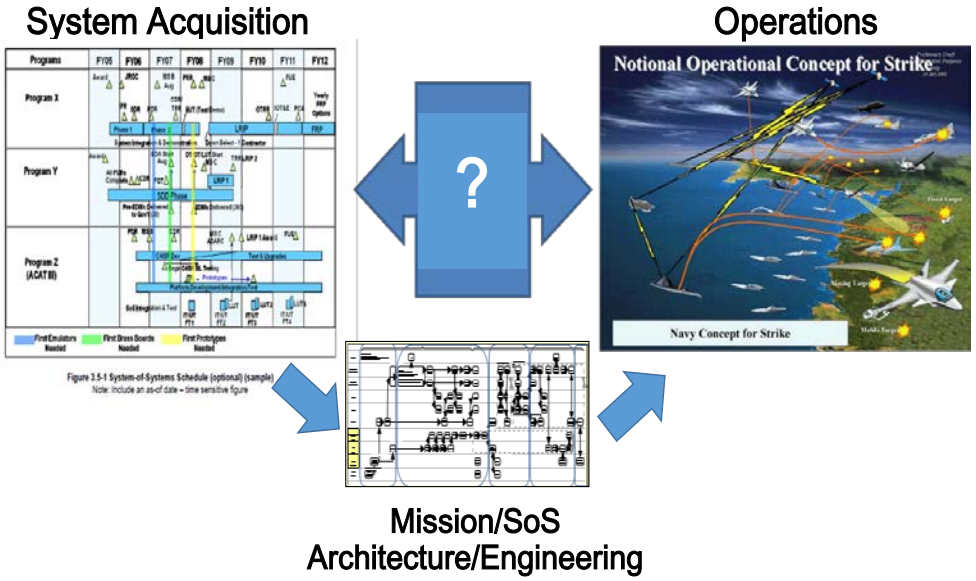
The Challenge



- Systems are acquired to meet user needs in a mission context
- Mission operations are supported by sets of systems (or systems of systems) which work together to achieve mission objectives
- Systems supporting each role in a mission (i.e. kill chain) will vary over the course of the operation and be used for multiple missions

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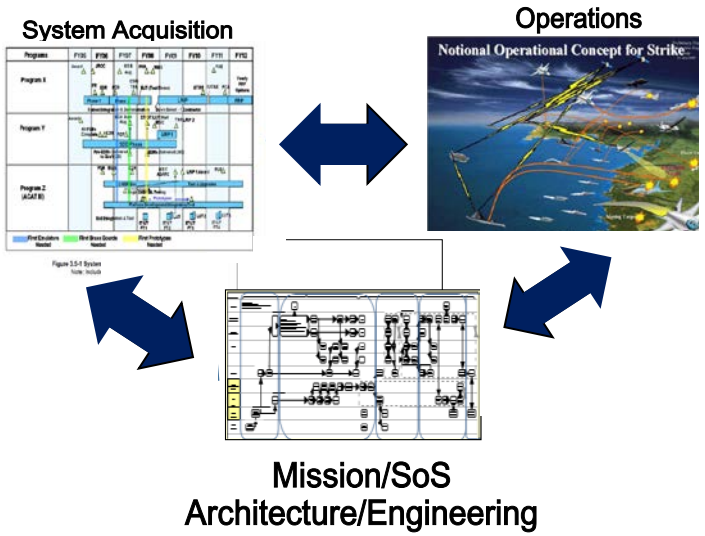
Mission Engineering



Mission Engineering is the deliberate planning, analyzing, organizing, and integrating of current and emerging operational and system capabilities to achieve desired warfighting mission effects

- Mission engineering treats the end to-end-mission as the 'system'
- Individual systems are components of the larger mission 'system'
- Systems engineering is applied to the systems of systems supporting operational mission outcomes
- Mission engineering goes beyond data exchange among systems to address cross cutting functions, end to end control and trades across systems
- Technical trades exist at multiple levels; not just within individual systems or components
- Well-engineered composable mission architectures foster resilience, adaptability and rapid insertion of new technologies

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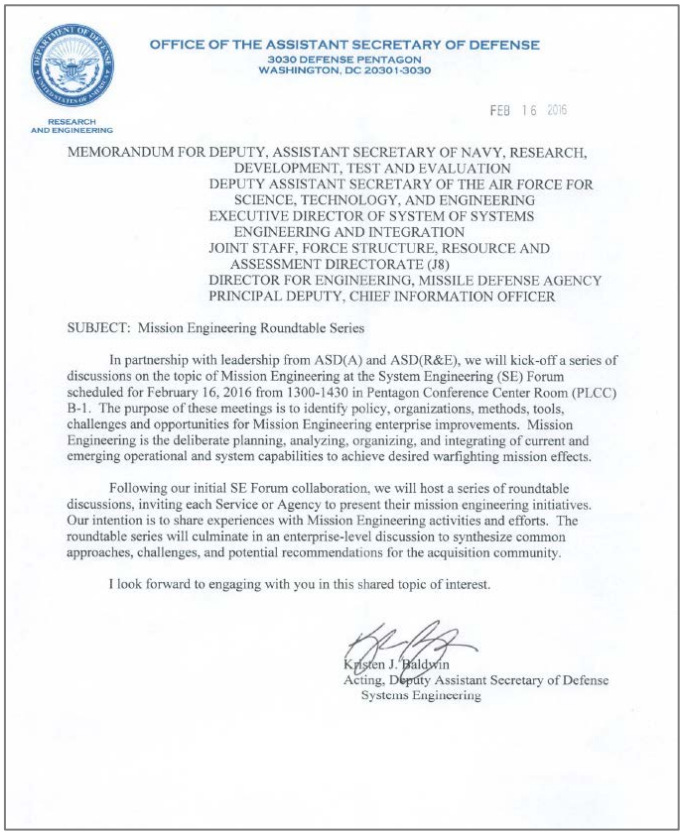
AT&L
Mission Engineering Roundtables



OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
3030 DEFENSE PENTAGON
WASHINGTON, DC 20301-3030

RESEARCH AND ENGINEERING

FEB 16 2016

MEMORANDUM FOR DEPUTY, ASSISTANT SECRETARY OF NAVY, RESEARCH, DEVELOPMENT, TEST AND EVALUATION
DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE FOR SCIENCE, TECHNOLOGY, AND ENGINEERING
EXECUTIVE DIRECTOR OF SYSTEM OF SYSTEMS ENGINEERING AND INTEGRATION
JOINT STAFF, FORCE STRUCTURE, RESOURCE AND ASSESSMENT DIRECTORATE (J8)
DIRECTOR FOR ENGINEERING, MISSILE DEFENSE AGENCY
PRINCIPAL DEPUTY, CHIEF INFORMATION OFFICER

SUBJECT: Mission Engineering Roundtable Series

In partnership with leadership from ASD(A) and ASD(R&E), we will kick-off a series of discussions on the topic of Mission Engineering at the System Engineering (SE) Forum scheduled for February 16, 2016 from 1300-1430 in Pentagon Conference Center Room (PLCC) B-1. The purpose of these meetings is to identify policy, organizations, methods, tools, challenges and opportunities for Mission Engineering enterprise improvements. Mission Engineering is the deliberate planning, analyzing, organizing, and integrating of current and emerging operational and system capabilities to achieve desired warfighting mission effects.

Following our initial SE Forum collaboration, we will host a series of roundtable discussions, inviting each Service or Agency to present their mission engineering initiatives. Our intention is to share experiences with Mission Engineering activities and efforts. The roundtable series will culminate in an enterprise-level discussion to synthesize common approaches, challenges, and potential recommendations for the acquisition community.

I look forward to engaging with you in this shared topic of interest.

Kristen J. Baldwin
Acting, Deputy Assistant Secretary of Defense
Systems Engineering

- Intent: Start a dialog between offices in OSD, the Joint Staff, and Components on Mission Engineering
- Action: DASD(SE) will host a series of roundtables to share experiences of each Service or Agency on Mission Engineering activities and efforts
  - Identify policy, organizations, methods, tools, challenges, and opportunities for Mission Engineering enterprise improvements
  - Compare mission engineering initiatives across Services and Agencies
- Outcome: Synthesize common approaches, challenges, and potential recommendations for the acquisition community into a final product to share with leadership and the broader community

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Roundtable Questions

- How does Service or Agency address operational mission performance and impacts across acquisition, systems engineering and T&E?
  - What are your component's current policy, guidance and organizational responsibilities?
  - Across what missions areas within your component do you need to apply SoS activities?
  - What are the methods and tools you use today?
  - Provide a specific example of how these have been applied both within programs and across programs in a mission context.
  - How do you work with industry to address your Mission Engineering needs?
  - What are the major challenges you face today?
  - What do you see as potential opportunities for improvements?
  - What joint mission areas do you see that require cross-component efforts?

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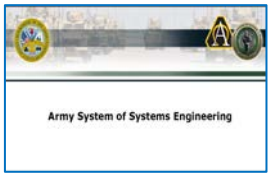
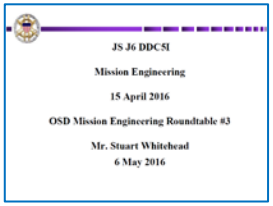
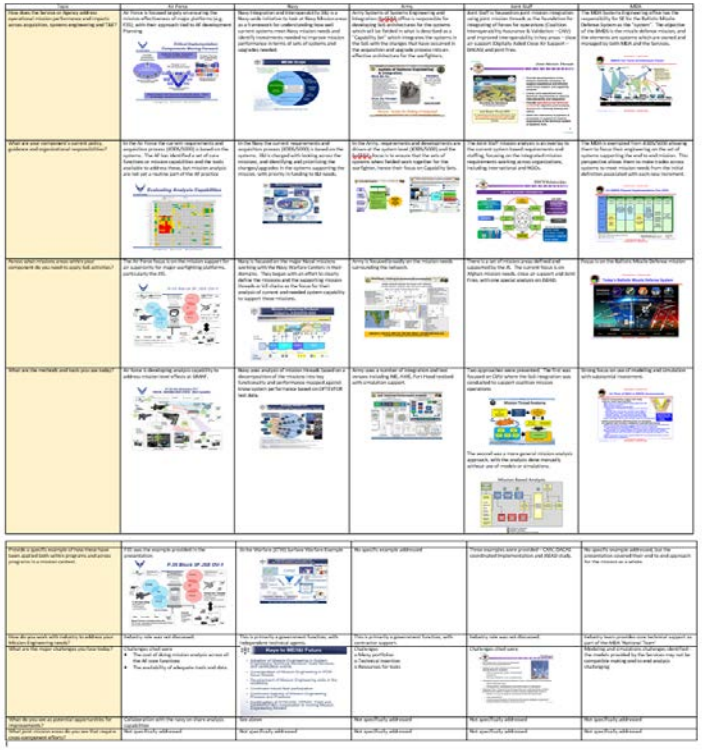
Mission Engineering is Underway By Components





Snapshot of Roundtables



Hosted Roundtables
April – May 2016

Results: Service activities are focused on unique approaches and mission perspectives.

- Assess current mission capabilities as basis for analysis of shortfalls, options and recommended programming and budgeting changes (Navy I&I)
- Address integration during development (Army NIE/AWE)
- Early development planning to derive mission gaps and capability solutions (AF)
- Comprehensive, ongoing engineering and integration towards improved mission performance (Missile Defense Agency)

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Impacts of ME on the DoD Enterprise

- Defines mission outcomes to identify and frame the correct problem
- Develops an accepted end state for mission success with defined mission success factors to drive the performance requirements for individual systems
- Aligns the affected stakeholders – Users, Operators, Acquirers, Testers, Sustainers - with the desired mission and capability outcomes
- Develops an assessment framework to measure progress toward mission accomplishment through end-to-end system integration of test & evaluation of mission threads

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Outcomes of ME

- PPBE informed by gaps created by dis-investment decisions or unfunded mission critical components
- Cross-cutting capabilities performing as required or desired
  - Development and engineering synchronized
  - Fielding expectations documented and promulgated
  - Sustaining activities prepared to support fielding
- Stakeholders of capabilities are identified with greater potential to:
  - Improve coordination of management actions
  - Resolve or avoid system conflicts
- Opportunity for much greater and more effective savings when trades & analyses are performed at a mission or portfolio level

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Sample Mission Areas

- Currently addressed DoD mission areas
  - Ballistic Missile Defense (MDA)
  - Nuclear Command and Control/National Leader Command and Control (NLCC)
  - Digitally Aided Close Air Support (DACAS)
  - Air/Cruise Missile Defense (Navy AEGIS & Army IAMD)
- Other examples which cross Services
  - Tactical SATCOM
  - CHEM BIO
  - Environmental Monitoring (Weather)
  - Spectrum Operations
  - Assured PNT
  - Cyber Situational Awareness

- Innovative ME approaches needed in
  - Air Superiority in contested environments
  - Wide area surveillance and targeting

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Challenges Faced Today (1 of 2)

- Limited corporate/leadership demand for ME
- Lack of integration of ME considerations and results into SETRs, Milestone reviews, resourcing decisions
- Cost/benefit of conducting mission engineering and analysis
- Large scope and complexity of missions
  - Cross multiple portfolios and organizations
  - Multiple complex, system interdependencies
- Lack of dedicated ME resources (funding, people, tools, data)
  - Availability and development of ME skills
  - Development of effective ME processes and practice
- Data, methods and tools (next page)

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Challenges Faced Today (2 of 2)

Methods, tools and data

- Challenges of developing integrated analysis capabilities that bridge engineering and mission effects
  - Limits on the available analysis methods to address complexity and dynamics
  - Difficult to link changes in systems or SoS engineering models with impacts on missions in operational or mission simulations
  - Tools address only subset of issues, making complex analysis and engineering trades manpower intensive and time consuming, are difficult to use together
- Need for data on missions, systems, interfaces, interactions and interdependencies
  - Very distributed, maintained in various forms by different organizations
  - Focus on specific system needs and don't address interdependencies and interactions
  - Even when available, can be hard to locate or access
  - Current system models are developed for different purposes which can challenge their effective use in addressing mission level issues

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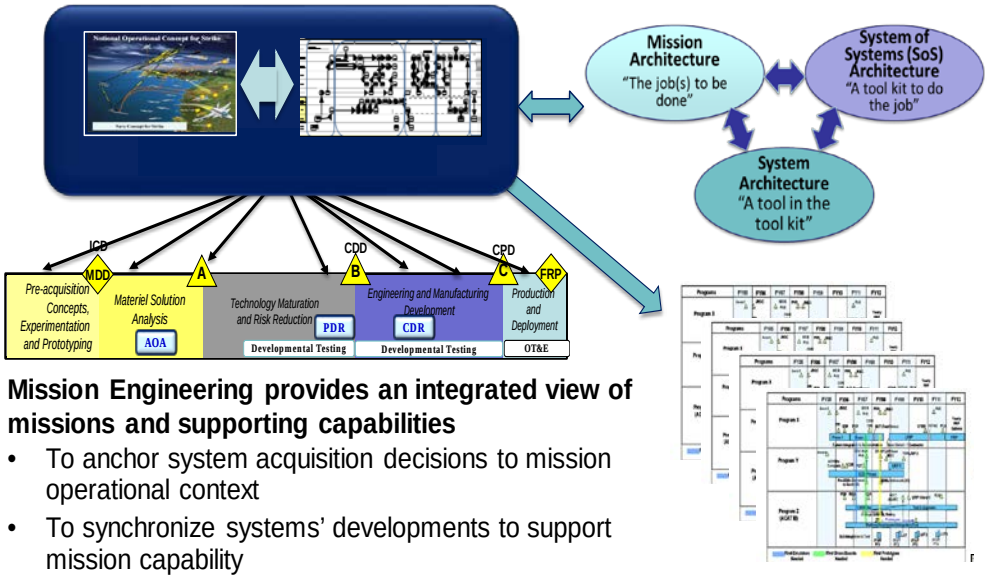
Industry Support to Mission Analysis and Mission Engineering

NDIA SE Division and INCOSE lead Industry 'Mission Engineering Study' to determine

- Industry state of the practice industry regarding mission analysis and engineering and
- How industry can improve the practice and engage in mission engineering



Mission Engineering provides an integrated view of missions and supporting capabilities

- To anchor system acquisition decisions to mission operational context
- To synchronize systems' developments to support mission capability
- To provide an integrated mission capability to warfighters

Conclusions

- Industry finds value in ME and MA
- Industry has much to offer: large number of practitioners and a variety of tools and approaches
- Much more can be done if we work collaboratively to:
  - Refine and understand the definition of ME
  - Address the common challenges
  - Share best practices, tools, and models
  - Find a means to provide access to relevant data
  - Share resources for skill development
  - Explore other opportunities (e.g., additional modeling capabilities)
- Recommend establishing a joint action plan to move forward

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To Summarize

- Mission Engineering
  - Develops an understanding of the operational environment in conjunction with the JCIDS process to identify and frame the correct mission context (JCS)
  - Develops an accepted end state for mission success with defined mission success factors to drive the performance requirements for individual systems/platforms and provides for systems, platforms, and systems of systems success (Program Offices)
  - Develops an assessment framework to measure progress towards mission accomplishment through end-to-end test and evaluation with the system./platform, systems of systems within the mission context (T&E Community)

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Opportunities

- Potential for cross organizational collaboration to share
  - ME approaches, practices and lessons learned
  - Models, simulations, and tools
  - Analytic approaches and methods
  - Analysis results

- Opportunity to work together to identify gaps and synchronization points across component ME activities

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For Additional Information

Robert A. Gold

ODASD, Systems Engineering

703.695.3155

robert.a.gold4.civ@mail.mil

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