# Digital Transformation of Systems Engineering

## 27th Annual National Defense Industrial Association Systems and Mission Engineering Conference

Mr. Thomas Simms
Principal Deputy Executive Director
Office of Systems Engineering and Architecture
Office of the Under Secretary of Defense for
Research and Engineering

Norfolk, Virginia
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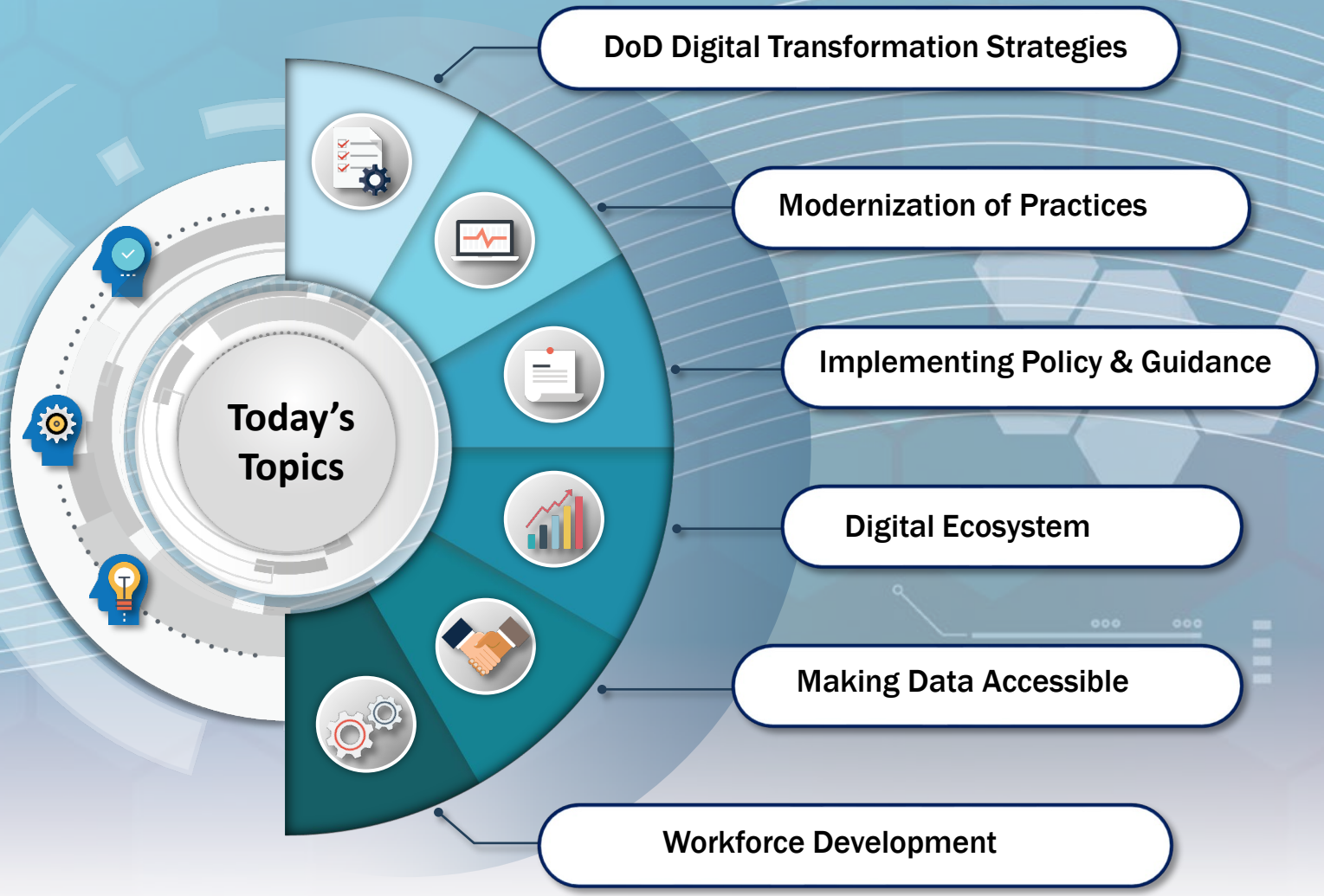
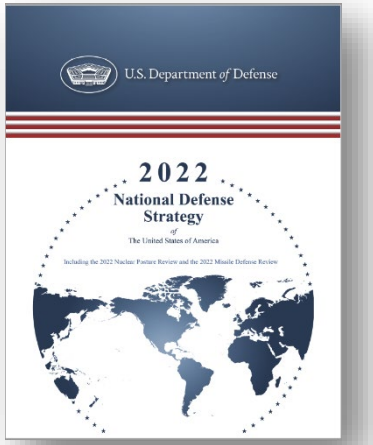
# DoD Digital Transformation Efforts

**Deputy Secretary of Defense Memorandum, "*Creating Data Advantage*" (May 5, 2021)**

***"Data is a strategic asset. Transforming the Department of Defense (DoD) to a data centric organization is critical to improving performance and creating decision advantage at all echelons from the battlespace to the board room, ensuring U.S. competitive advantage."***

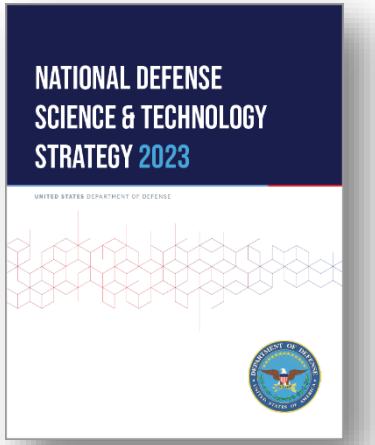


# DoD Digital Transformation Strategies



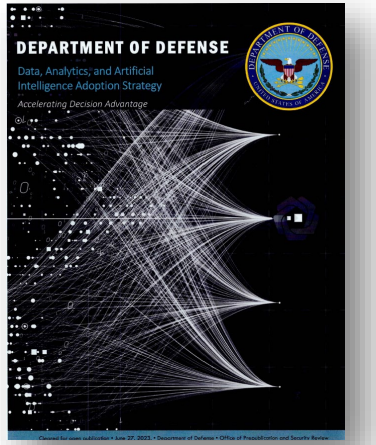

**National Defense Strategy (2022)**

"… and faster development of technologies and system concepts through digital engineering and open architecture designs."



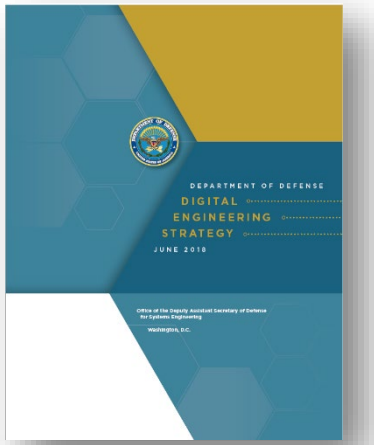

**National Defense Science & Technology Strategy (2023)**

"… and cultivate talent; revitalize our physical infrastructure; upgrade our digital infrastructure …"




**DoD Data, Analytics, and AI Adoption Strategy (2023)**

"… realizing the full promise of data, analytics, and AI is not the sole job of a single organization; it's on all of us."




**DoD Digital Engineering Strategy (2018)**

"… transforming its engineering practices to digital engineering, incorporating technological innovations into an integrated, digital, model-based approach."

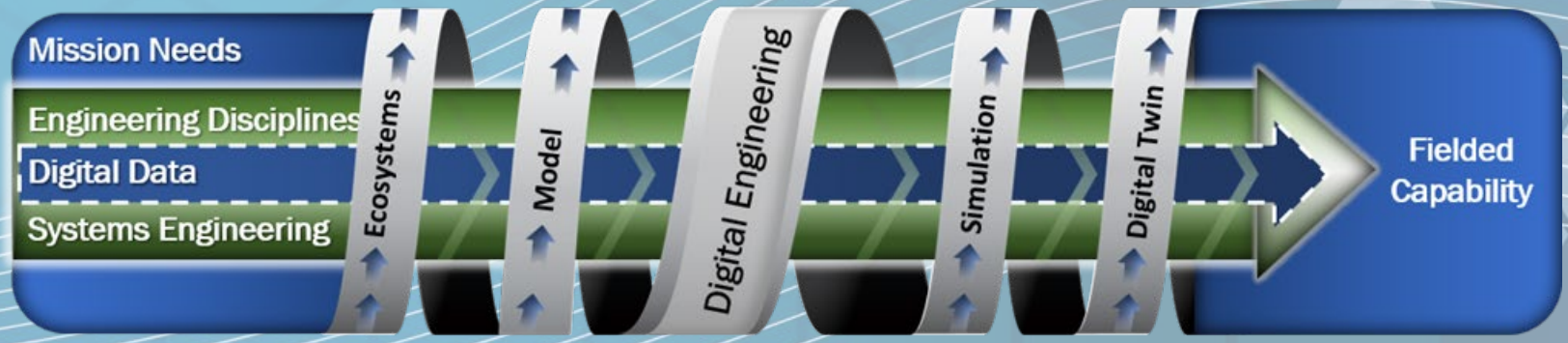
## Driving Better Decisions and Outcomes Using Digital Data

# Modernization of Practices: Digital Engineering

*Digital engineering does not replace systems engineering but moves the activities into the digital realm.*

**National Defense Strategy (2022)**

"…. and faster development of technologies and system concepts through digital engineering and open architecture designs."




*Digital engineering moves the primary means of communicating system information from documents to digital models and their underlying data.*

# Modernization of Practices: MOSA

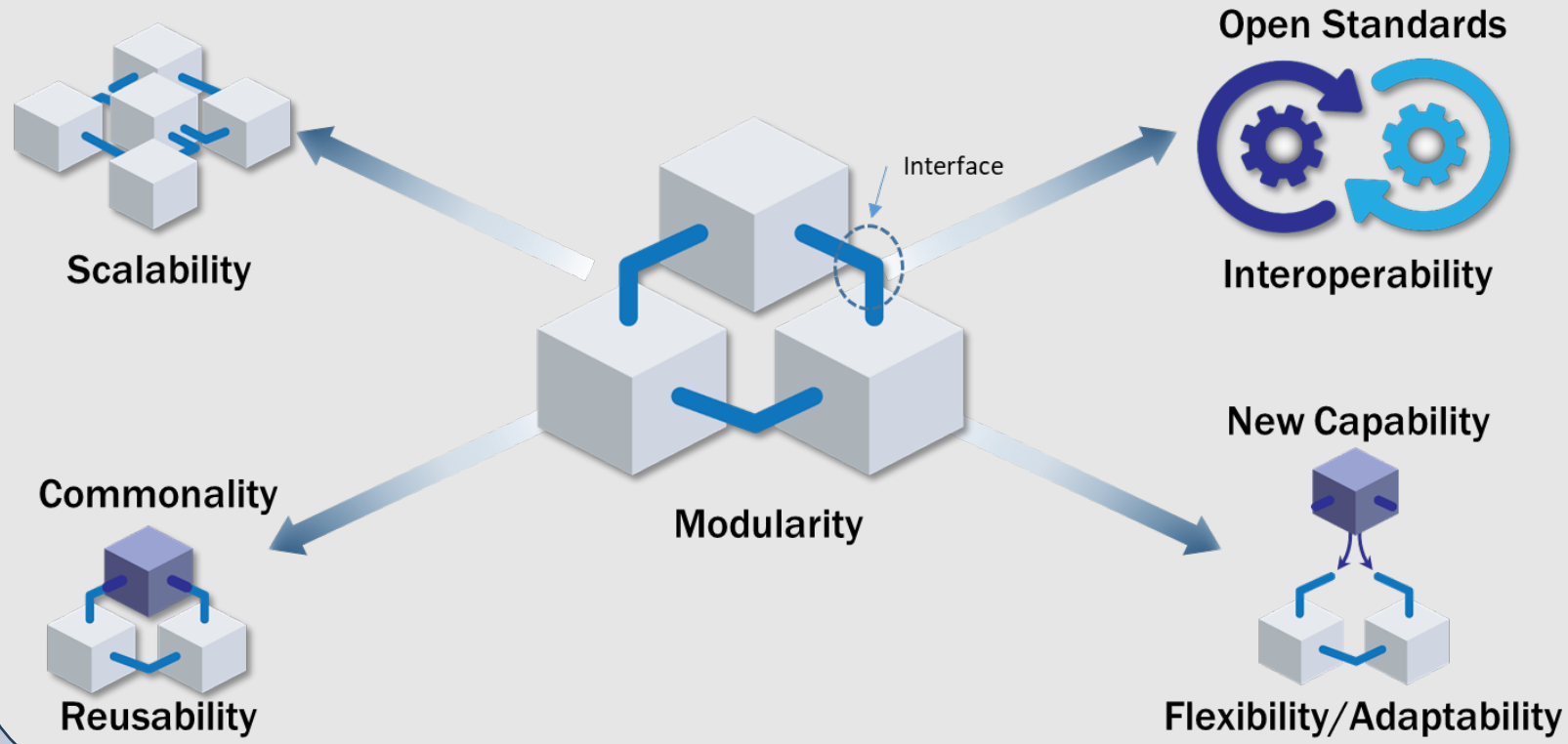
**National Defense Strategy (2022)**

"…. and faster development of technologies and system concepts through digital engineering and open architecture designs."

**Deputy Secretary of Defense Memorandum, "Creating Data Advantage" (May 5, 2021)**

Use automated data interfaces that are externally accessible and machine-readable; ensure interfaces use industry-standard, non-proprietary, preferably open-source, technologies, protocols, and payloads

## Modular Open Systems Approach (MOSA) Principles



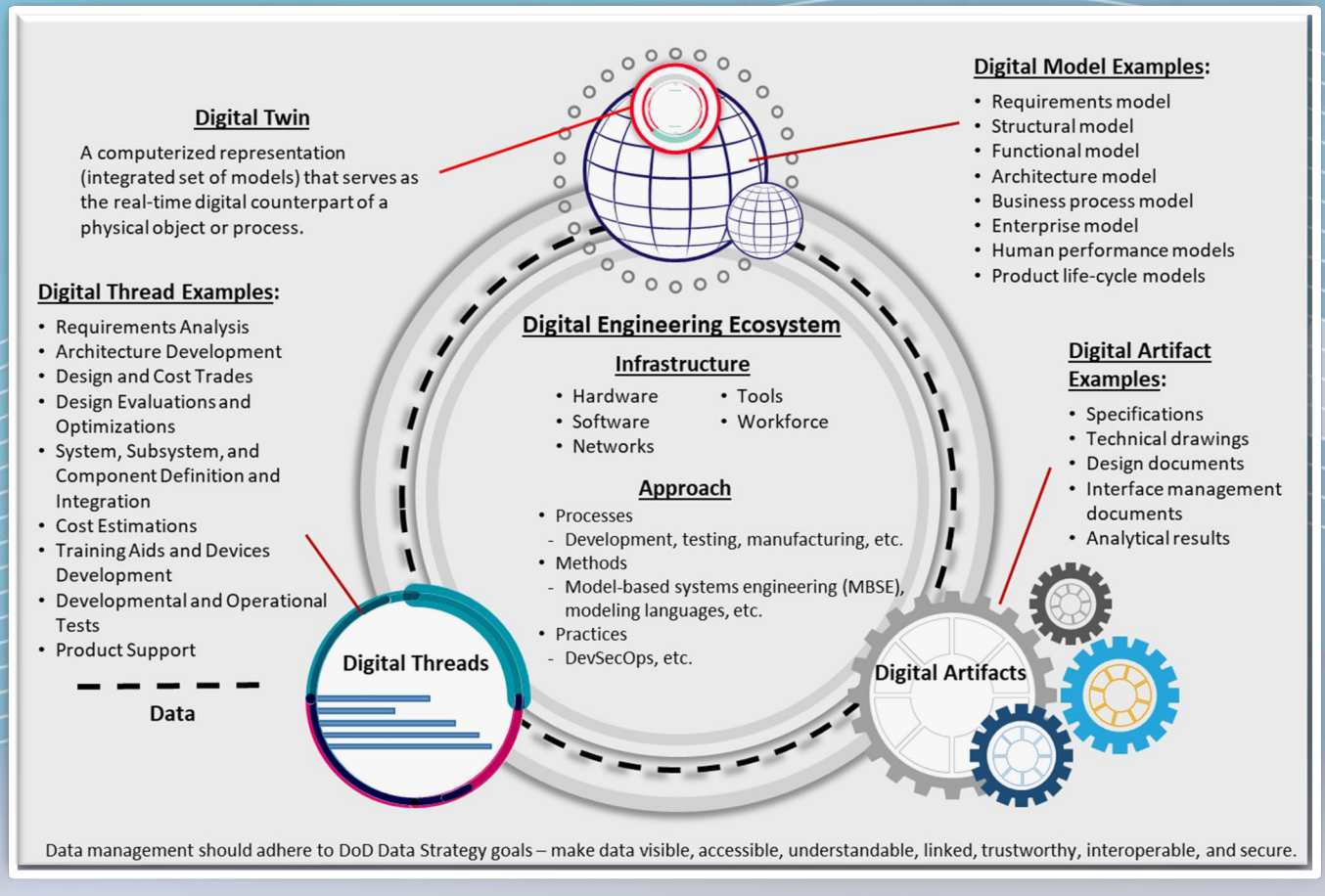

**Applies to hardware, software, or an integrated assembly of both**

# Implementing Policy & Guidance: DoDI 5000.97, *Digital Engineering*

**DoDI 5000.97, *Digital Engineering*, Dec 21, 2023**

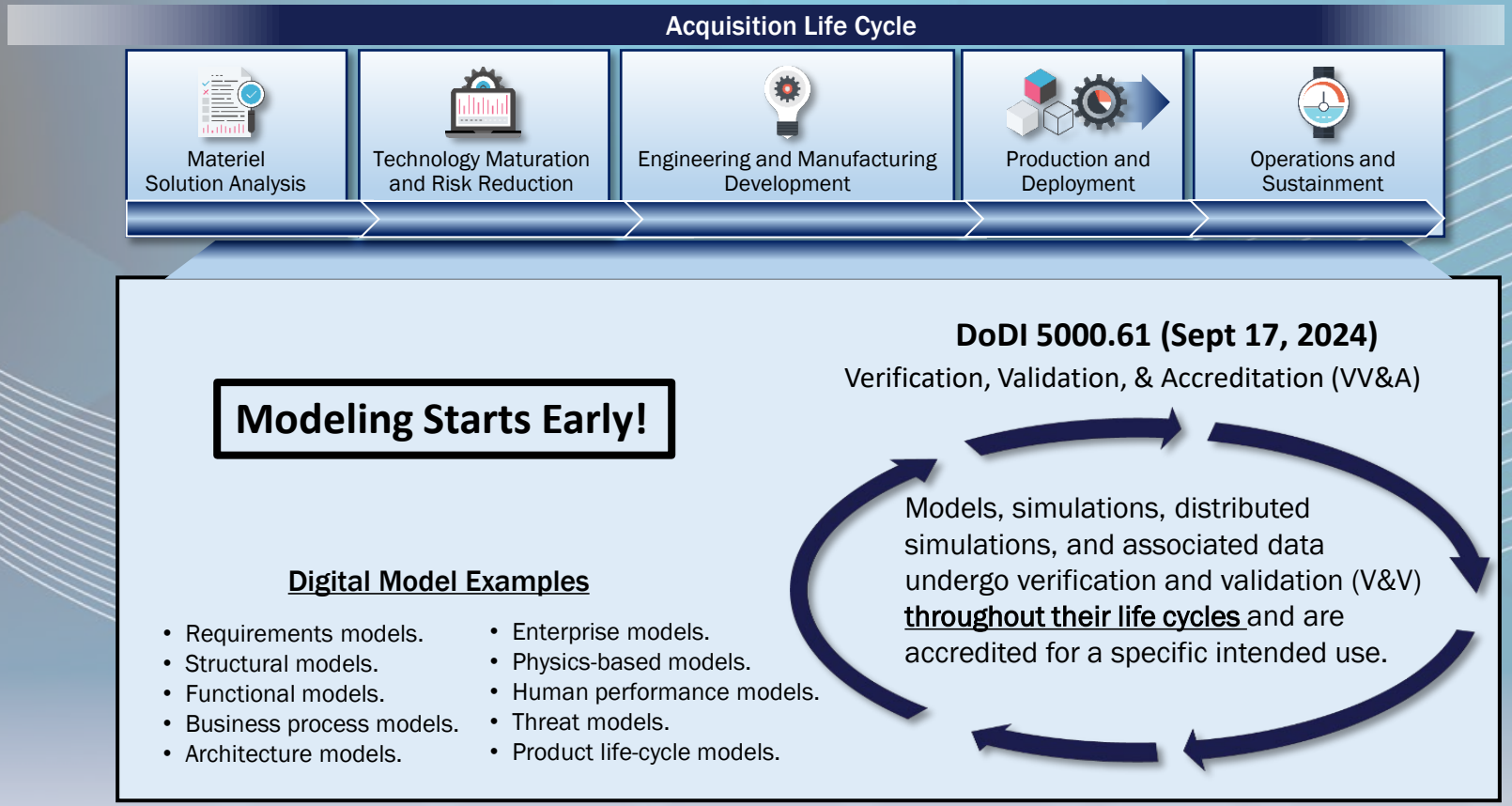
**This policy directs:**

- **Digital engineering** …. *"addressed in the Acquisition Strategy and in the Systems Engineering Plan."*
- **New Programs** …. *"incorporate digital engineering during development unless the program's decision authority provides an exception."*
- **Existing Programs** …. *"incorporate digital engineering, to the maximum extent possible, when it is practical, beneficial, and affordable."*




## Programs to Incorporate an Integrated, Digital, Model-Based Approach

# Implementing Policy & Guidance: DoDI 5000.97, *Digital Engineering* (cont'd)




**DoDI 5000.97:**

*"These models capture system representations and, together with their underlying data, provide an authoritative source of truth to stakeholders."*

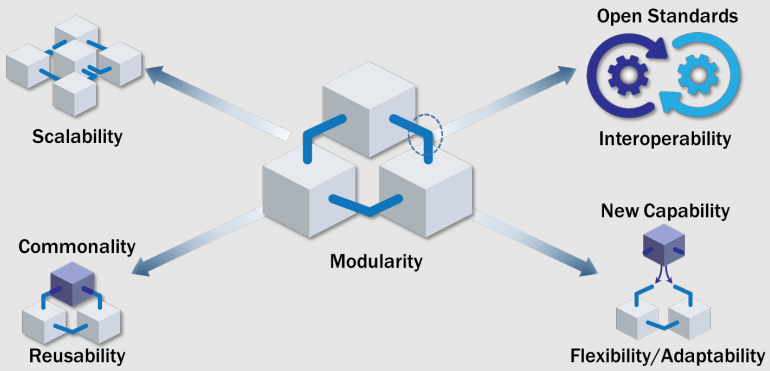
**DoDI 5000.97:**

*"Programs will update and maintain the digital model(s) throughout the system life cycle and maintain configuration management (i.e., version control)."*

## Use, Update, and Maintain Models Throughout Acquisition Life Cycle

# Implementing Policy & Guidance: DoDI 5000.85 & DoDI 5000.88

**Modular Open Systems Approach (MOSA)**




**2019**

**FY20 NDAA Sec. 840**

Statutory direction for MOSA

**2022**

**FY22 NDAA: Title 10, Section 4401-4403**

Renumbered Statutory requirements:

- **Section 4401:** MOSA in acquisition programs, maximum extent practicable
- **Section 4402:** address MOSA in Analysis of Alternatives (AoA), Acquisition Strategy, and Request for Proposal (RFP)
- **Section 4403:** ensure that major system interfaces incorporate commercial standards and other widely supported consensus-based standards

**DoDI 5000.85, "Major Capability Acquisition" (Nov 4, 2021, Change 1)**

- "To enable incremental development, and to enhance competition, innovation, and interoperability, MDAPs that receive Milestone A or B approval after January 1, 2019, must be designed and developed with MOSA to the maximum extent practicable."
- "The MDA for an MDAP that uses MOSA must ensure that the RFPs for the EMD phase and the P&D phase describe the MOSA and the minimum set of major system components that must be included in the system design."

**DoDI 5000.88, "Engineering of Defense Systems" (Nov 18, 2020)**

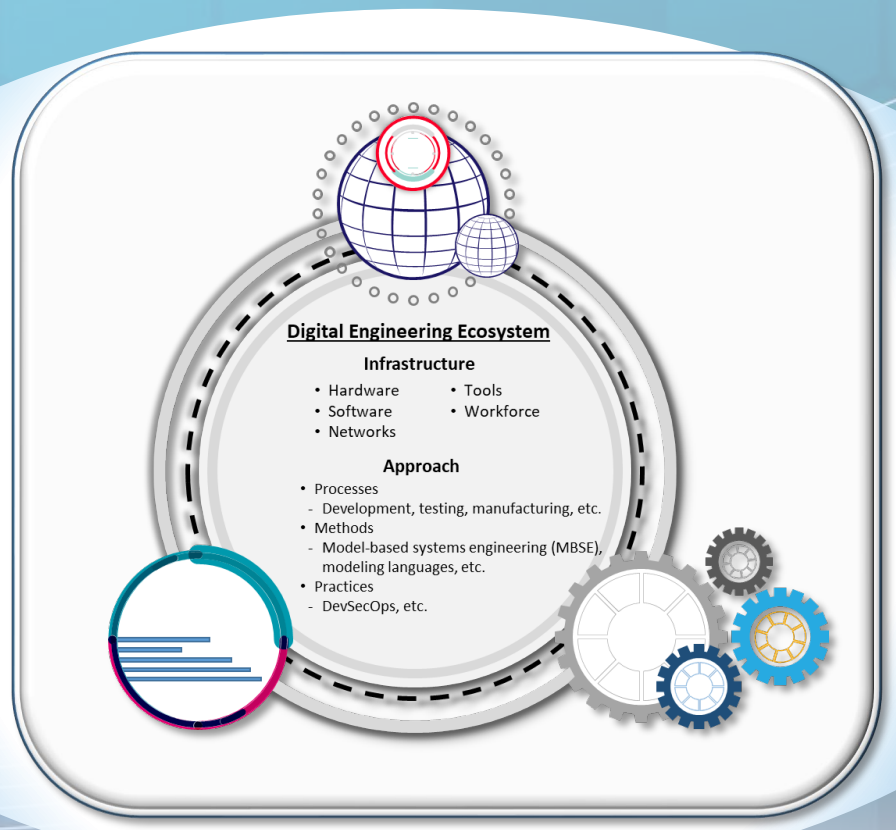
- "The overall technical approach for system design and development, which balances system performance, life-cycle cost, schedule, and risks in addressing mission needs. For MDAPs, the technical approach will incorporate a modular open systems approach (MOSA) to the maximum extent practicable. All other programs should consider implementing MOSA."

# Digital Ecosystem: Digital Infrastructure (Examples)

Not a comprehensive list

CHEETAS

Joint Mission Environment Test Capability




Cloud One (Air Force)

Cloudworks (Air Force)

cARMY (Army)

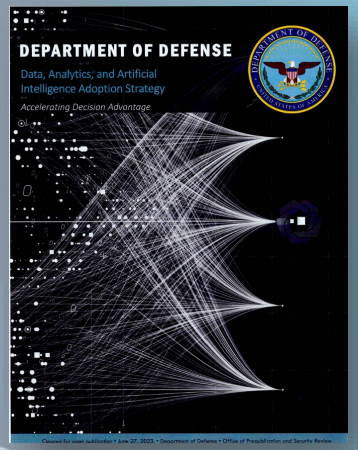
Cosmos (Navy)

Platform One (Air Force)

**DoDI 5000.97:**

**"Digital engineering ecosystem assets may be provided by the DoD, the DoD Components, or program offices." .... PMs should use existing DoD or Military Service-level digital engineering resources to the maximum extent possible before investing in new digital engineering capabilities."**

# Making Data Accessible: Data Is a Strategic Asset

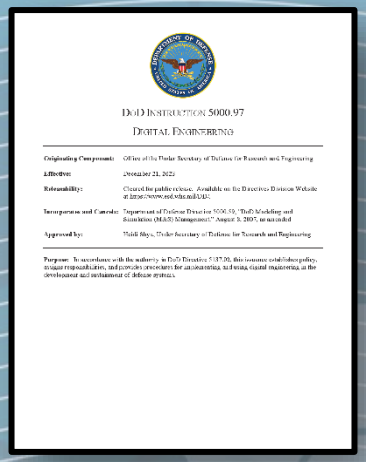



**DoD Data, Analytics, and AI Adoption Strategy (2023)**

"...high-quality data that does not align to the VAULTIS framework will be of limited value to analytical and AI efforts"

## DoD Data Strategy Goals (VAULTIS):

1) Make Data ***Visible*** – Consumers can locate the needed data.
2) Make Data ***Accessible*** – Consumers can retrieve the data.
3) Make Data ***Understandable*** – Consumers can recognize the content, context, and applicability.
4) Make Data ***Linked*** – Consumers can exploit data elements through innate relationships.
5) Make Data ***Trustworthy*** – Consumers can be confident in all aspects of data for decision making.
6) Make Data ***Interoperable*** – Consumers have a common representation and comprehension of data.
7) Make Data ***Secure*** – Consumers know that data is protected from unauthorized use or manipulation.




**DoD Instruction 5000.97 Digital Engineering (2023)**

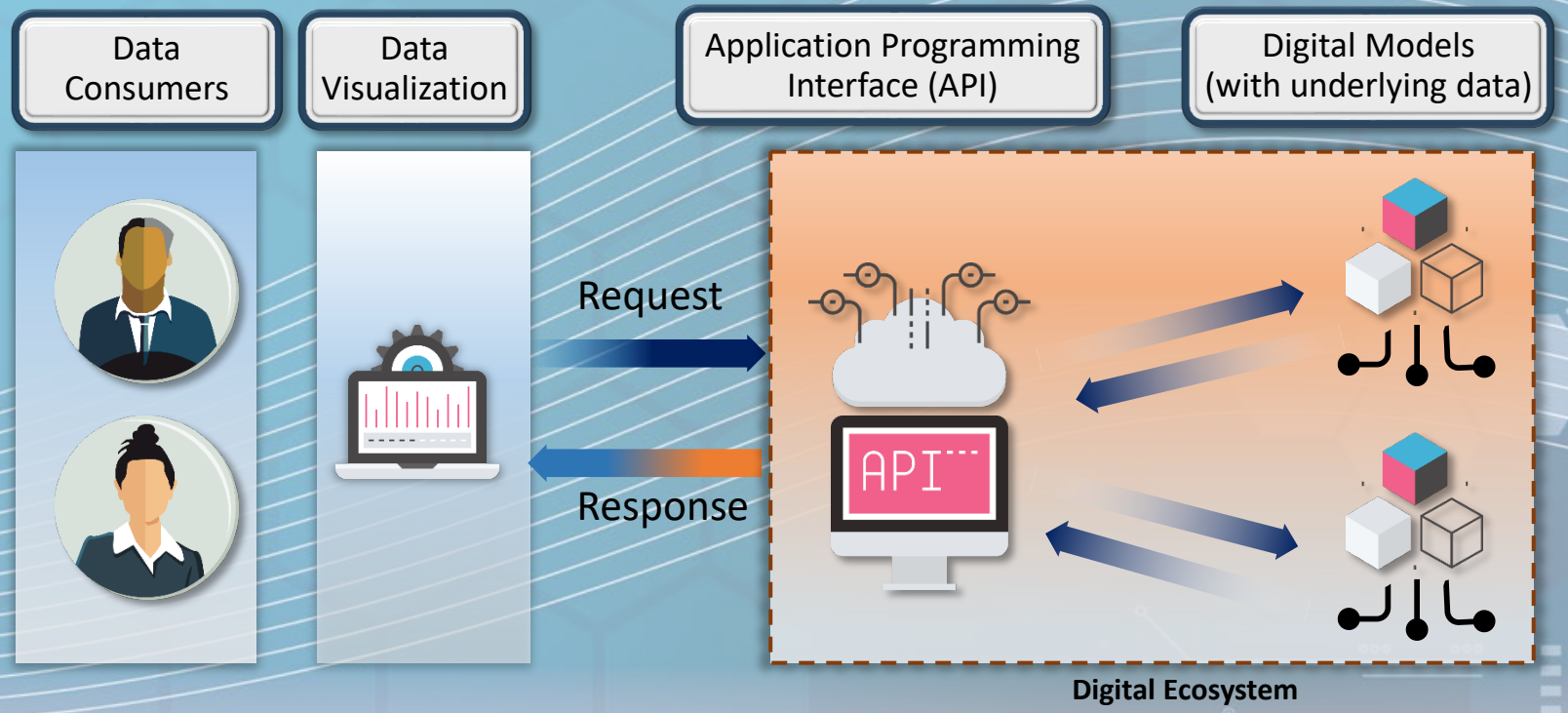
"These models capture system representations and, together with their underlying data, provide an authoritative source of truth to stakeholders."

# Making Data Accessible: Application Programming Interfaces (APIs)

**API characteristics:**

- Interoperable
- Discoverable
- Adheres to common standards
- Platform and language independent
- Zero-Trust secured
- Resilient

Example shows API getting data from digital engineering models for visualization




APIs allow two or more components to communicate/exchange data

**Application Programming Interface (API) Technical Guidance document released August 2024**

Defense Innovation Board, *"Building a Data Economy"* (2024): "DoD should address its lack of data extensibility across environments by using Application Programming Interfaces (APIs)…."

# Workforce Development: Strengthen Talent Pipeline


## K-12 Eligible Programs

DSEC | DEFENSE STEM EDUCATION CONSORTIUM

Defense Science, Technology, Engineering, and Mathematics Education Consortium

https://www.dodstem.us/about/partners/

National Defense Education Program

https://www.dodstem.us/about/partners/

***Provide STEM Learning Opportunities***

## Scholarship for Service Programs

SMART
SCIENCE, MATHEMATICS, AND RESEARCH FOR TRANSFORMATION
PART OF THE NATIONAL DEFENSE EDUCATION PROGRAM

STEM SMART Scholar

https://www.smartscholarship.org/smart

DCTC
DEFENSE CIVILIAN TRAINING CORPS
NATIONAL SECURITY LEADERS TODAY AND BEYOND

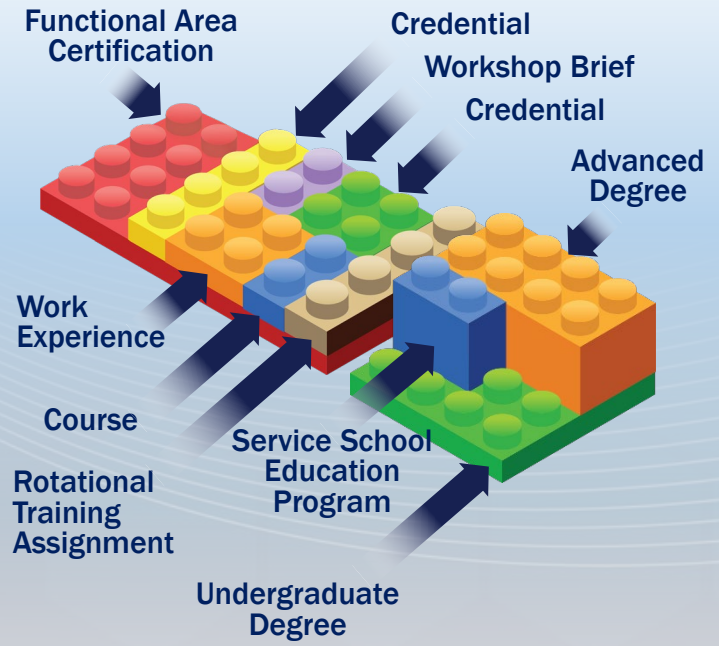
Defense Civilian Training Corps

https://dctc.mil/index.html

***Attract Future DoD Civilians***

# Workforce Development: Advance Our Workforce Skills

## Learning & Training

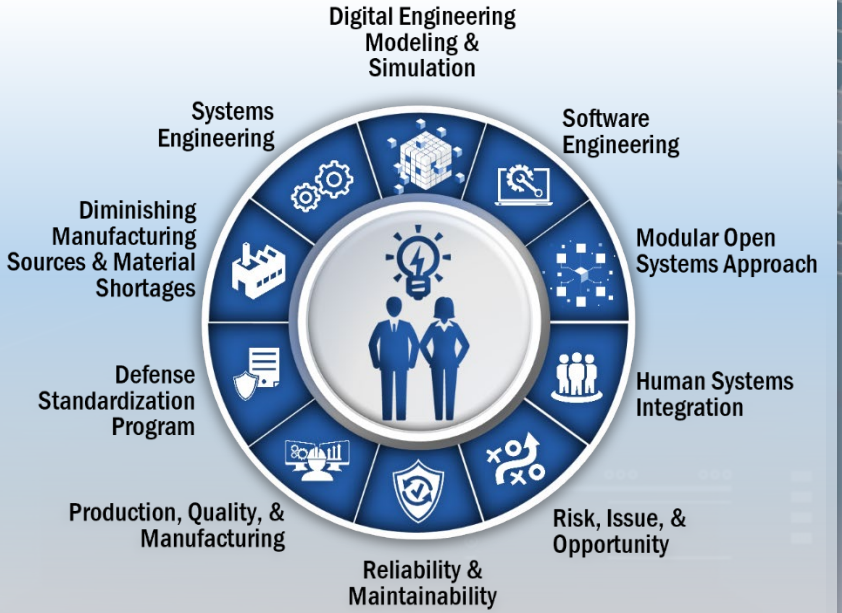



*Build a Culture of Continuous Learning*

**Workforce Development**

**Strengthen**
Talent Pipeline
**Advance**
Our Workforce Skills

## Communities of Practice




*Facilitate Knowledge Sharing*

# Workforce Development: Digital Specific Training

## FUNCTIONAL AREA

The **Engineering and Technical Management (ETM)** workforce has a vital role in developing, fielding, and sustaining defense systems and ensuring DoD products are delivered on time, perform as expected, and are cost-effective.

The role requires developing and implementing solutions with an integrated technical approach across the total life cycle to satisfy stakeholder needs and expedite transition of technology to the user, practicing early production planning and systematically examining producibility.

## ETM CERTIFICATION (two levels)

### Foundational: 10 Courses (36 hours)

Includes

**FOUNDATIONAL CERTIFICATION COURSES**

| Course | Title |
|---|---|
| ETM 1070 | Digital Literacy Fundamentals |
| ETM 1080 | Software Literacy Fundamentals |

### Practitioner: 9 Courses (64 Hours)

Includes

**PRACTITIONER CERTIFICATION COURSES**

| Course | Title |
|---|---|
| ETM 2070V | Digital Literacy for Practitioners |
| ETM 2080V | Software Literacy for Practitioners |

## DEFENSE ACQUISITION CREDENTIAL: CENG 001: Digital Engineering for DoD Consumers

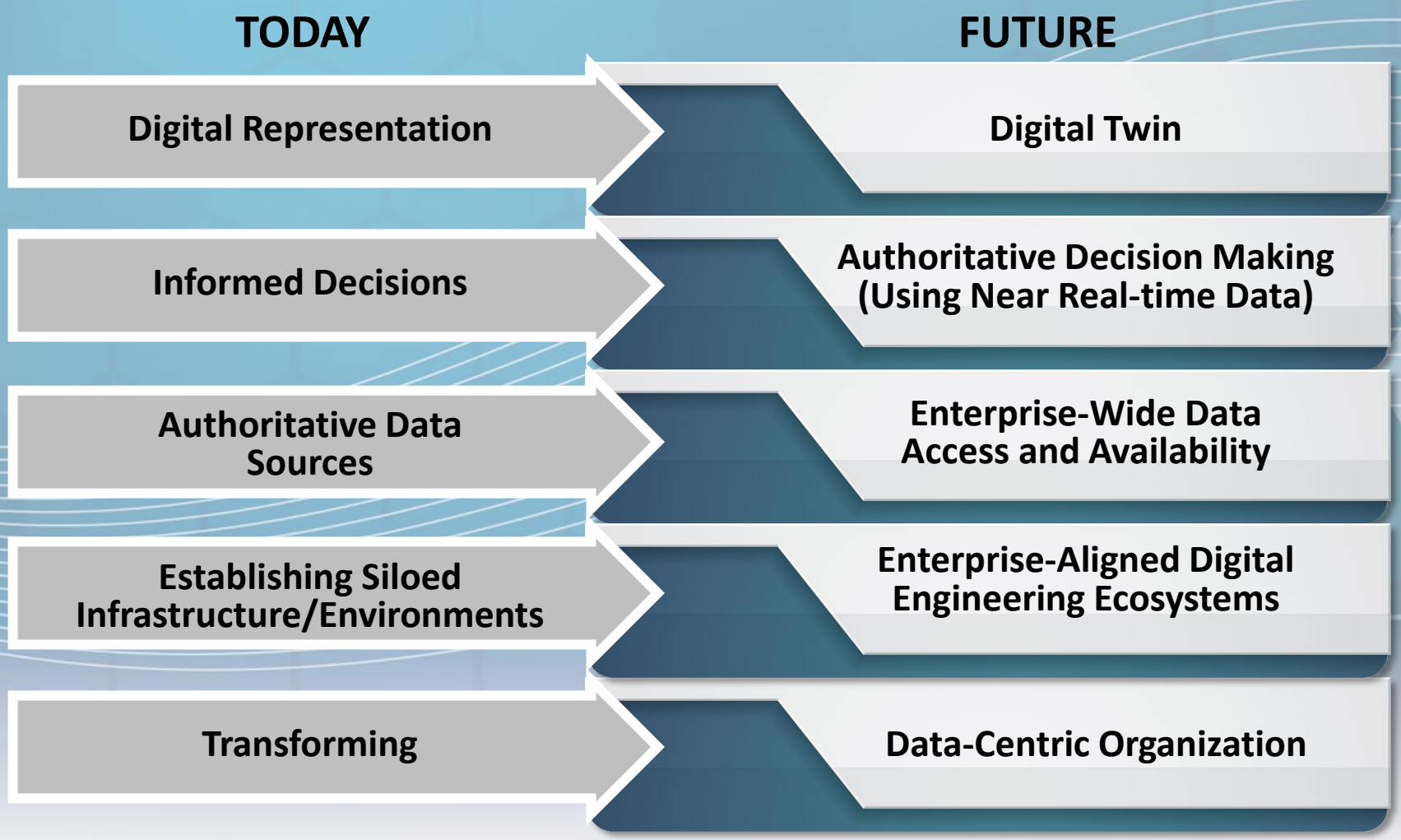
Approximately 1,000 People Credentialed

- 3rd Party — DAU-sponsored online course from Coursera
- DAU — DoD-authored content
- Cap-stone — Pass a comprehensive, capstone exam with a score of 80% or higher

| Coursera | DAU | DAU |
|---|---|---|
| MBSE: Model-Based Systems Engineering | Models, Simulations, and Digital Engineering | Digital Engineering for DoD Consumers Credential Capstone Assessment |
| (HOS 0006) Online Course \| 21 hours | (CLE 084) Online Course \| 5 hours | (CENG 0001) Exam \| 1 hour |

## More Digital Engineering Credentials Under Development

# Summary: Digital Transformation



# Contact

Office of Systems Engineering and Architecture

osd-sea@mail.mil

https://www.cto.mil/sea/