

# Role of Industry in Mission Engineering

## INCOSE 2019 International Workshop

### System of Systems Working Group

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Mission Engineering Phase II  
Version 1.0, January 2019

Mission Engineering Phase II Study  
January 2019

An Industry Task Team led by the  
National Defense Industrial Association Systems Engineering  
Division (NDIA SED)  
and the  
International Council on Systems Engineering (INCOSE)

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# Bottom Line Up Front

- Systemic industry & government issues identified in 2011 report on development planning remain unresolved
- Context of missions is critical to industry role – calling for an engagement model among contractors and industry, especially in conceiving and “devops”
- Industry has detailed knowledge of their constituent systems below the level of the technical baseline
- Leverage IR&D to support mission assurance
- Establish mechanisms for information sharing such as OTAs to deal with OCI issues
- Industry support Digital Engineering implementation
- Address both opportunities and risks for both industry and government
- Anticipate further questions including both new, original questions and refinements of questions addressed in this report

# Context

- 2009 WSARA – real or perceived OCI of non-SETA contractors
- 2017 NDAA – mission engineering



## Mission Engineering

**Robert Gold**  
Office of the Deputy Assistant Secretary of Defense  
for Systems Engineering

19th Annual NDIA Systems Engineering Conference  
Springfield, VA | October 26, 2016

### Mission Engineering is Underway By Components



Snapshot of Roundtables

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)

Hosted Roundtables  
April – May 2016



## Mission Integration Management NDAA 2017 Section 855

**Mr. Robert Gold**  
Director, Engineering Enterprise  
Office of the Deputy Assistant Secretary of Defense  
for Systems Engineering

20th Annual NDIA Systems Engineering Conference  
Springfield, VA | October 25, 2017

- 2018 Reorganization of OSD into R&E and A&S
- Undersecretary of Defense for R&E
  - Digital Engineering Strategy
  - Mission Engineering separate from Systems Engineering



### Foreword

In the Department of Defense (DoD) National Defense Strategy of 2018, Secretary of Defense James Mattis encouraged all of us to adopt new practices to achieve greater performance and affordability to meet current and future challenges. Without sustained and predictable investment to restore readiness and modernize, we will rapidly lose our military advantage, resulting in a Joint Force that has legacy systems irrelevant to the defense of our people. In order to meet the National Defense Strategy's lines of effort, we must modernize our defense systems and prioritize speed of delivery to be able to fight and win the wars of the future.

One way we can do this is by incorporating the use of digital computing, analytical capabilities, and new technologies to conduct engineering in more integrated virtual environments to increase customer and vendor engagement, improve threat response timelines, foster infusion of technology, reduce cost of documentation, and impact sustainment affordability. These comprehensive engineering environments will allow DoD and its industry partners to evolve designs at the conceptual phase, reducing the need for expensive mock-ups, premature design lock, and physical testing.

This DoD Digital Engineering Strategy outlines the Department's five strategic goals for the digital engineering initiative. The goals promote the use of digital representations of systems and components and the use of digital artifacts as a technical means of communication across a diverse set of stakeholders. The strategy addresses a range of disciplines involved in the acquisition and procurement of national defense systems, and it encourages innovation in the way we build, test, field, and sustain our national defense systems and how we train and shape the workforce to use these practices.

This strategy is the result of extensive research and collaboration among the DoD Components and academic partners, as well as interactions with industry, professional societies, and defense acquisition associations. The possibilities these digital practices bring arise from years of effort and advancements in technical, legal, and social sciences. The practices have demonstrated their usefulness in engineering-related tasks and in many areas of DoD operations.

This strategy describes the "what" necessary to foster the use of digital engineering practices. Those implementing the practices must develop the "how" – the implementation steps necessary to apply digital engineering in each enterprise. The Services should develop corresponding digital engineering implementation plans during 2018 to ensure the Department advances this timely and imperative effort.



**Michael D. Griffin**  
Under Secretary of Defense for Research and Engineering  
U.S. Department of Defense

# Foundational Work

# NDIA

Development Planning report January 2011



**National Defense Industrial Association  
Systems Engineering Division  
Development Planning Working Group**

Report – Phase I

**Industry's Role in Development Planning**

Final Jan 2011

- Purpose**  
This report provides industrial support during the Defense Group's...
- Background**  
The Development Systems and Planning Development would provide OSD is acquisition...



**National Defense Industrial Association  
Systems Engineering Division  
Architecture and Mission Analysis Committees**

**The Role of Architecture to Influence the Development  
Planning Trade Space**



**RT-171: Mission Engineering Competencies  
Technical Report**

Technical Report SERC-2018-TR-106  
April 30, 2018

**Principal Investigator:** Dr. Gregg Vesonder, Stevens Institute of Technology  
**Co-Principal Investigator:** Dr. Dinesh Verma, Stevens Institute of Technology

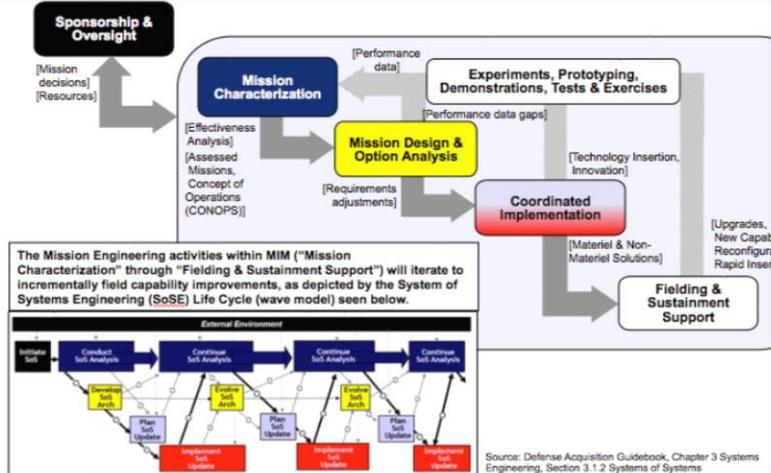
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**Sponsor:** Office of the Deputy Assistant Secretary of Defense for Systems Engineering (DASD(SE))



## Key MIM Activities (1 of 2)



**Industry Support to Mission  
Analysis and Mission  
Engineering**



## Industry Support to Mission Analysis and Mission Engineering

Preliminary Study Report – May 2016

NOTE: Not an official position from these organizations, but the study was coordinated through them.



Industry Support to Mission  
Analysis and Mission  
Engineering



## BLUF

NDIA SED and INCOSE Offer to Lead Industry Task Team on Mission Engineering: (1) State of industry practice and (2) Role of industry

- Both government and industry are doing mission engineering with shared areas of interest, but:
  - Mission Engineering requires more definition,
  - There are challenges associated with Mission Engineering,
  - There is a need for the right enablers; such as practices, tools, modeling, and data, and
  - There is a need to hone Mission Analysis / Mission Engineering skills based on the items above
- Collaboration between DoD and industry can help ME effectiveness

The defense industry can be a key Mission Engineering partner to address the needs.

# Role of Industry – Issues

- **Issue 1:** In-Depth Industry Knowledge of Current Systems and Technology
- **Issue 2:** Industry IR&D on Innovative Mission Approaches & Systems Technologies
- **Issue 3:** Facilitating Cross-Industry Mission Engineering Engagement
- **Issue 4:** Technical Approaches to Mission Engineering and Analysis
- **Issue 5:** Government Actions to Incentivize Industry Mission Engineering Engagement

# 1 In-Depth Industry Knowledge of Current Systems and Technology

- Questions
  - Under what circumstances will it be critical to have industry input to understand options and implications of making changes in how a system is used to support changes in the SoS supporting a mission?
  - How would this type of engagement be structured?
  - What would incentivize industry to participate?
- Analysis – Circumstances critical for industry involvement
  - Industry capturing their own internal detailed knowledge
  - Government developing a standard approach
  - Obtaining information from the Government early
- Recommendations – Engagement Structure
  - Developing Government / Industry engagement model
  - Ability to review Government models

# 2 Industry IR&D on Innovative Mission Approaches & Systems Technologies

- Questions
  - How could industry IR&D contribute to new mission concepts and approaches or new systems techniques to foster improved mission effectiveness?
  - What information or insights would industry need to enable this?
  - What would incentivize industry to invest IR&D in these areas?
  - What are the risks to industry (competition; IP)?
- Analysis
  - Industry has demonstrated the capability to investigate innovative approaches to addressing challenging defense problems bringing a fresh perspective and novel approaches. This opens the possibility of industry contributions to new ways to improve mission effectiveness or new systems approaches to support mission adaption under the Industry IR&D efforts.
- Recommendations
  - Industry IR&D Contributions
    - Government involving Industry earlier
    - Government providing directed IR&D
    - Developing a Government / Industry Governance Model
  - Information and Insights
    - Government getting Industry involved earlier
    - Government defining their responsibilities

# 3 Facilitating Cross-Industry Mission Engineering Engagement

- Questions
  - What are the issues in getting industry teams drawn from multiple companies to work together to support ME initiatives?
  - What are the incentives for industry?
  - What models (e.g. MDA National team) exist and how could these be adapted to support ME?
  - What are the pros and cons of different approaches?
  - What are the risks to industry?
- Analysis
  - Missions are supported by systems of systems which are developed by different industry providers. Mission engineering efforts involving industry will naturally need to include teams from different, often competing companies. To effectively engage industry in ME activities, there needs to be a way to facilitate constructive cross-industry engagement with a focus on operational mission outcomes.
- Recommendations
  - Mitigating OCI
  - Establishing teaming arrangements
  - Developing the SoS architecture collaboratively
  - Developing a national team-like concept of operations
  - Assessing teaming considerations

# 4 Technical Approaches to Mission Engineering and Analysis

- Questions
  - What type of mission engineering related technical experience and resources does industry have which could benefit DoD mission engineering efforts?
  - How can industry progress in digital engineering provide a foundation for mission engineering?
  - How could these be shared with government?
  - What is the incentive for industry to share these? What are the risks?
- Analysis
  - The 2016 Industry Task Force report on ME indicated that industry conducts ME for various purposes and has a base of experience in ME technical modeling and analysis approaches which could benefit DoD ME efforts. These include environments which could be used for ME experimentation and analysis, technical digital approaches for representation of SoS, and analysis of mission impacts. This industry technical base could form a focus for government industry ME technical exchange and implementations.
- Recommendations for Industry
  - Understanding Industry technical expertise and resources
  - Presenting Industry technical expertise and resources
  - Providing training on the digital engineering strategy
  - Developing an input-output criteria framework
  - Participating in the DEIX Working Group
  - Contributing and participating in other activities
  - Sharing with the Government

# 5 Government Actions to Incentivize Industry

## Mission Engineering Engagement

- Questions
  - What set of incentives have been identified for the set of topics related to industry's role in ME?
  - What type of information or insights could government provide which would motivate industry to engage in ME?
  - What can government do to reduce risks for industry to engage in ME?
- Analysis
  - For industry to engage in an activity like ME, there needs to be some clear potential benefits. It has been noted that if industry perceives that the government is committed to implementation of MIM and fund industry to develop capabilities resulting from MIM/ME efforts, they will be encouraged to commit time and effort to engage and support government efforts. Questions of incentives have been raised for all the topics above, which could usefully be summarized under this topic, but beyond this, there may be general actions the government could take which would incentivize industry to support new ME efforts.
- Recommendations for Government
  - Applying modularity and openness principles
  - Conducting pre-work
  - Ensuring systems are mission effective
  - Providing links to industry
  - Working together with industry
  - Using the market place to share information
  - Providing clear definitions to OCI boundaries

# Clarification on Government Owning the Technical Baseline

*Owning the Technical Baseline for Acquisition Programs in the U.S. Air Force: A Workshop Report (2016)*

- **Technical baseline:** Data and information that provide the program office knowledge to establish, trade off, verify, change, accept, and sustain functional capabilities, design characteristics, affordability, schedule, and quantified performance parameters at the chosen level of the system hierarchy.
- **Owning the technical baseline:** Air Force program managers and personnel have sufficient technical knowledge of their engineering development programs to enable program success by *making informed, timely, and independent decisions*<sup>5</sup> to manage cost, schedule, and performance risk while ensuring disciplined program execution. Owning the technical baseline allows the Air Force to respond knowledgeably and have minimal disruption to mission success. [emphasis added]

**Owning the technical baseline does not require the Government to own all the technical data for a program.**

# Core Team and Workshop Participants

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**Thank you**