SoSECIE Webinar

Welcome to the
2020 System of Systems Engineering Collaborators Information Exchange (SoSECIE)

We will start at 11AM Eastern Time

Skype Meeting +1 (703) 983-2020, 46013573#

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NDIA System of Systems SE Committee

- **Mission**
  - To provide a forum where government, industry, and academia can share lessons learned, promote best practices, address issues, and advocate systems engineering for Systems of Systems (SoS)
  - To identify successful strategies for applying systems engineering principles to systems engineering of SoS
- **Operating Practices**
  - Face to face and virtual SoS Committee meetings are held in conjunction with NDIA SE Division meetings that occur in February, April, June, and August

NDIA SE Division SoS Committee Industry Chairs:
Mr. Rick Poel, Boeing
Ms. Jennie Horne, Raytheon
OSD Liaison:
Dr. Judith Dahmann, MITRE

Simple Rules of Engagement

- I have muted all participant lines for this introduction and the briefing.
- If you need to contact me during the briefing, send me an e-mail at sosecie@mitre.org.
- Download the presentation so you can follow along on your own
- We will hold all questions until the end:
  - I will start with questions submitted online via the CHAT window in Skype.
  - I will then take questions via telephone; State your name, organization, and question clearly.
- If a question requires more discussion, the speaker(s) contact info is in the brief.

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2020-2021 System of Systems Engineering Collaborators Information Exchange Webinars

Sponsored by MITRE and NDIA SE Division

April 7, 2020
Challenges for Systems of Systems / Mission Engineering in a Space Acquisition Environment
Lt Col Benjamin Bennett

April 21, 2020
Mission Engineering, Systems Engineering and Systems of Systems Engineering
Dr. Andreas Tolk

May 5, 2020
New Digital Engineering Enabled Systems and Mission Engineering Performance Measure
Dr. Ed Kraft

June 2, 2020
SERC: Methods to Evaluate Cost/Technical Risk and Opportunity
Thomas McDermott and Cody Fleming

July 28, 2020
Addressing Mission Engineering from a Lead Systems Integration Perspective
Dr. Warren Vaneman

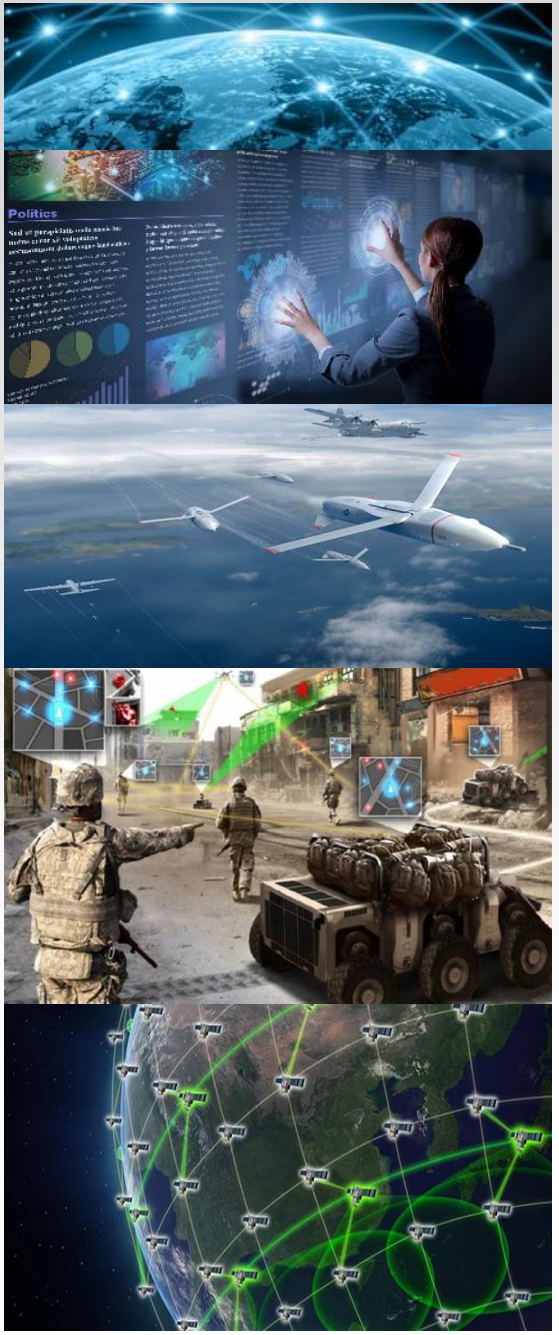
Extending the DoD Digital Engineering Strategy to Missions, Systems of Systems, and Portfolios

Ms. Philomena Zimmerman
Acting Director, Engineering Policy and Systems, OUSD(R&E)

Dr. Tracee Gilbert
Contractor Support, Engineering Policy and Systems, OUSD(R&E)

Dr. Judith Dahmann
The MITRE Corporation

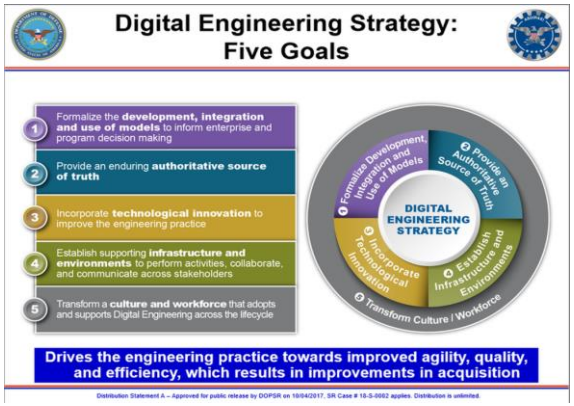
22nd Annual NDIA Systems and Mission Engineering Conference
Tampa, FL| 23 October 2019



Topics

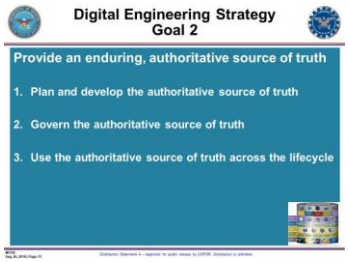
- Digital engineering and the five goals of the Digital Engineering Strategy (DES) provide the foundation for transforming systems engineering
- The DES focuses on improving engineering of systems through the lifecycle
- A next step is extending the DES to apply beyond systems – to missions, systems of systems (SoS), and portfolios

DoD Digital Engineering Strategy



- **The Department of Defense (DoD) is pursuing a digital engineering strategy: Digital engineering principles and implementation possibilities provide the basis for transforming systems engineering**

Models



Authoritative Data

Technological Innovation

Supporting Infrastructure

Culture and Workforce

Digital Engineering Strategy
Focus on Systems

- Application of digital engineering to systems provides clear benefits
- As DoD increases focus on mission – on supporting SoS and portfolios to meet operational mission needs – what are the benefits of applying digital engineering beyond traditional systems?
- As we understand these opportunities for digital engineering, how can we extend the application of digital engineering to address broader and growing needs?

Focus of DES is systems, but goals are broad with application to missions, SoS, and portfolios

Digital Engineering Strategy - Foreword

Michael D. Griffin, USD(R&E)

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.*

Drivers

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****.*

How?

Needs and opportunities are broad, but the focus is on systems in regard to designs, mockups, and testing.

Extending the Strategy

"Engineer our mission capabilities to meet dynamic challenges of today's defense environment"

wars of the future.

Drivers

One way we can do this is by incorporating the use of digital computing,

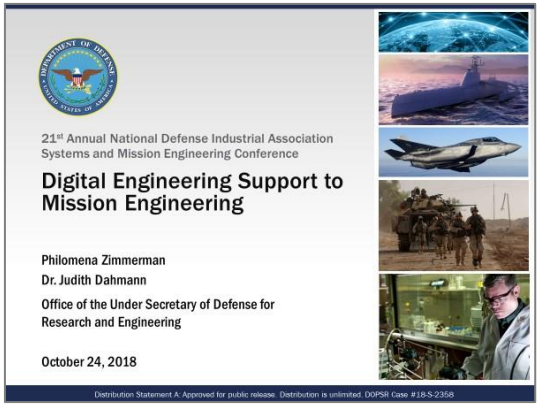
"Comprehensive digital engineering environments to identify and address gaps in our systems of systems architectures supporting critical missions"

ups, premature design lock, and physical testing.

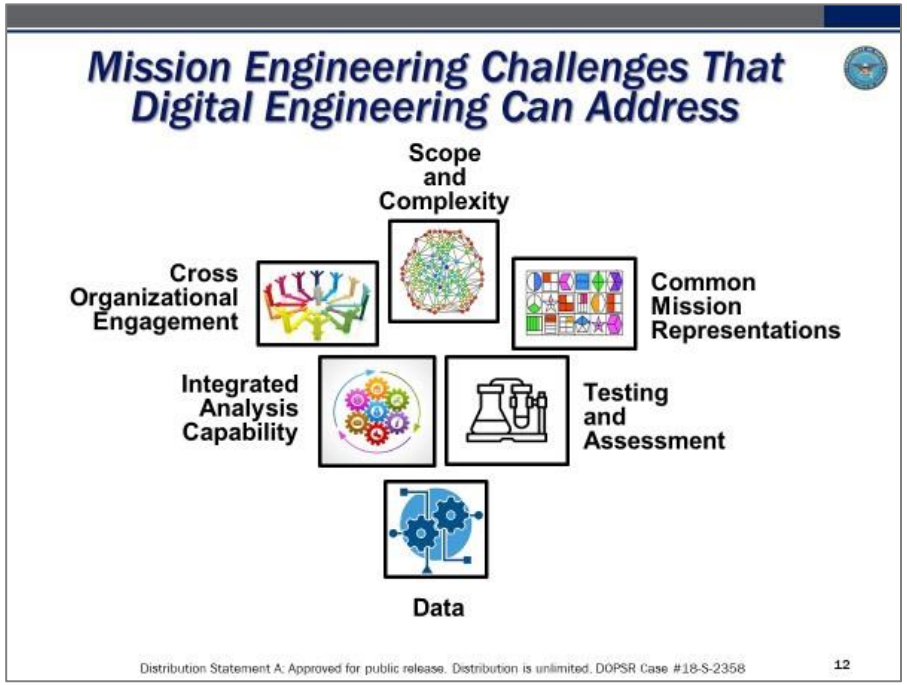
How? DES

Extend the focus to address broad mission enterprise needs and supporting SoS and portfolios

Opportunities for Extending Digital Engineering Benefits Beyond Systems



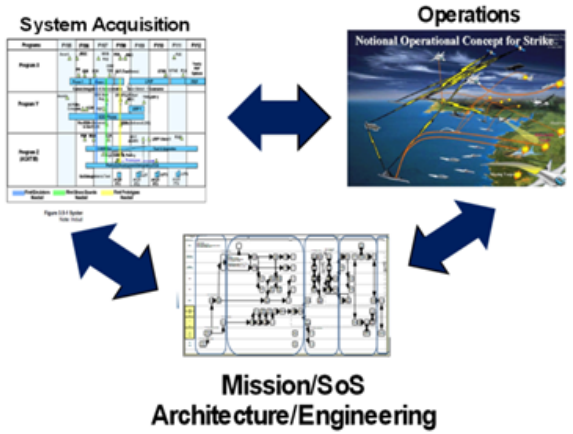
- Digital engineering can provide value to address the challenges of mission engineering



The DoD DES . . . provides a set of enablers to address key challenges facing mission engineering in DoD today. . . . Digital engineering does not, in itself, address the challenges, but it provides an approach to shared, curated models and data supported by a collaborative infrastructure. . . Digital engineering provides a viable, extensible set of tools and methodologies to address mission engineering challenges as an innovative and cross-organizational approach using today's computational technologies

Characteristics of Mission Engineering

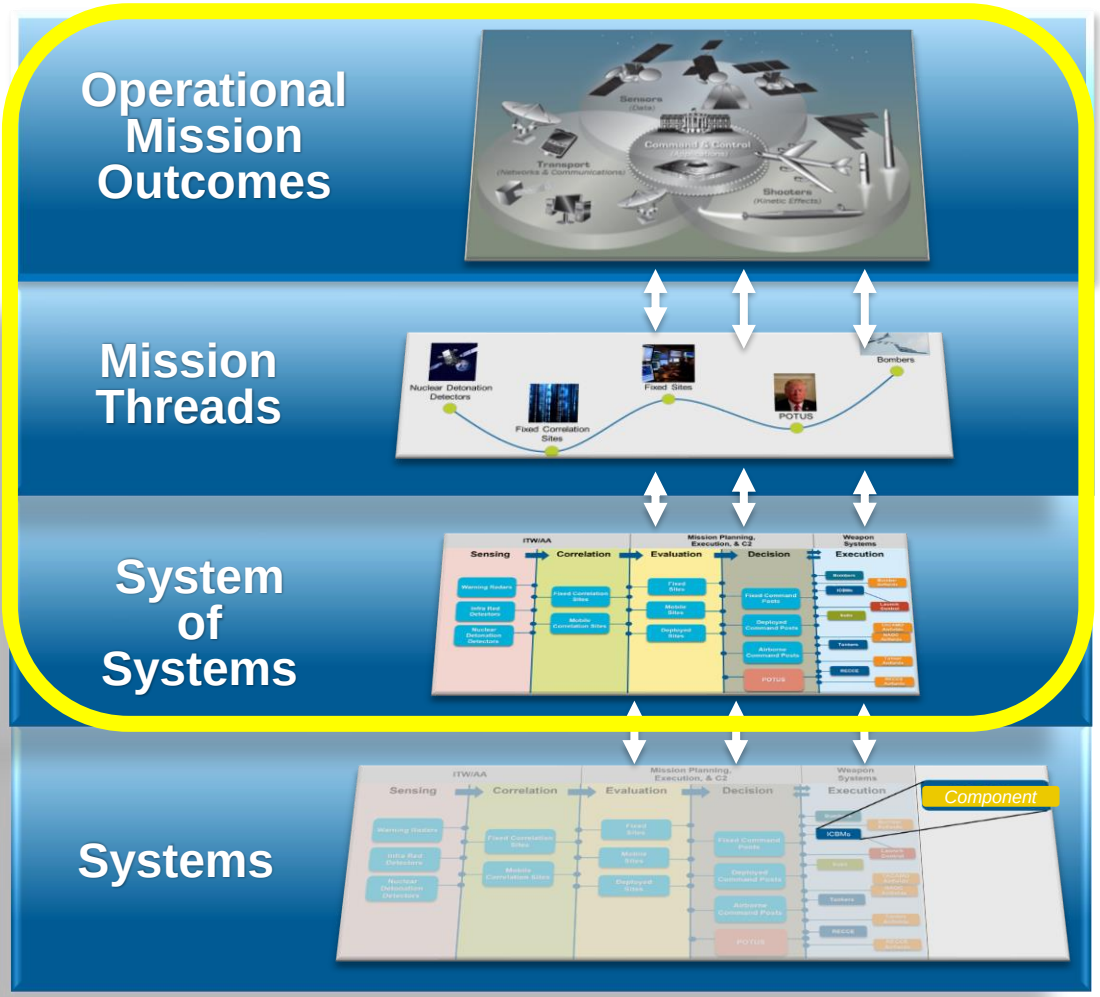
Mission Engineering



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 SoS 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

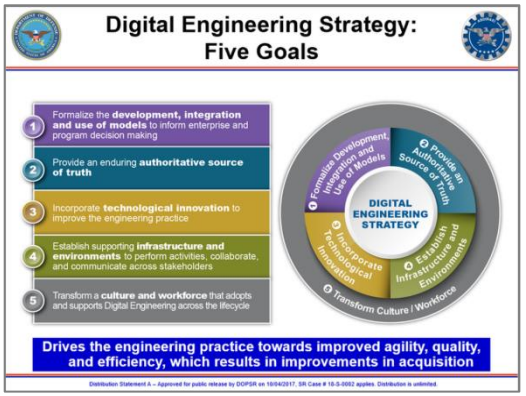
An Expanded View of Systems Engineering Beyond "Systems"

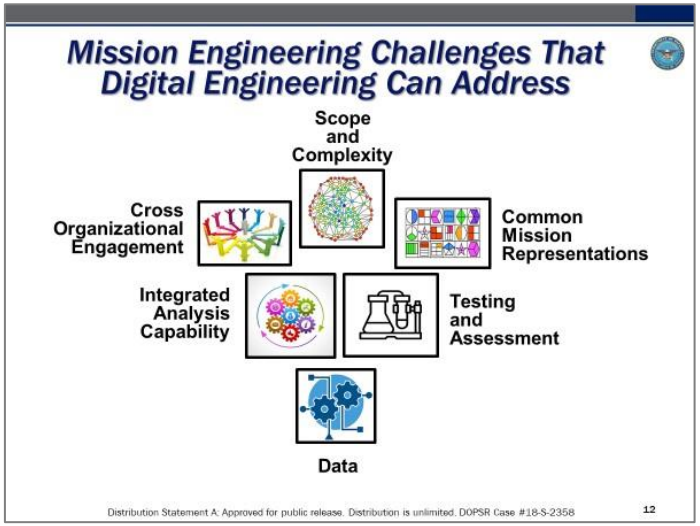


- As focus shifts to ensuring effectiveness of U.S. operational mission capabilities, systems engineering expands to ensure investments in systems and technology enable mission outcomes
- Digital engineering enables the linking of systems and technology to mission effectiveness

Approach

- **For each of the DES Five Goals:**
  - How does the DES address the goal for systems?
  - How does the digital engineering goal enable missions, SoS, and portfolios?
  - What does this mean for applying digital engineering to missions, SoS, and portfolios?



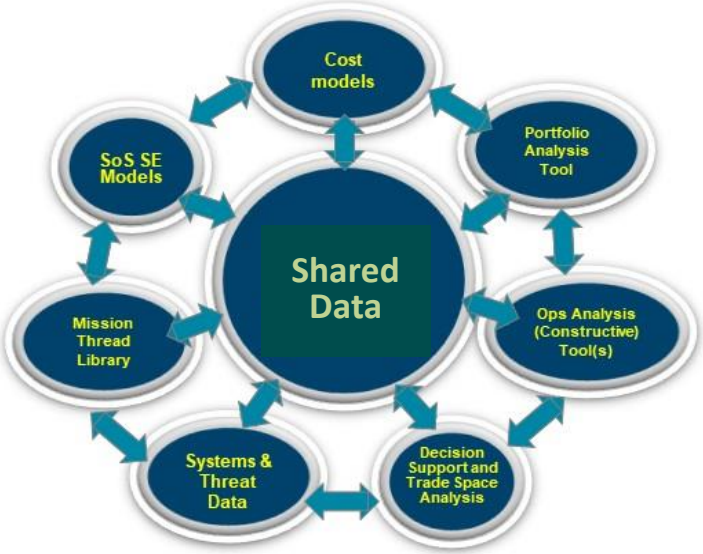


Models

Goal 1: Lifecycle Management of Models as Enterprise Assets

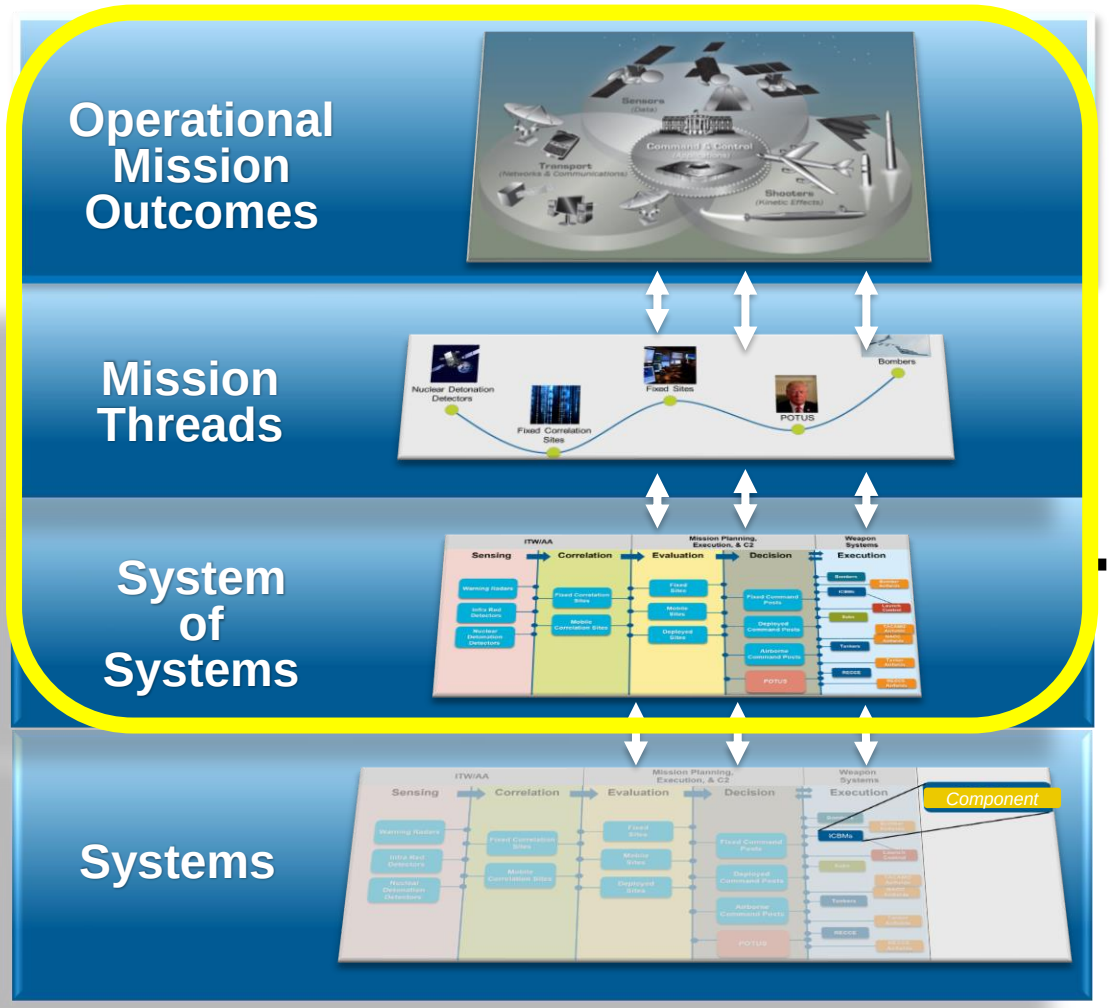
Models/Tools to Support System Acquisition

Models/Tools to Support Missions, SoS, Portfolios

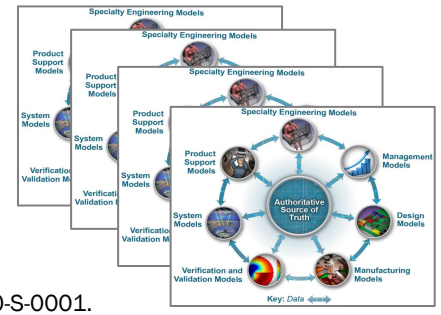


What types of models and digital tools support missions, SoS, portfolios?

Models/Tools for Digital Engineering Beyond "Systems"

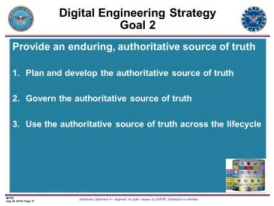


- Operational Simulations
- Operational Mission Thread//Effects Chain Models
- System of Systems Architecture Model
- Portfolio Analysis Tools



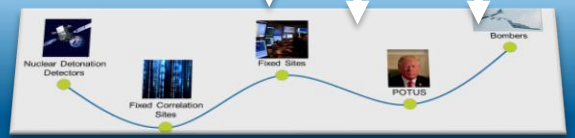
Goal 2: Shared Data Supports Linkage Among Models

Shared Data



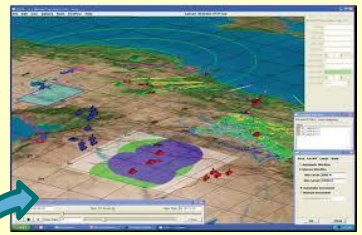
Operational Mission Outcomes

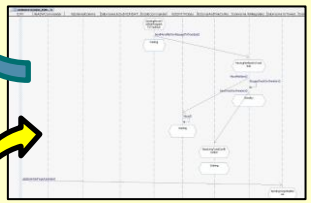
Mission Threads

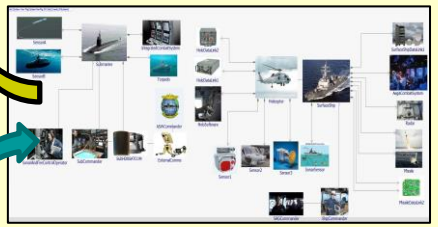


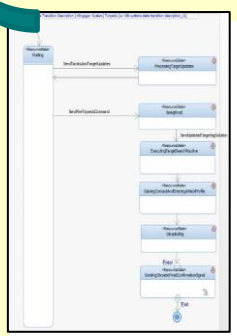
System of Systems

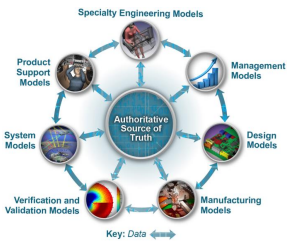
Systems



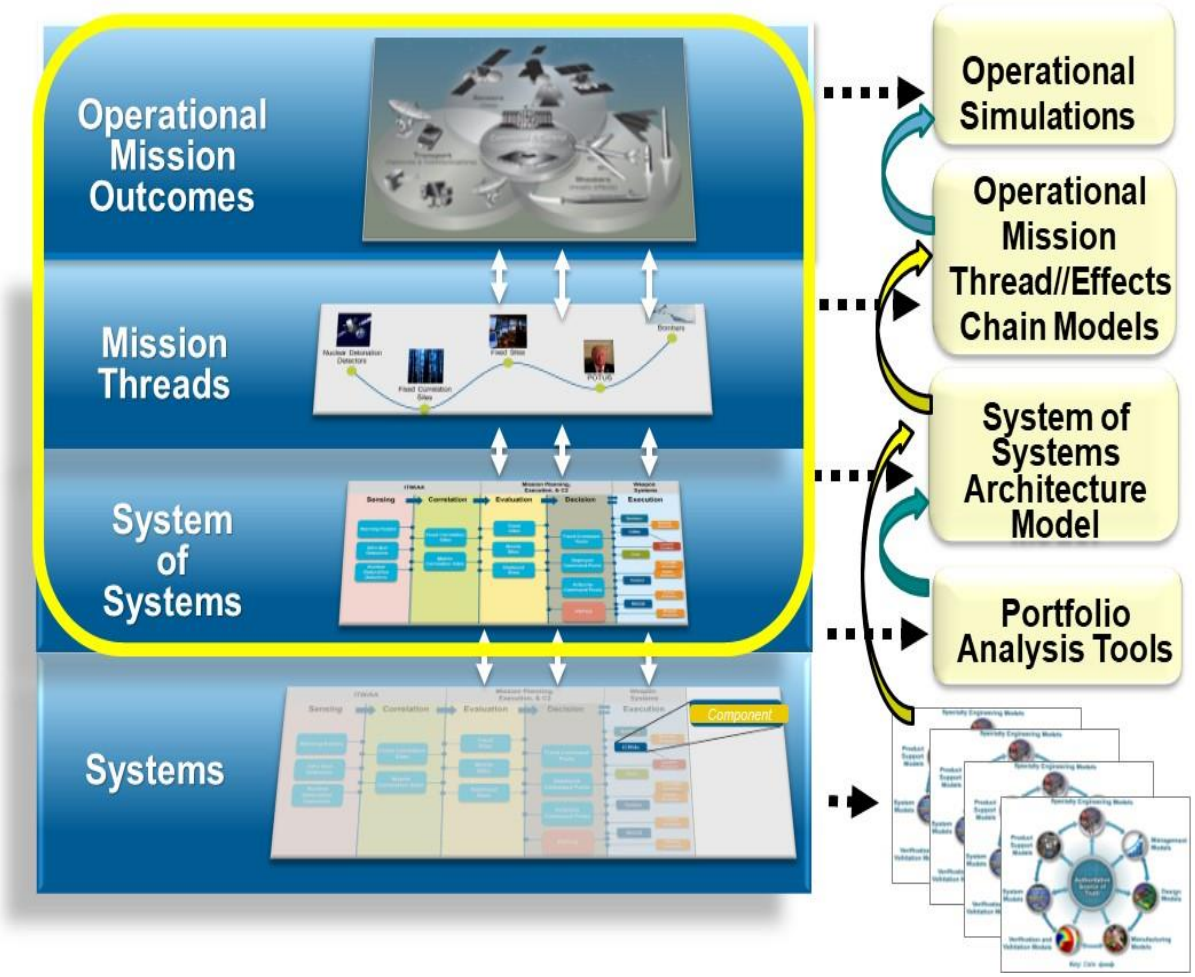








Goal 3: Integrated Analysis to Support Decision Making



- What do we need to accurately reflect CURRENT and FUTURE Missions?
- How does the Concept of Operations change with the introduction of new technologies?
- What are the new operational mission requirements?
- How am I rethinking my new capabilities to complete old and new missions?
- What mix of OLD and NEW systems and investments meets evolving mission needs?
- How do I model the physics of the new capabilities in the mission construct?

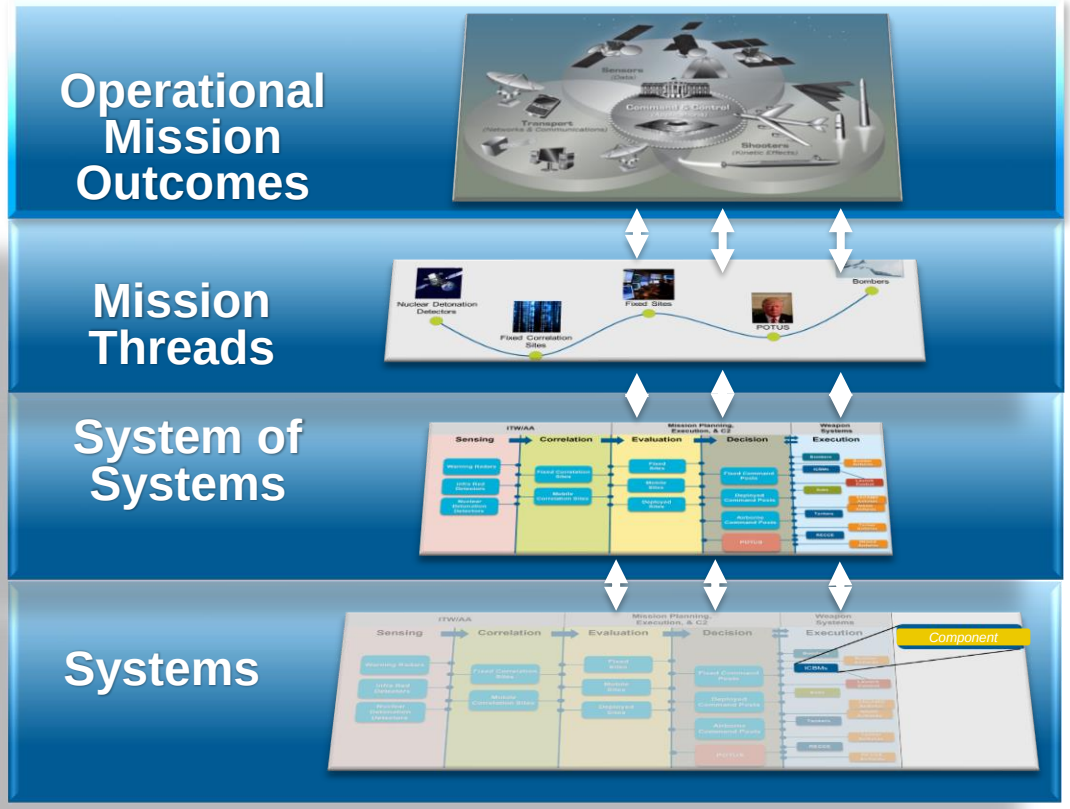
Infrastructure

Digital Engineering Strategy
Goal 4

Establish a supporting infrastructure and environments to perform activities, collaborate, and communicate across stakeholders

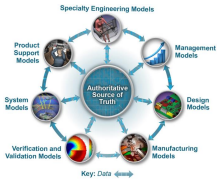
1. Develop, mature, and use digital IT infrastructures
2. Develop, mature and use digital engineering methodologies
3. Secure IT infrastructure and protect intellectual property

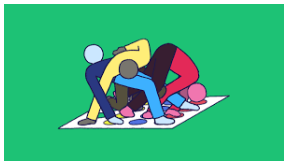
Goal 4: Supporting Infrastructure Computational Resources and Availability



Proper tool for proper job

Need timely access to the right data





Support continuous collaboration

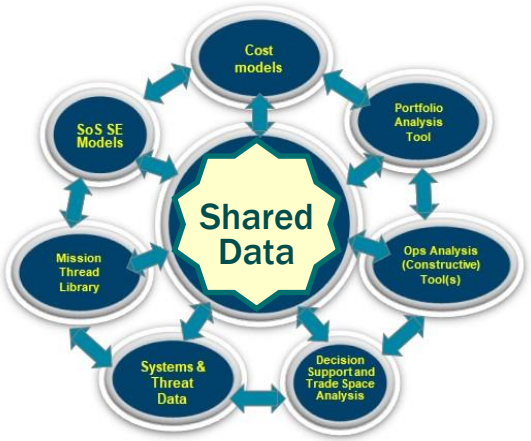
Incorporate new ideas into digital ecosystem

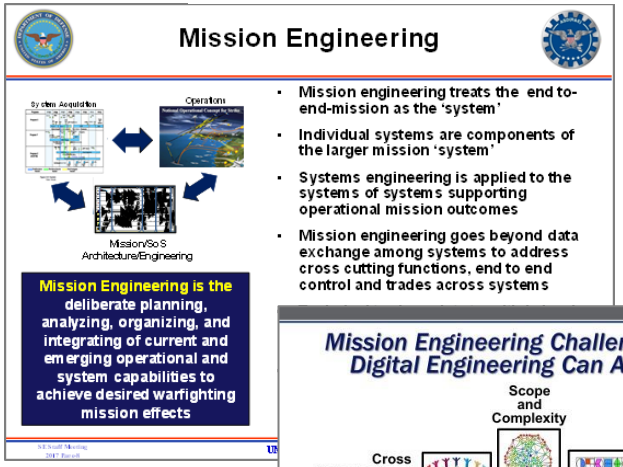
Incorporate proper levels of modeling resolution and fidelity

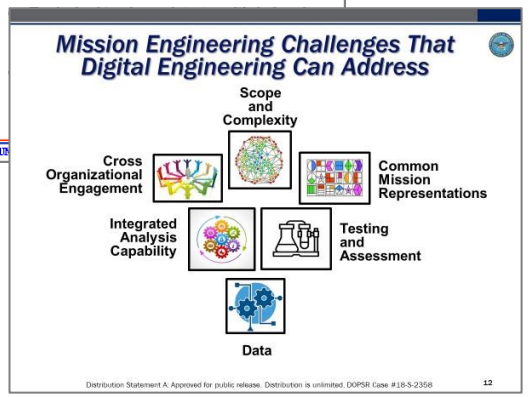
Culture and Workforce

Goal 5: Transformation

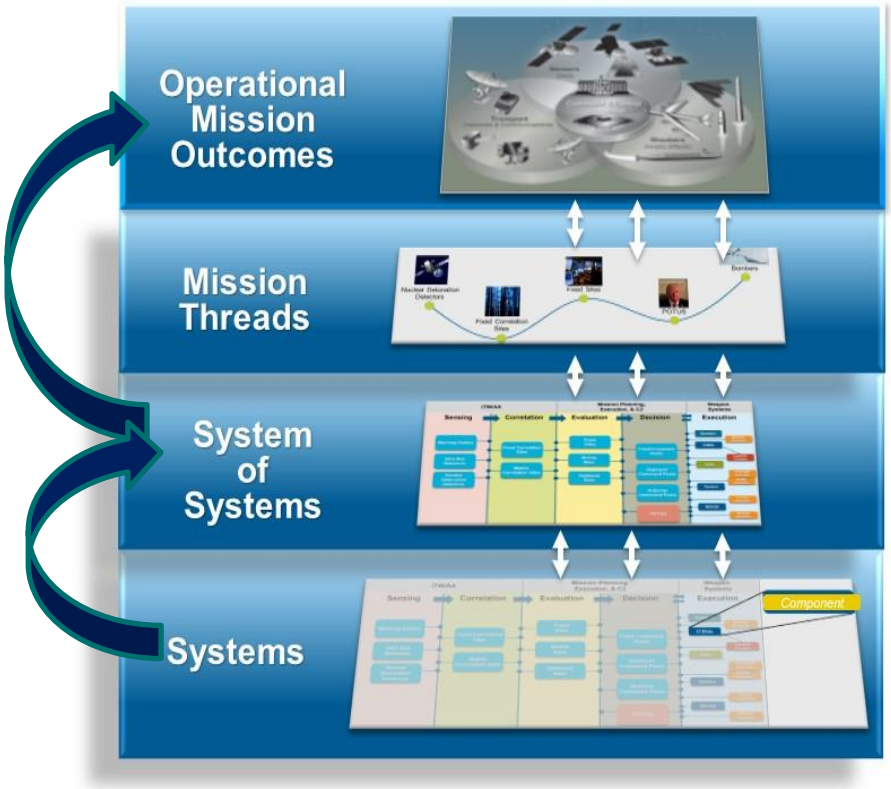
- Digital engineering goal is to transform the way we do engineering
  - Recognizing this is a change for the culture and the workforce
- Application of engineering to mission is also a change for the DoD culture and workforce
- Application of systems engineering to missions presents an opportunity
  - To apply digital engineering from the start
  - To leverage computational capabilities to address enterprise complexity







In Sum . . .



- DoD is making significant progress in implementing digital engineering to transform the way we engineer systems
- Equally, digital engineering provides the means to address broader questions about investments in technology and systems to support effective DoD missions, implementation of SoS and analyzing and managing capability portfolios

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Questions?

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For Additional Information

Ms. Philomena Zimmerman

Dr. Tracee Gilbert

Office of the Under Secretary of Defense
Research and Engineering

571-372-6695 | philomena.m.zimmerman.civ@mail.mil

Dr. Judith Dahmann

The MITRE Corporation

703-298-6694 | jdahmann@mitre.org

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