21st Annual National Defense Industrial Association Systems and Mission Engineering Conference

DoD Digital Engineering Implementation Challenges and Recommendations

Ms. Philomena Zimmerman

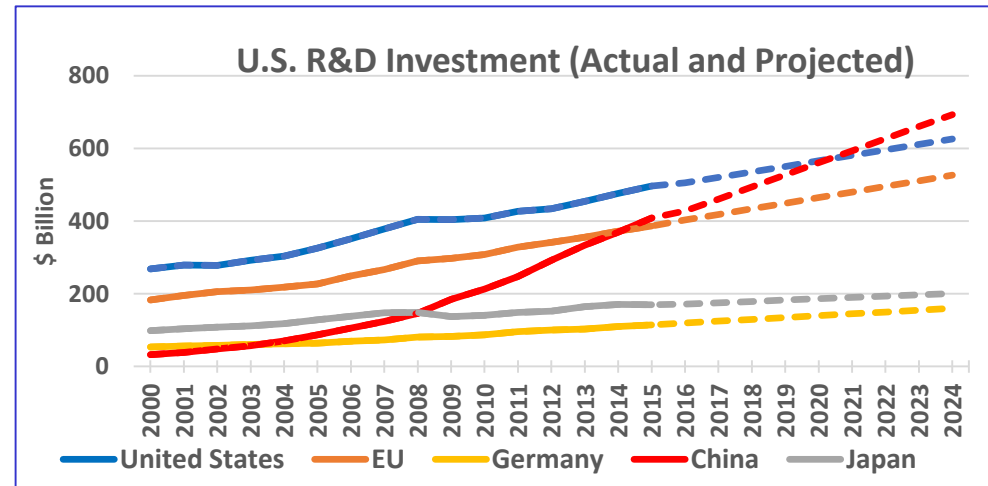Office of the Under Secretary of Defense for Research and Engineering

October 24, 2018

The World Today
Technology Is Transforming the Battlespace

- The proliferation of knowledge and technology erodes historic U.S. advantages

- Our near-peers are increasing their rate of investment in military R&D

- A hyper-competitive environment for National Security technologies

- The discriminators are speed and cycle time

U.S. R&D Investment (Actual and Projected)

$ Billion

Legend: United States — EU — Germany — China — Japan

X-axis: 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

Y-axis: 0, 200, 400, 600, 800

- NSF 2015 data predicted R&D investment parity with China in 2020

- Feb 2018, NSB estimates China R&D investment parity with U.S. by end of 2018

- 2017 GLOBAL R&D FUNDING FORECAST WINTER 2017 Industrial Research Institute, R&D Magazine

R&D – Research & Development
NSB – National Science Board

Digital Engineering and the National Defense Strategy

Key Quotes:

*"We will **modernize key capabilities**, recognizing we cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment."*

*"To keep pace with our times, the **department will transition to a culture of performance** and affordability that operates **at the speed of relevance.**"*

*"**Success does not go to the country that develops a new technology first**, but rather, to **the one that better integrates it** and more swiftly adapts its way of fighting."*

*"**Our current bureaucratic processes are insufficiently responsive** to the department's needs for new equipment."*

Remarks by Secretary of Defense
James N. Mattis
on the National Defense Strategy
January 19, 2018

Digital Engineering Strategy
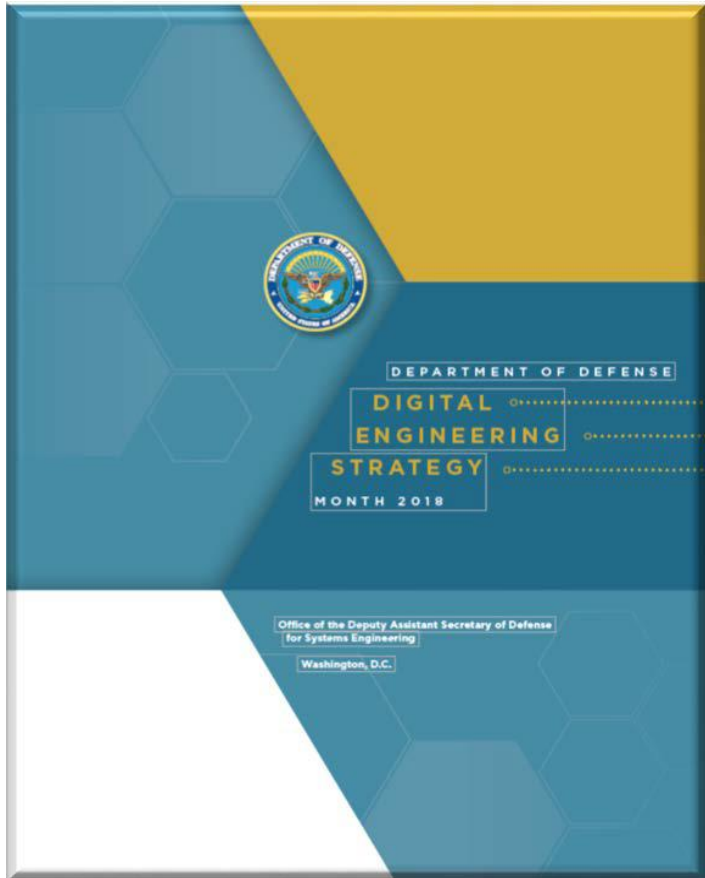
- **Digital Engineering Strategy**
  - Basic capabilities needed by Services and Agencies to begin use of Digital Engineering practices

- **Objective**
  - Guide the planning, development, and implementation of digital engineering across the services and agencies

- **Expected Impact**
  - Increase technical cohesion and awareness of system in lifecycle activities
  - Reform the Department's business practices for greater performance and agility

- **Coordination**
  - Approved by USD(R&E), DASD(SE), and each Service

https://www.acq.osd.mil/se/docs/2018-DES.pdf

Digital Engineering to Service Secretaries and DEPSECDEF

"The strategy sets a new vision for the way we conceive, build, test, field, and sustain our national defense systems."

"It also transforms how we must train and shape the workforce to use digital engineering practices..."

"We will convene a Digital Engineering Summit..."

"We invite the Services and Agencies to share their Digital Engineering Implementation initiatives..."

Separate memo to DEPSECDEF:

"I expect the first implementation plans from each Service by end of December 2018"

Digital Engineering Overview

What is Digital Engineering?

- Combines model-based techniques, digital practices, and computing infrastructure
- Enables delivery of high pay off solutions to the warfighter at the speed of relevance

Reforms Business Practices

- Digital enterprise connects people, processes, data, and capabilities
- Improves technical, contract, and business practices through an authoritative source of truth and digital artifacts

DIGITAL ENGINEERING ECOSYSTEM

| A | B | C | IOC | FOC |
| Material Solution Analysis (MSA) Phase | Technology Maturation & Risk Reduction (TMRR) Phase | Engineering & Manufacturing Development (EMD) Phase | Production & Deployment (P&D) Phase | Operations & Support (O&S) Phase / Disposal |

1. Formalize the Development, Integration and use of Models
2. Provide an Authoritative Source of Truth
3. Incorporate Technological Innovation
4. Establish Infrastructure and Environments
5. Transform Culture and Workforce

METHODS PROCESSES TOOLS HW/SW NETWORKS SECURITY

Modernizes how we design, operate, and sustain capabilities to outpace our adversaries

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Digital Strategy Goals and Focus Areas

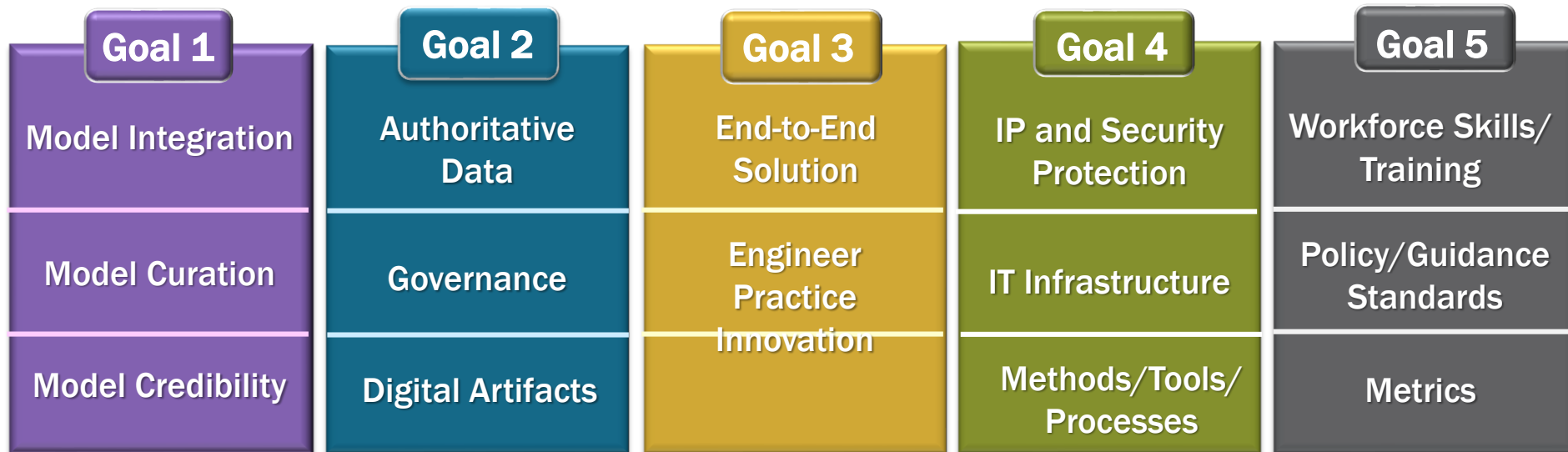| Digital Engineering (DE) Vision: Modernizes how the Department conceives, builds, tests, fields, and sustains our national defense systems.						
GOALS	**1** Formalize the development, integration, and use of models to inform enterprise and program decision making	**2** Provide an enduring, authoritative source of truth	**3** Incorporate technological innovation to improve the engineering practice	**4** Establish a supporting infrastructure and environments to perform activities, collaborate, and communicate across stakeholders	**5** Transform the culture and workforce to adopt and support digital engineering across the lifecycle	**GOALS**
FOCUS AREAS	Formalize the planning for models to support engineering activities and decision making across the lifecycle	Plan and develop the authoritative source of truth	Establish an end-to-end digital engineering enterprise	Develop, mature, and use digital engineering IT infrastructures	Improve the digital engineering knowledge base	**FOCUS AREAS**
	Formally develop, integrate, and curate models	Govern the authoritative source of truth	Use technological innovations to improve the digital engineering practice	Develop, mature, and use digital engineering methodologies	Lead and support digital engineering transformation efforts	
	Use models to support engineering activities and decision making across the lifecycle	Use the authoritative source of truth across the lifecycle		Secure IT infrastructure and protect intellectual property	Build and prepare the workforce	
MEANS	METHODS, PROCESSES, TOOLS, TECHNOLOGY, DATA, PEOPLE					**MEANS**

Challenges

- **Identified cross-Service Challenges for each DE Strategy Goal**
  - Working with Services to develop way ahead to address challenges

Goal 1	Goal 2	Goal 3	Goal 4	Goal 5
Model Integration	Authoritative Data	End-to-End Solution	IP and Security Protection	Workforce Skills/ Training
Model Curation	Governance	Engineer Practice Innovation	IT Infrastructure	Policy/Guidance Standards
Model Credibility	Digital Artifacts		Methods/Tools/ Processes	Metrics

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Formalize Development, Integration, and Use of Models (Goal 1)

Challenges
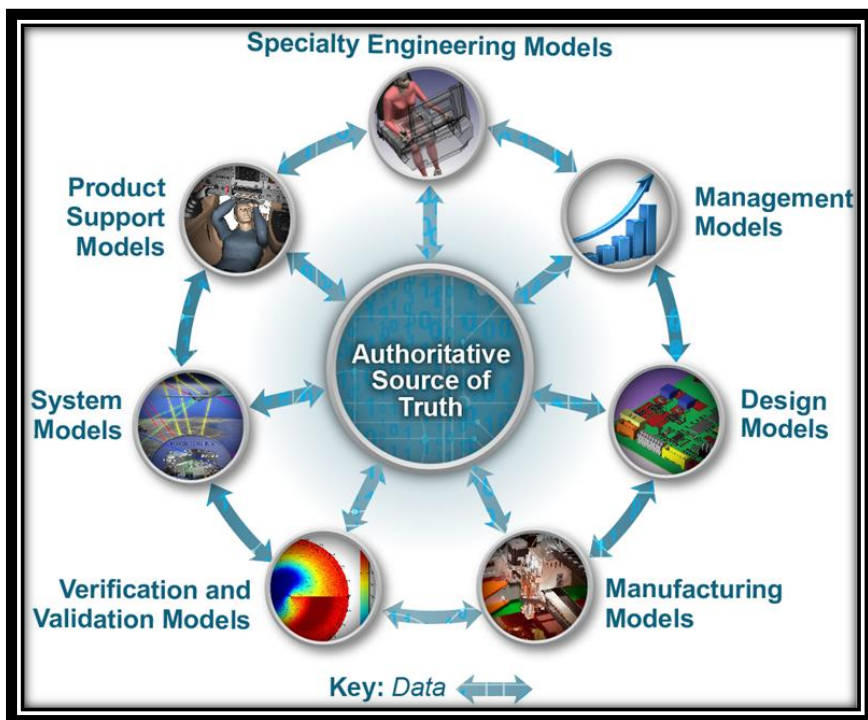
Topic	Short Description
Model Integration	Models are not developed or used across domains, acquisition phases, and programs.
Model Curation	Models are not curated such that information can be preserved, discovered and used across the lifecycle.
Model Credibility	Traditional VV&A approaches do not account for model credibility and trust in the digital age.

Provide an Authoritative Source of Truth (Goal 2)
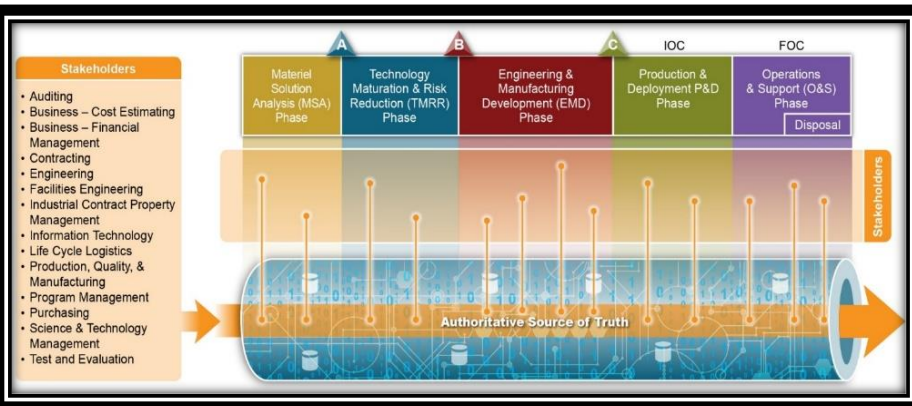

Challenges

Topic	Short Description
Authoritative Data	Vast amounts of data are scattered across multiple stove-piped systems and organizations in various forms
Governance	Managing and controlling data sources are fragmented or ad hoc
Digital Artifacts	Exchanging digital artifacts in a document-based culture

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Incorporate Technological Innovation (Goal 3)

Challenges

Topic	Short Description
End-to-End Solutions	Digital engineering activities are disjointed across the lifecycle
Engineering Practice Innovation	Transforming the way engineers leverage technology to be responsive to change
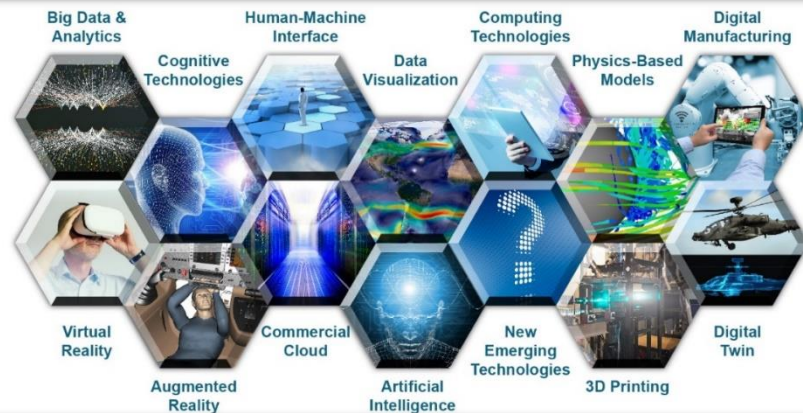
Establish Infrastructure and Environments (Goal 4)

Challenges

Topic	Short Description
IP & Critical Technology Protection	Limited strategies for protecting and securing the integrity of classified and proprietary digital data
IT Infrastructure	IT infrastructures not designed for complex digital model-based engineering activities
Methods, Tools, & Processes	Current methods process and tools do not holistically support the digital engineering activities

DIGITAL ENGINEERING ENVIRONMENT

METHODOLOGIES — Processes, Tools, Methods, People, Networks, HW/SW, Security — IT INFRASTRUCTURE

Transform Culture and Workforce (Goal 5)

Challenges

Topic	Short Description
Workforce Skills Training	Limited incentives workforce skills, insufficient training capacity and resources to meet the demand
Policy, Guidance, & Standards	Limited policies, guidance, and standards to comprehensively address digital engineering activities
Metrics	Lack of a common set of metrics that serve as leading indicators of adoption and effectiveness

Digital Engineering Way Ahead

Collaborators/Partnerships

Armed Services

DoD Components

Interagency

Industry/OEMs/ Industrial Orgs

NDIA   INCOSE   AIA   AIAA

LOCKHEED MARTIN   GE

Rolls-Royce   NORTHROP GRUMMAN   BOEING

Academic

SYSTEMS ENGINEERING RESEARCH CENTER   DAU Defense Acquisition University

Strategy & Service Plans

DEPARTMENT OF DEFENSE
DIGITAL ENGINEERING STRATEGY
MONTH 2018

Office of the Deputy Assistant Secretary of Defense for Systems Engineering
Washington, D.C.

Outlines DoD's five strategic goals for Digital Engineering initiatives

Service Implementation Plans

U.S. ARMY   NAVY   U.S. AIR FORCE

Next Steps

- Service Implementation Plans completed by the end of the year

- Service, Industry, Academic, and Standards collaborations to further the Digital Engineering Strategy

- Digital Engineering Working Group to address challenges

- Digital Engineering Information Exchange Working Group to advance concepts

- Starter Kit and Continuous Learning Module 84 to train workforce

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Implementing Digital Engineering Across the Services

DoD Research and Engineering Enterprise
Solving Problems Today – Designing Solutions for Tomorrow

DoD Research and Engineering Enterprise
https://www.acq.osd.mil/chieftechnologist/

Defense Innovation Marketplace
https://defenseinnovationmarketplace.dtic.mil

Twitter
@DoDInnovation

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For Additional Information

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