



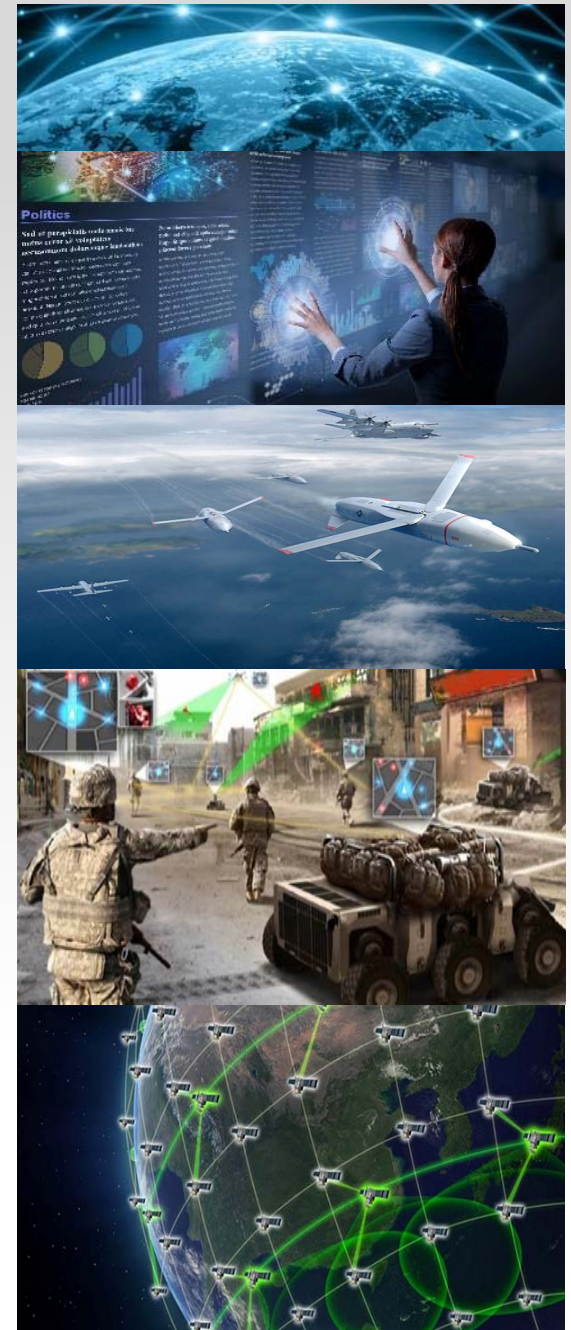
Extending the DoD Digital Engineering Strategy to Missions, Systems of Systems, and Portfolios

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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



Digital Engineering Strategy: Five Goals

1. Formalize the **development, integration and use of models** to inform enterprise and program decision making.
2. Provide an enduring **authoritative source of truth**.
3. Incorporate **technological innovation** to improve the engineering practice.
4. Establish supporting **infrastructure and environments** to perform activities, collaborate, and communicate across stakeholders.
5. Transform a **culture and workforce** that adopts and supports Digital Engineering across the lifecycle.

Drives the engineering practice towards improved agility, quality, and efficiency, which results in improvements in acquisition

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

Digital Engineering Strategy Goal 1

Formalize the development, integration, and use of models to inform enterprise and program decision making

1. Formalize the planning for models to support engineering activities and decision making across the lifecycle
2. Formally develop, integrate, and curate models
3. Use models to support engineering activities and decision making across the lifecycle

Models

Digital Engineering Strategy Goal 2

Provide an enduring, authoritative source of truth

1. Plan and develop the authoritative source of truth
2. Govern the authoritative source of truth
3. Use the authoritative source of truth across the lifecycle

Authoritative Data

Digital Engineering Strategy Goal 3

Incorporate technological innovation to improve the engineering practice

1. Establish an end-to-end digital engineering enterprise
2. Use technological innovations to improve the engineering practice

Technological Innovation

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

Supporting Infrastructure

Digital Engineering Strategy Goal 5

Transform the culture and workforce to adopt and support digital engineering across the lifecycle

1. Improve the digital engineering knowledge base
2. Lead and support digital engineering transformation efforts
3. Build and prepare the workforce

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.*

*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.***

Drivers

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”

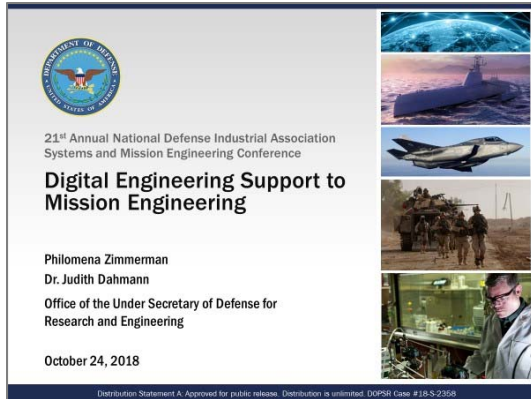
designs at the conceptual phase, reducing the need for expensive mock ups, premature design lock, and physical testing.

**How?
DES**

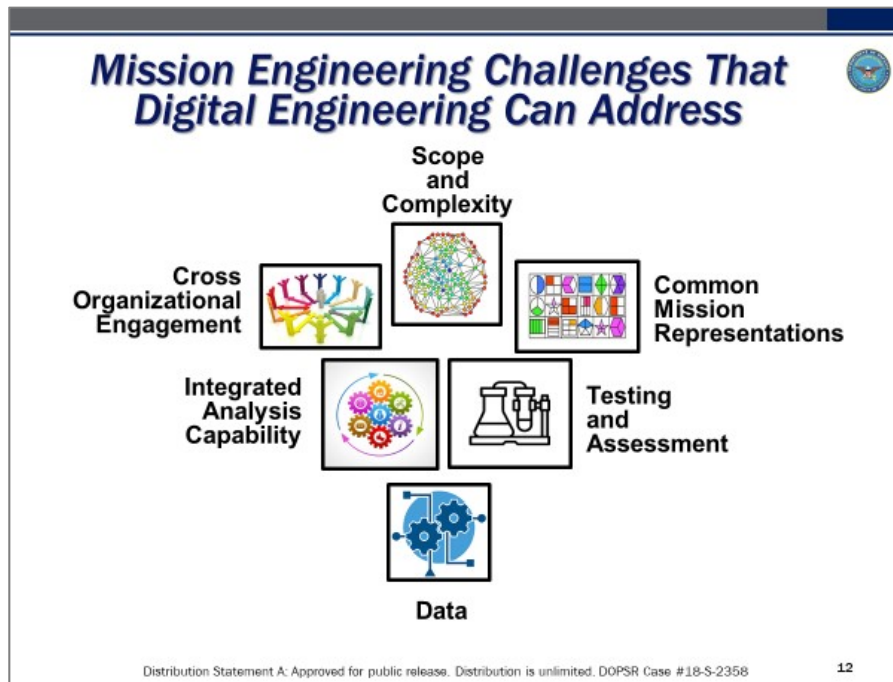
Extend the focus to address broad mission enterprise needs and supporting SoS and portfolios



Opportunities for Extending Digital Engineering Benefits Beyond Systems



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



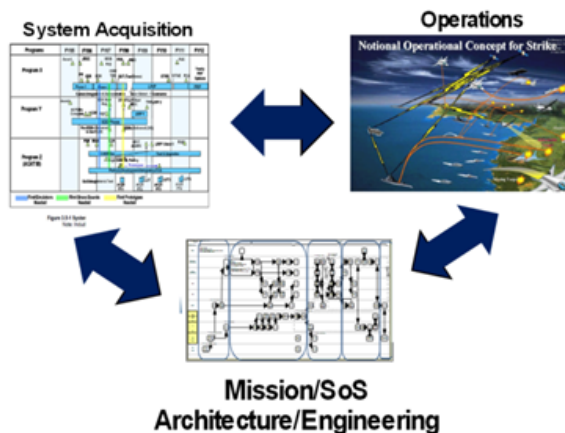
The DoD DES . . . provides a set of enablers to address key challenges facing mission engineering in DoD today. . . . Digital engineering does not, in itself, address the challenges, but it provides an approach to shared, curated models and data supported by a collaborative infrastructure. . . Digital 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



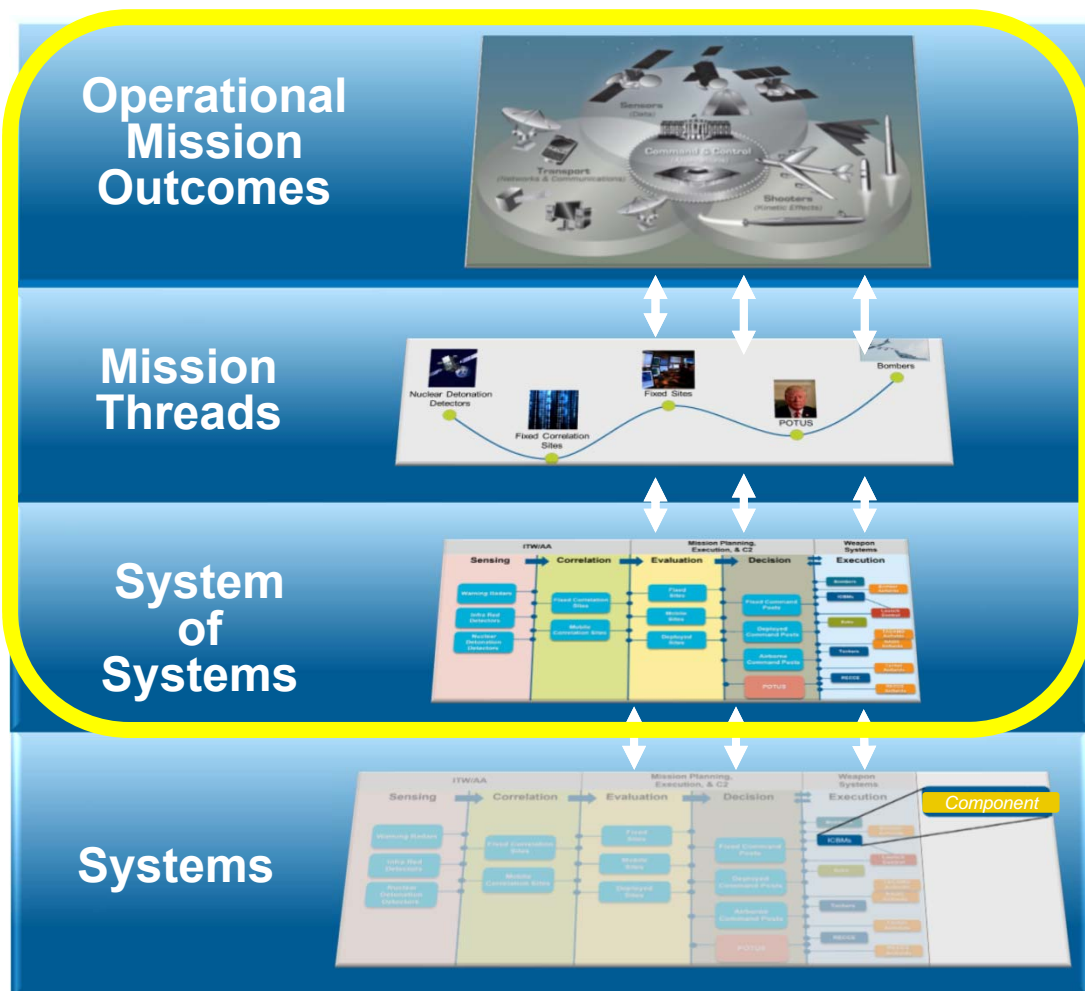
Mission Engineering is the deliberate planning, analyzing, organizing, and integrating of current and emerging operational and system capabilities to achieve desired warfighting mission effects

- 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

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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

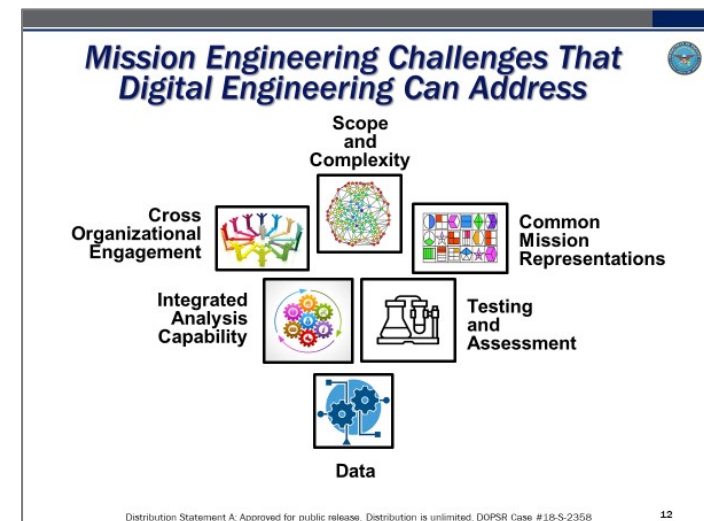


Approach



■ 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

Digital Engineering Strategy Goal 1

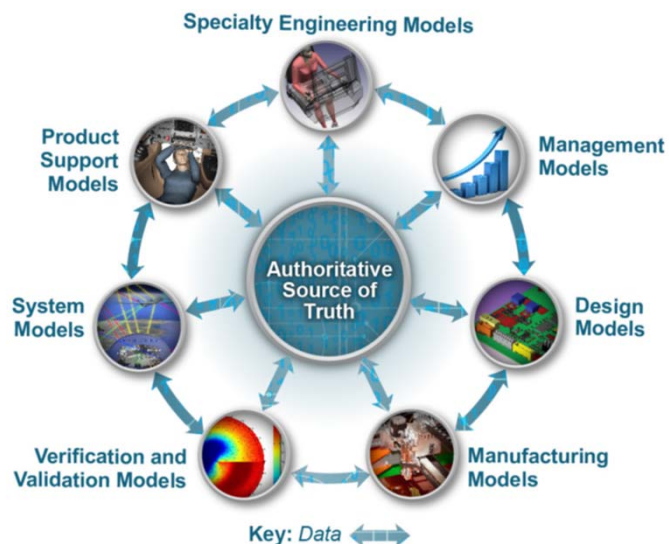
Formalize the development, integration, and use of models to inform enterprise and program decision making

1. Formalize the planning for models to support engineering activities and decision making across the lifecycle
2. Formally develop, integrate, and curate models
3. Use models to support engineering activities and decision making across the lifecycle

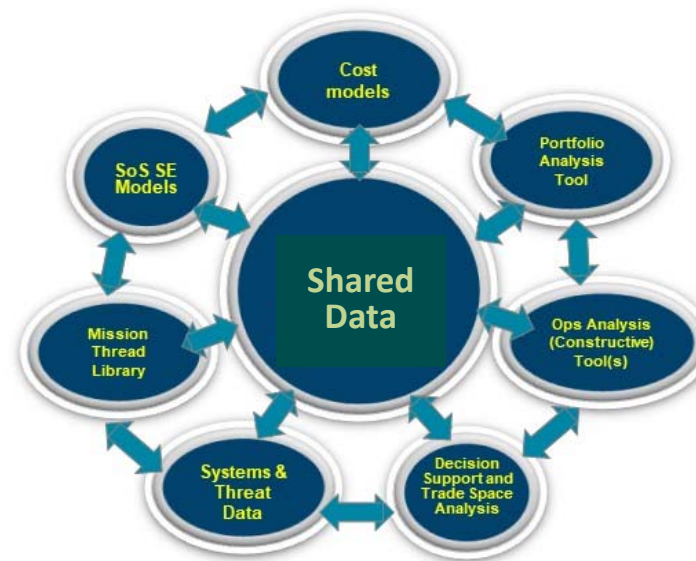


Goal 1: Lifecycle Management of Models as Enterprise Assets

Models/Tools to Support System Acquisition



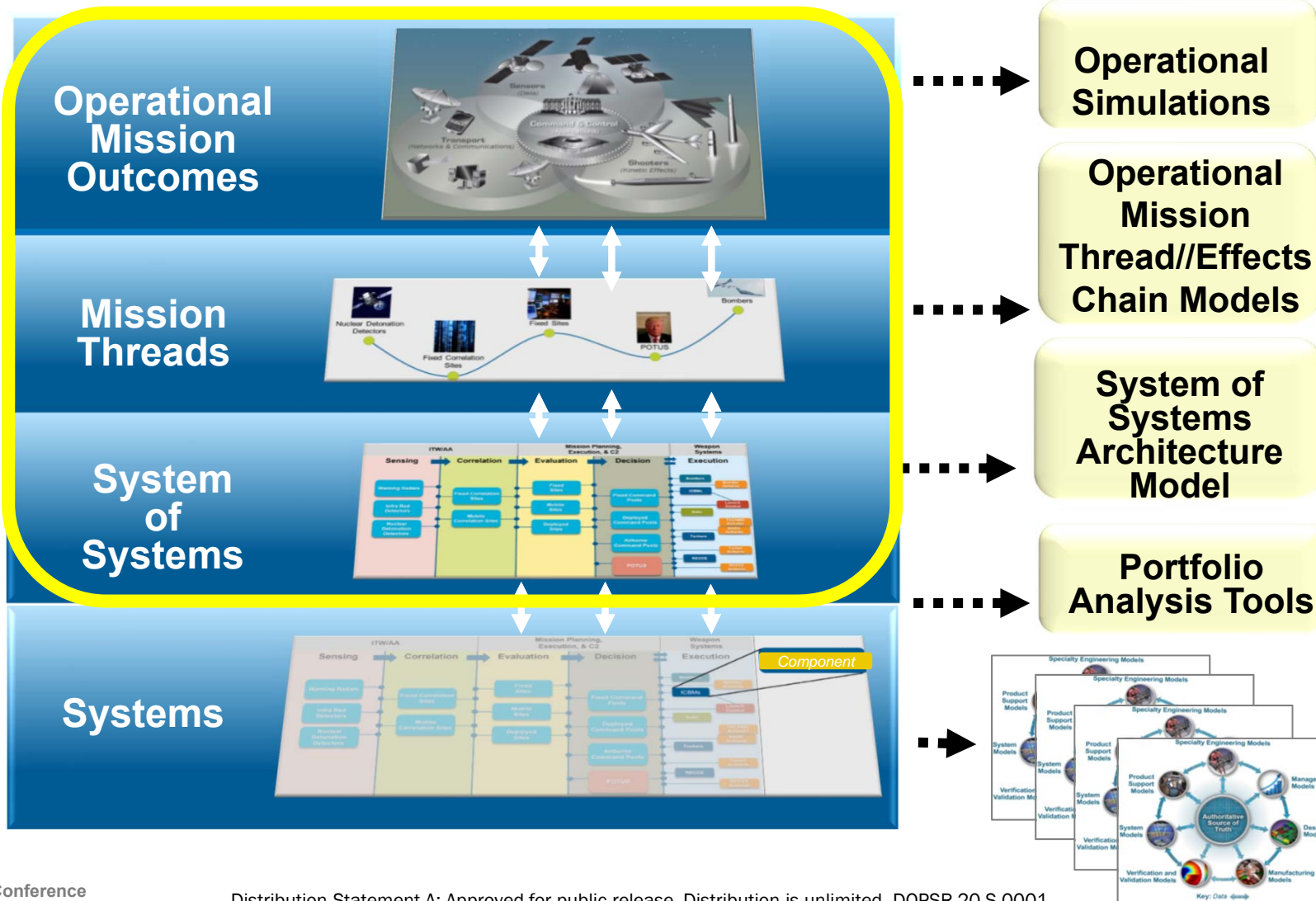
Models/Tools to Support Missions, SoS, Portfolios



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



Models/Tools for Digital Engineering Beyond "Systems"





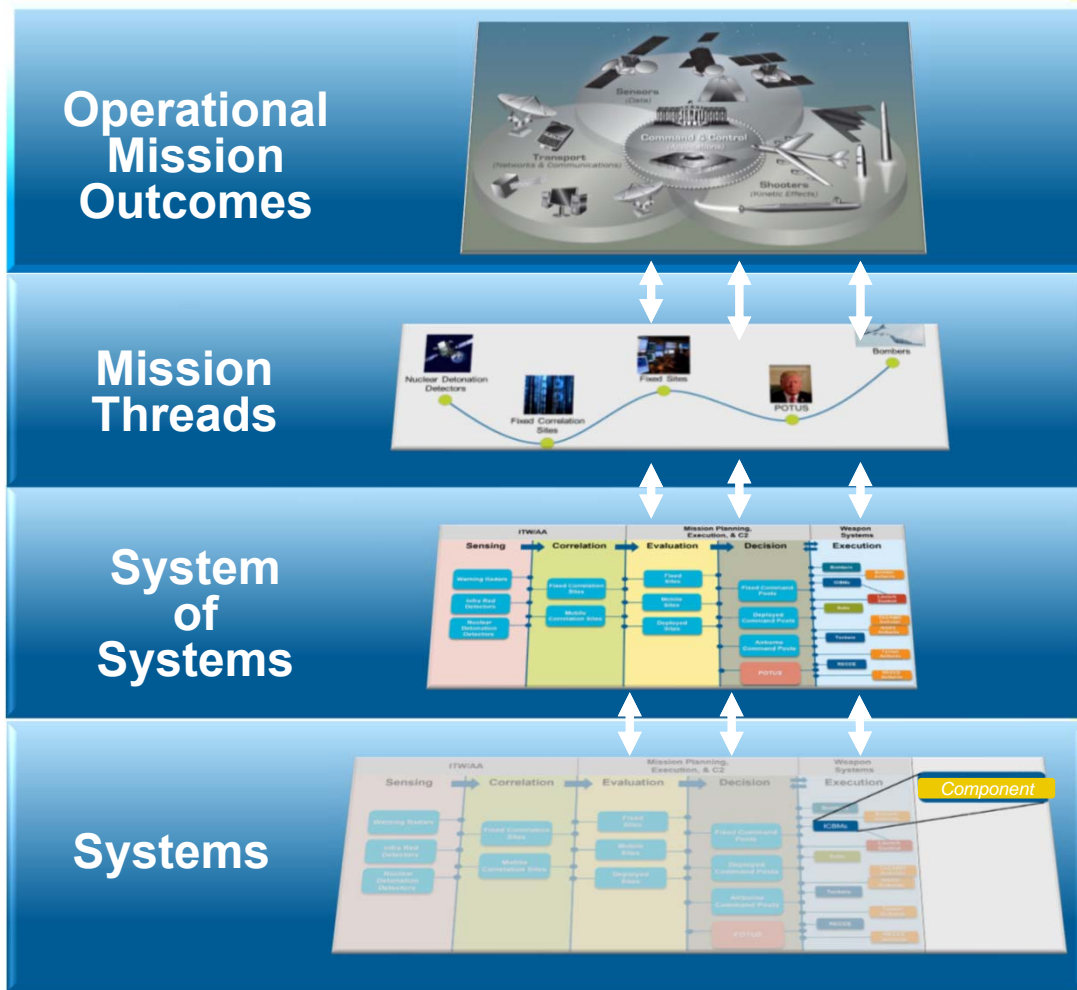
Shared Data

Digital Engineering Strategy Goal 2

Provide an enduring, authoritative source of truth

1. Plan and develop the authoritative source of truth
2. Govern the authoritative source of truth
3. Use the authoritative source of truth across the lifecycle

Goal 2: Shared Data Supports Linkage Among Models





Technological Innovation

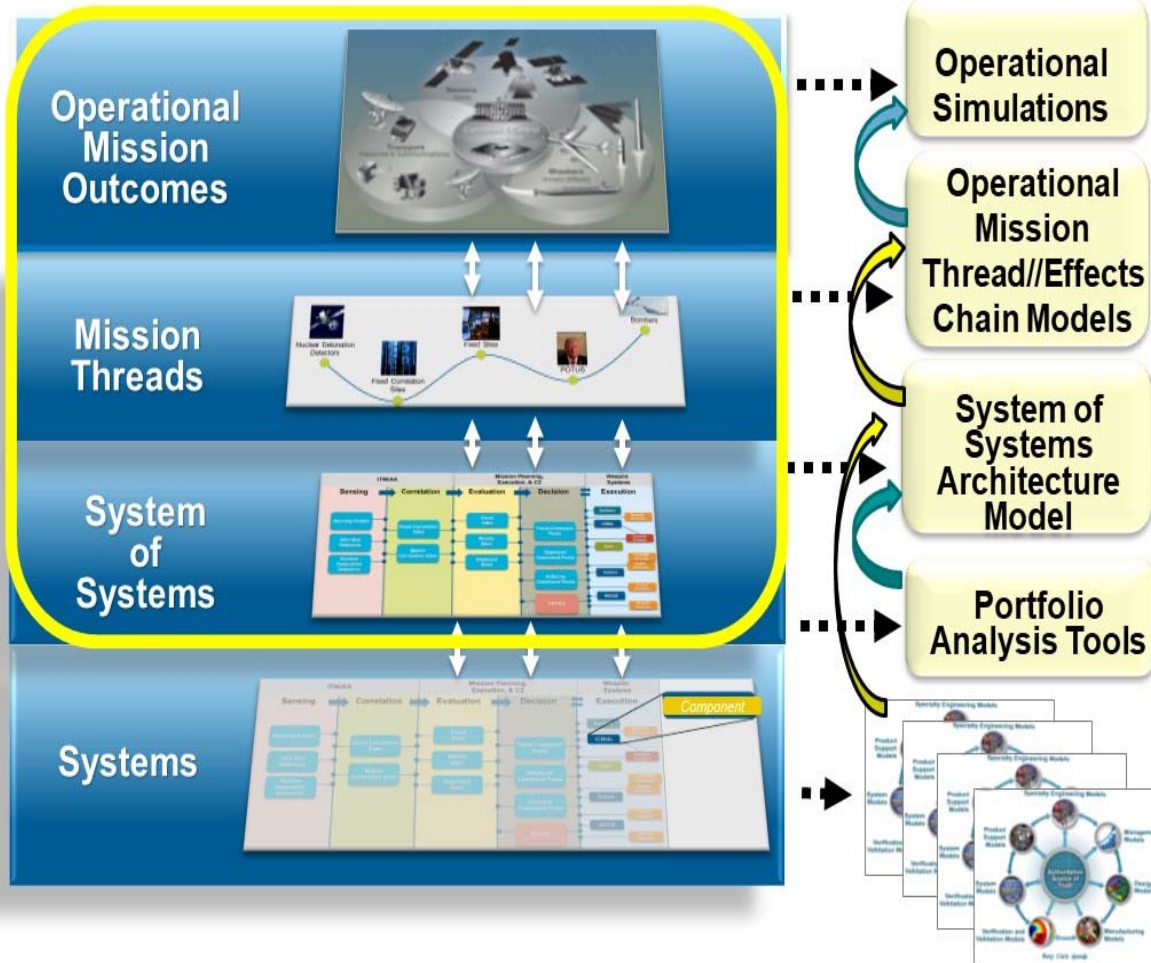
Digital Engineering Strategy Goal 3

Incorporate technological innovation to improve the engineering practice

1. Establish an end-to-end digital engineering enterprise
2. Use technological innovations to improve the engineering practice



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

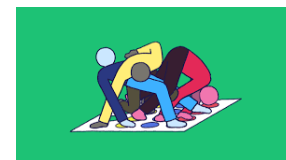


Goal 4: Supporting Infrastructure Computational Resources and Availability

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

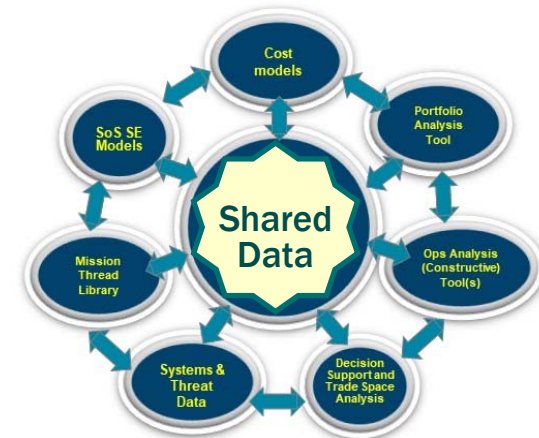


Culture and Workforce

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



Mission Engineering

- 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

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 Challenges That Digital Engineering Can Address

Scope and Complexity

Cross Organizational Engagement

Common Mission Representations

Integrated Analysis Capability

Testing and Assessment

Data

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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



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