

Aligning Digital Engineering and Modeling & Simulation at Office of the Secretary of Defense

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Chat GPT question about aligning DE and M&S

Digital engineering, modeling, and simulation are powerful tools that, when used together, can create a significant advantage in various industries. This combination offers numerous benefits that contribute to better product development, increased efficiency, and cost savings. Here's how they form a winning combination:

- 1. Faster Development and Iteration:** Digital engineering allows for the creation of a virtual representation of a product or system. By using computer-aided design (CAD) software, engineers can create detailed 3D models of their designs. When combined with simulation tools, these models can be tested and analyzed virtually before physical prototypes are built. This accelerates the design and iteration process, enabling quicker development cycles.
- 2. Reduced Costs:** Traditional product development involves building physical prototypes and conducting multiple rounds of testing, which can be expensive and time-consuming. Digital modeling and simulation help identify potential issues and flaws early in the design phase. This reduces the need for physical prototypes, saving both time and resources.
- 3. Enhanced Collaboration:** Digital engineering and simulation allow multidisciplinary teams to work collaboratively on a single digital model. This shared platform facilitates communication between various teams, such as design, engineering, manufacturing, and testing. Everyone can contribute their expertise and insights, leading to more informed decisions.
- 4. Risk Reduction:** Modeling and simulation enable engineers to test different scenarios and conditions in a controlled environment. This helps identify potential risks and challenges before they become significant issues during the manufacturing or operational phases. By addressing these issues early, companies can avoid costly rework and delays.
- 5. Optimized Performance:** Simulation tools can analyze how a product or system will behave under different conditions. Engineers can fine-tune designs to optimize

performance, durability, and efficiency. This leads to products that better meet customer requirements and expectations.

- 6. Iterative Improvement:** The digital engineering and simulation process allows for continuous improvement. As new data and insights become available, models can be updated and refined. This iterative approach leads to better designs over time.
- 7. Complexity Management:** Many modern systems are incredibly complex, and traditional testing methods might not cover all possible scenarios. Simulation can simulate a wide range of conditions, helping engineers uncover issues that might be challenging to detect through physical testing alone.
- 8. Training and Education:** Digital models and simulations can be used for training purposes. For example, in fields like aviation and healthcare, pilots and surgeons can practice their skills in virtual environments, improving their proficiency and safety.
- 9. Sustainability and Environmental Impact:** Digital engineering and simulation can help optimize designs for sustainability. By analyzing factors such as material usage, energy efficiency, and emissions, engineers can develop products with a reduced environmental footprint.
- 10. Regulatory Compliance:** In industries with strict regulatory requirements, digital models and simulations can aid in demonstrating compliance. Simulations can be used to showcase that a product meets safety, reliability, and performance standards.

In essence, the integration of digital engineering, modeling, and simulation creates a comprehensive framework that enhances product development, reduces costs, mitigates risks, and promotes innovation. This synergy enables companies to deliver higher-quality products to the market more quickly and efficiently.



Digital Engineering, Modeling & Simulation's Place in the Federal Government



SE&A
Systems Engineering
& Architectures

DEM&S
DIGITAL ENGINEERING
MODELING AND SIMULATION



Joe Biden
President



Lloyd J. Austin III
Secretary of Defense



Heidi Shyu
Under Secretary of Defense for
Research and Engineering



Thomas W. Simms
Executive Director, SE&A



Daniel Hettema
Director

<https://www.cto.mil/>



What do we Mean by Saying “DE”



Business Practices

- Tools & Environments
- Resource DE Enablers

Day-to-Day Engineering Tasks

- Engineering Culture
- Document vs Model Delivery

PM Processes

- Review Cycles
- Requirements

Expectations

- Tech Rigor Metrics
- Institutionalized Processes

Adoption of Emerging Tech

- Risk Mitigation of new Tech
- Local / Strategic Technical Thrusts

Procurement Policy

- Data Rights
- Contract Language

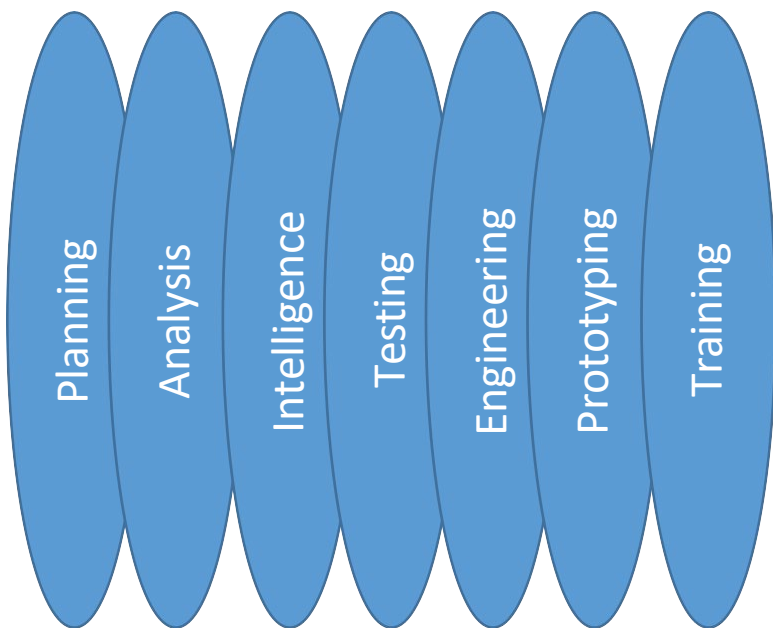
Academic vs. Practical Solutions

- Emerging Tech Standards
- Tech Breakthroughs

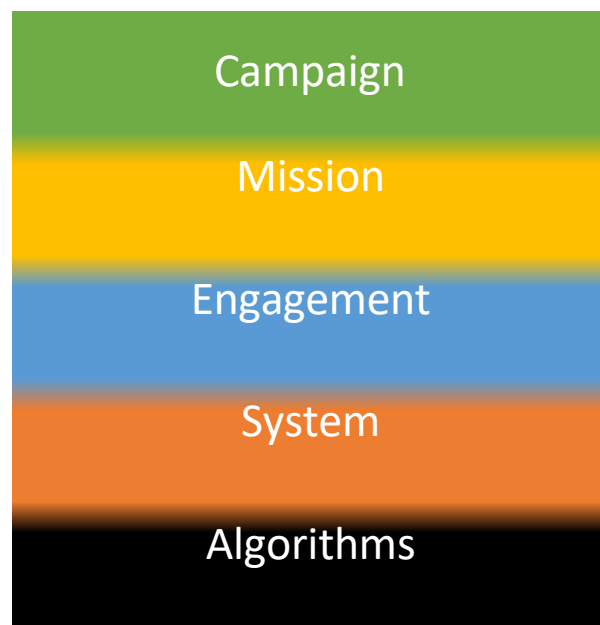
The Pursuit of “Digital Engineering” as a monolithic entity is vast beyond practicality: trying to solve all of it = boiling the ocean



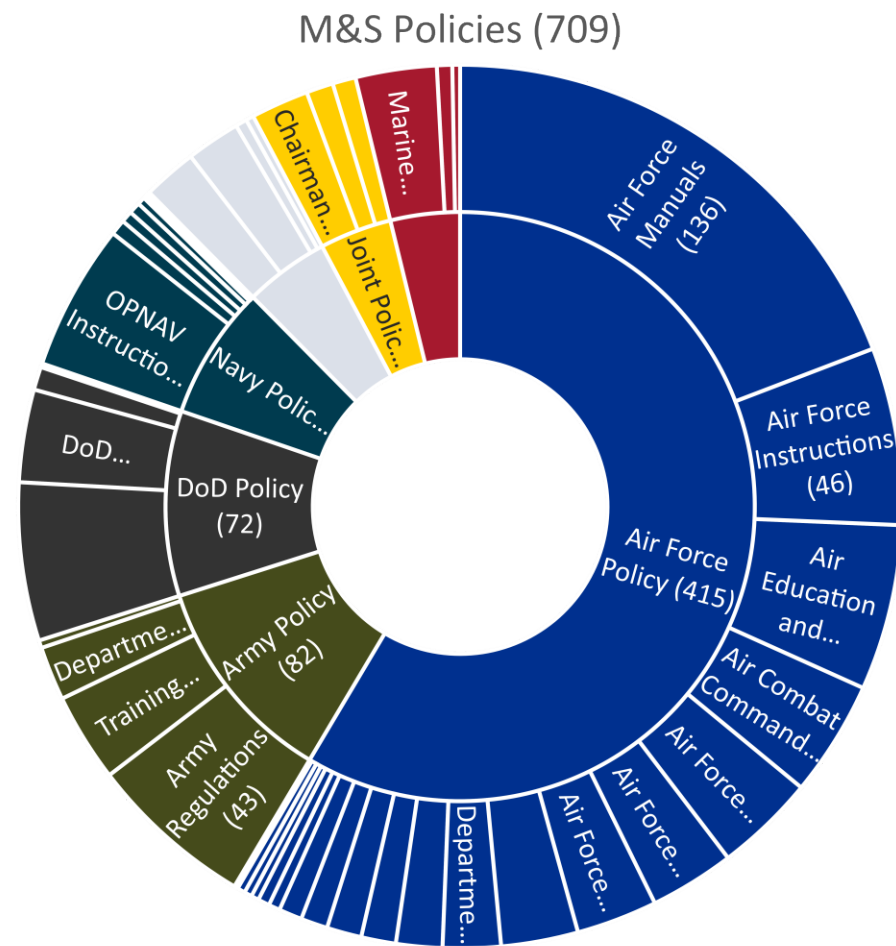
What do we Mean by Saying “M&S”



“Seven Surfboards”

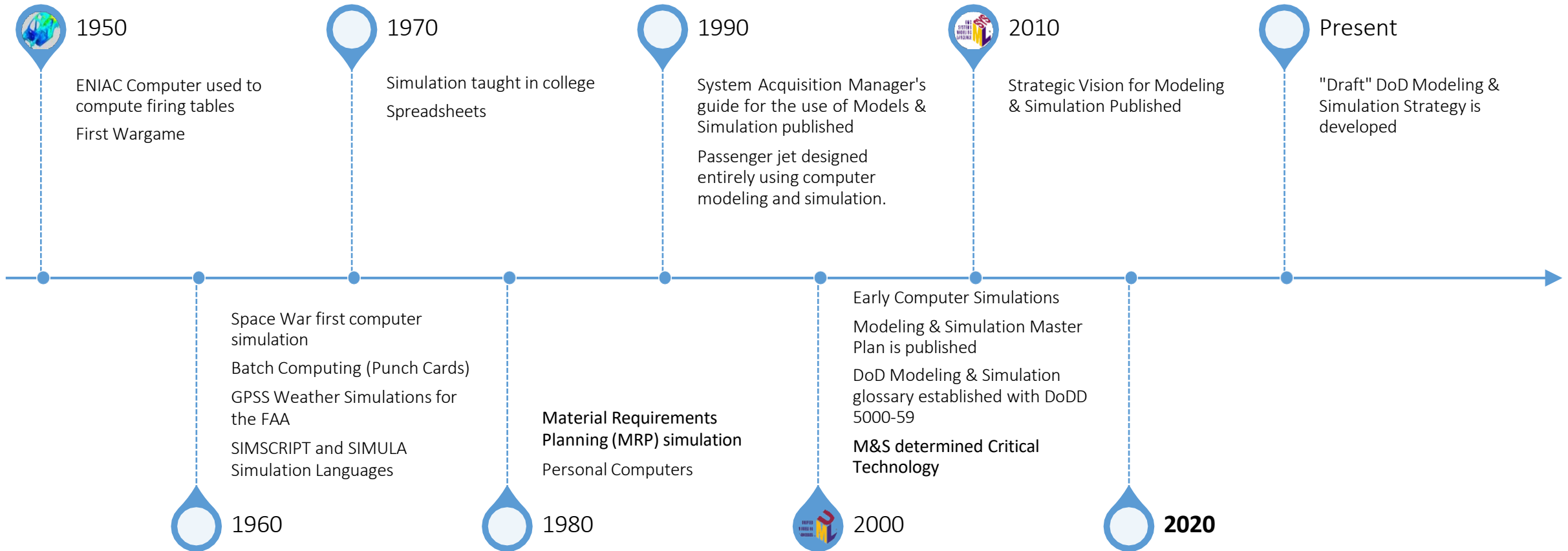


Modeling Levels



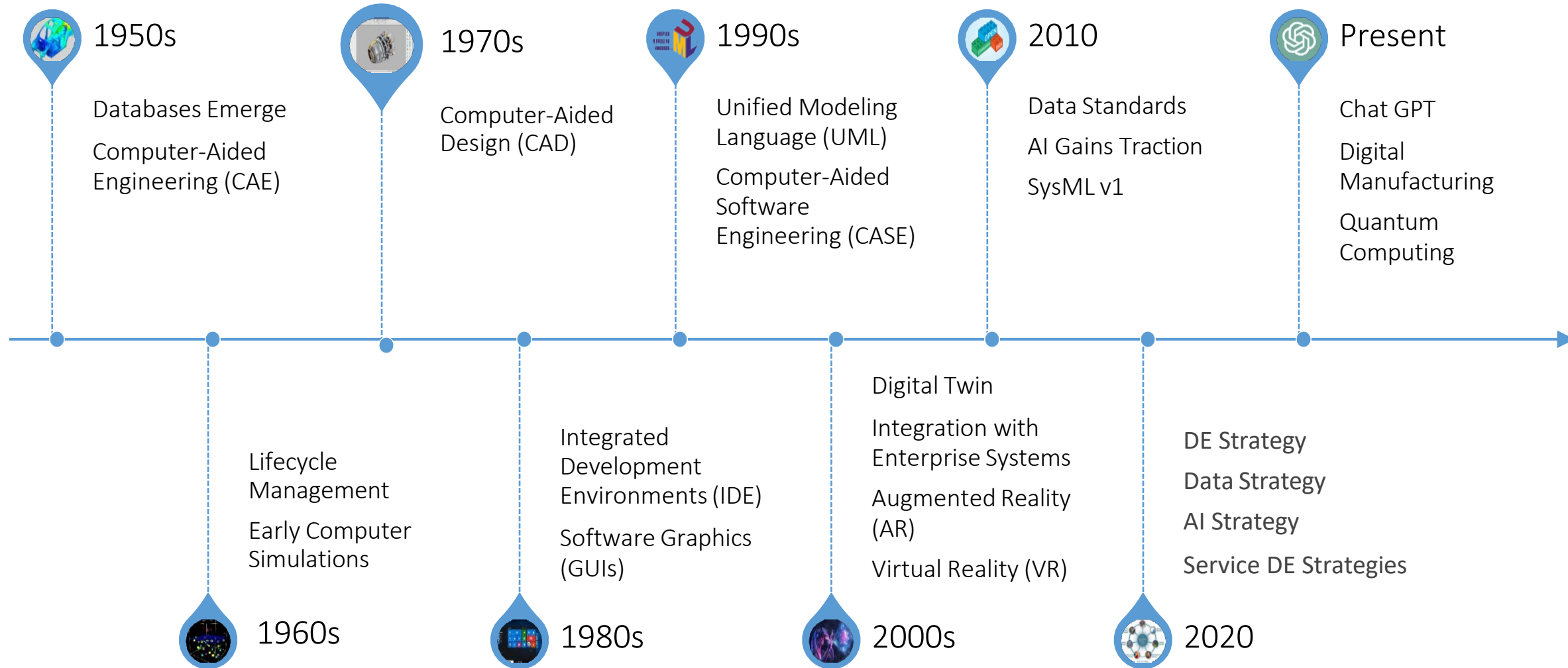


History of DoD M&S



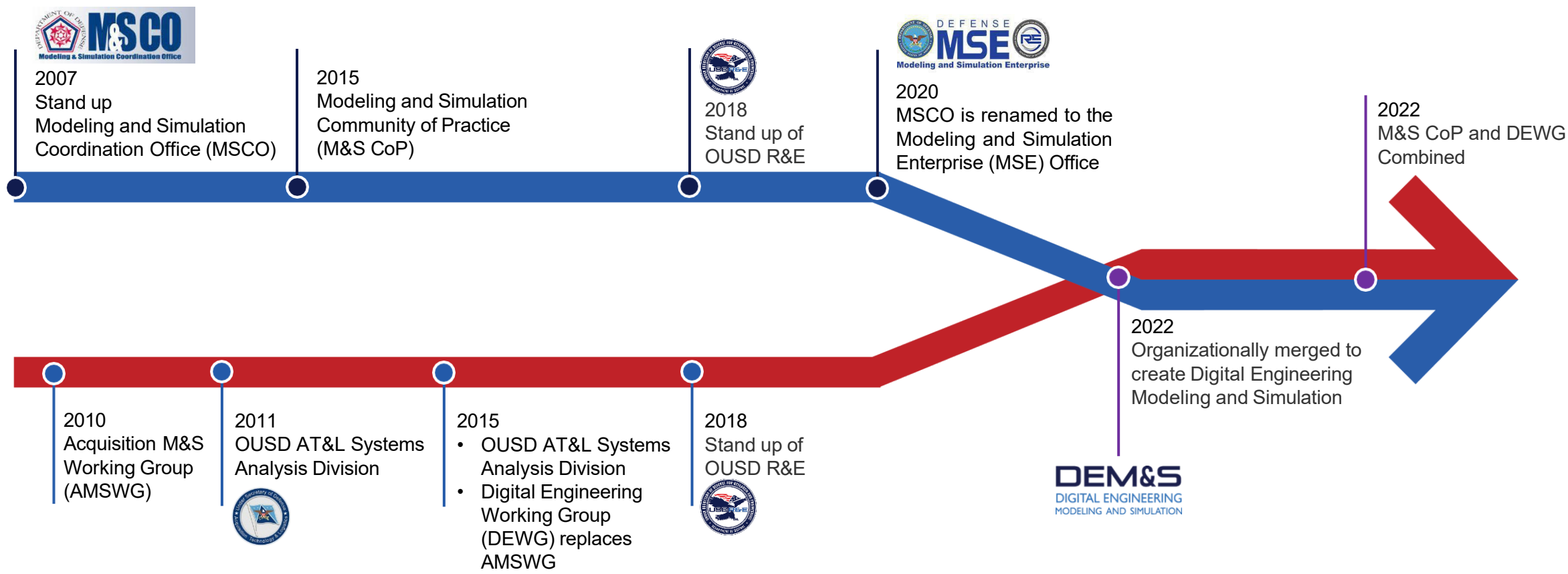


History of Systems Engineering





DEM&S Organizational Journey





Good News Stories

Emerging Technologies

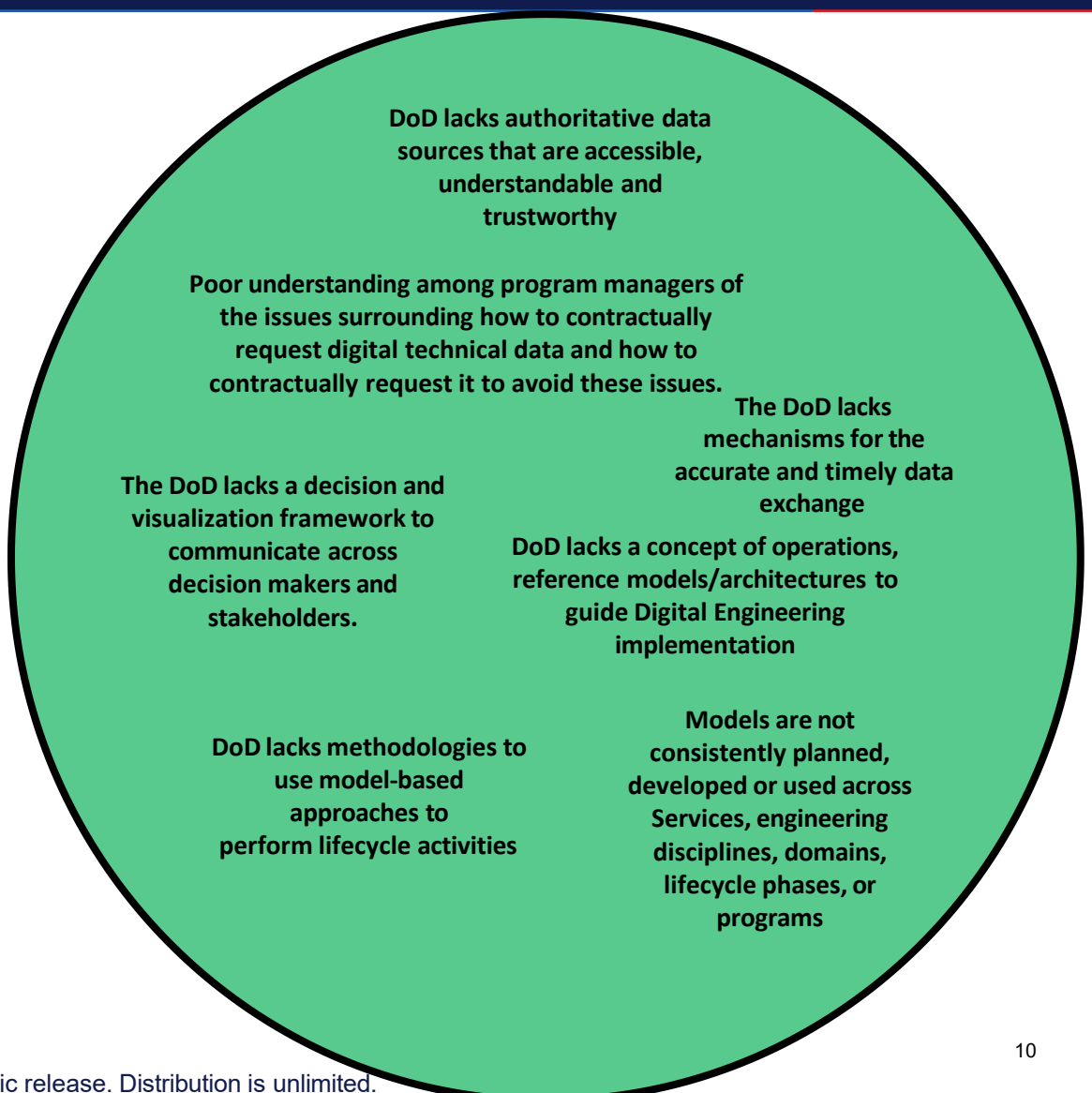
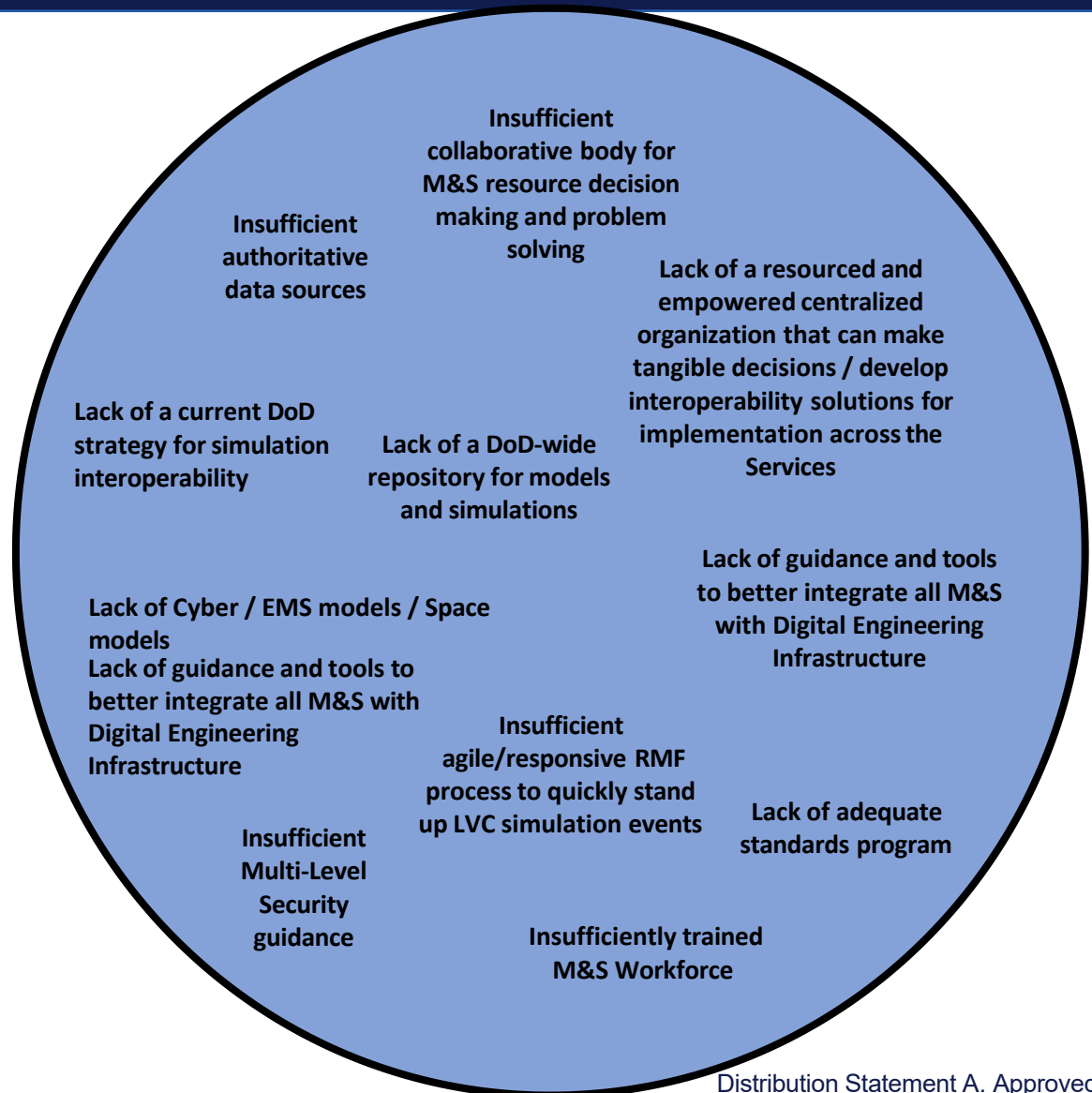
- High Level Architecture (HLA) – an early success and prominent focal point for wins in the Department. Now an enduring international standard.
- The Synthetic Environment Data Representation and Interchange Specification (SEDRIS) - filled an early need and continues to be used within the Department.

Collaboration and High-level Coordination

- Integrated Threat Analysis Simulation Environment (ITASE) - funded under centralized management and has become a classified environment hosted by the Intelligence community and utilized by the Services and Agencies.
- Combatant Command's four-star summit - DMSCO led working groups responded back to a Senior Steering Group with recommendations on solving interoperability issues in mission rehearsal planning.

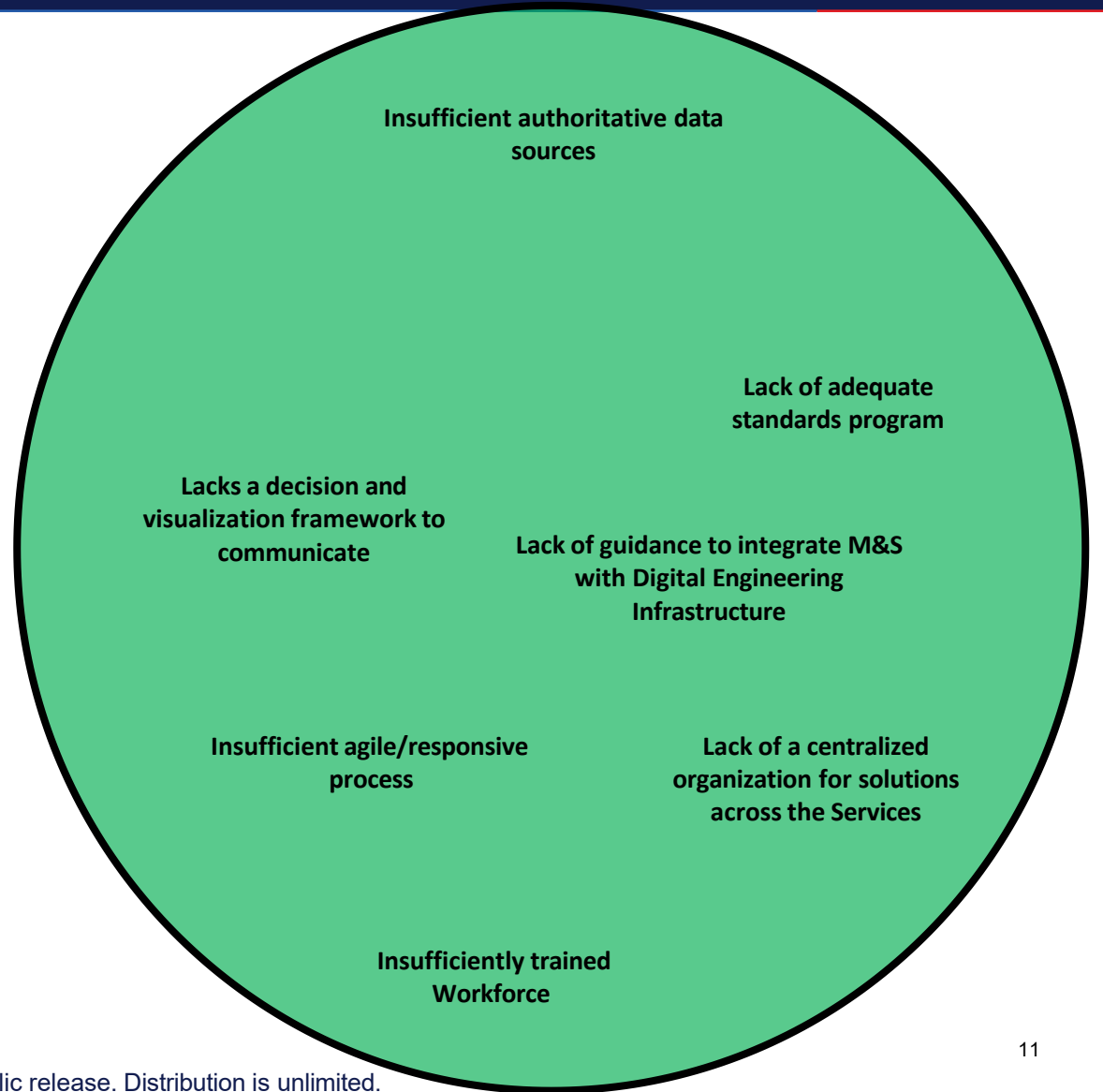
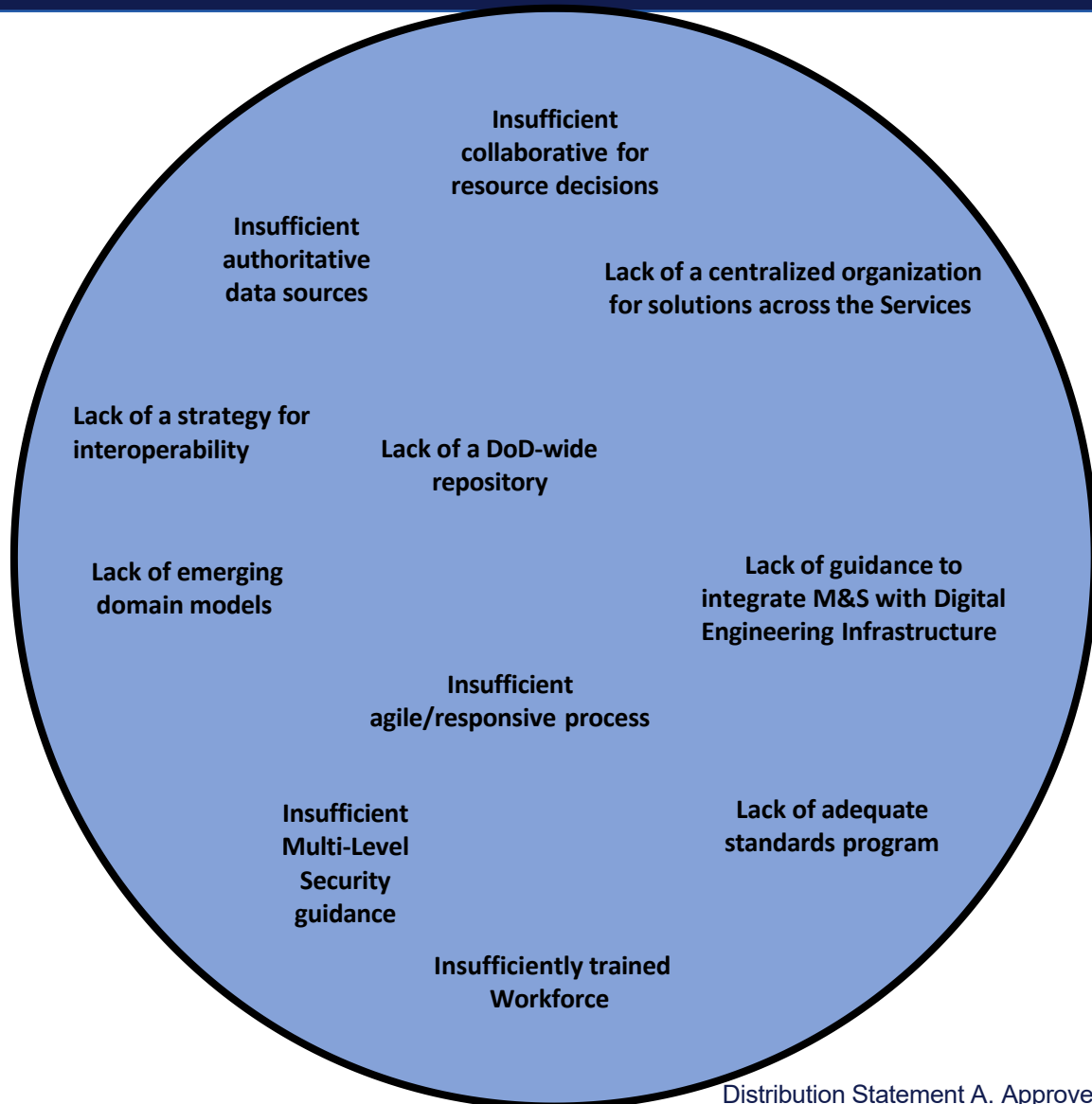


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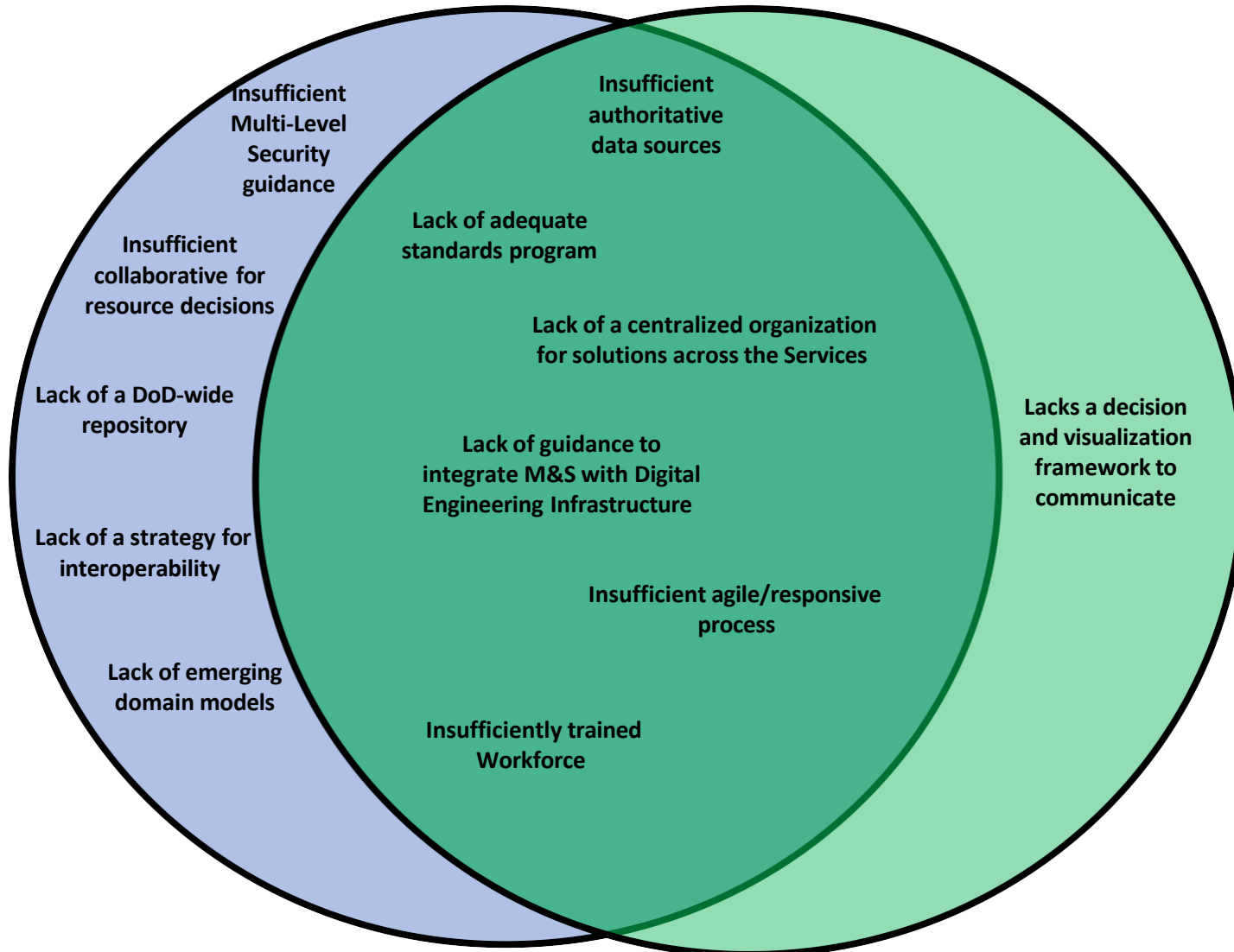


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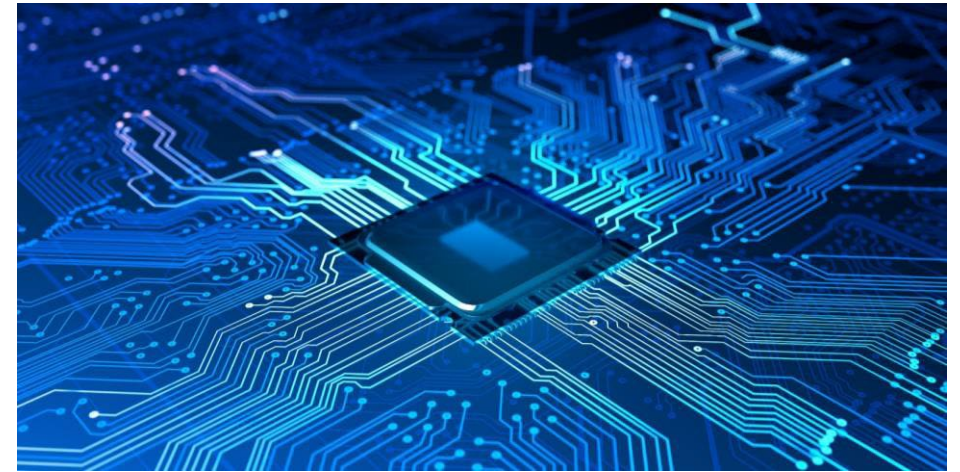


The Vision for Digital Engineering, Modeling & Simulation

1. Digital becomes **the normal**
2. Data & Information **flow across disciplines and ecosystems** throughout the lifecycle
3. Powerful **modeling, simulation, and visualization** tools are used
4. AI is used to **elevate experts** and gain insights
5. Decisions are **data driven** and made with confidence earlier
6. **Innovative culture** is adaptive and continuously improves practices across the Defense Acquisition Lifecycle

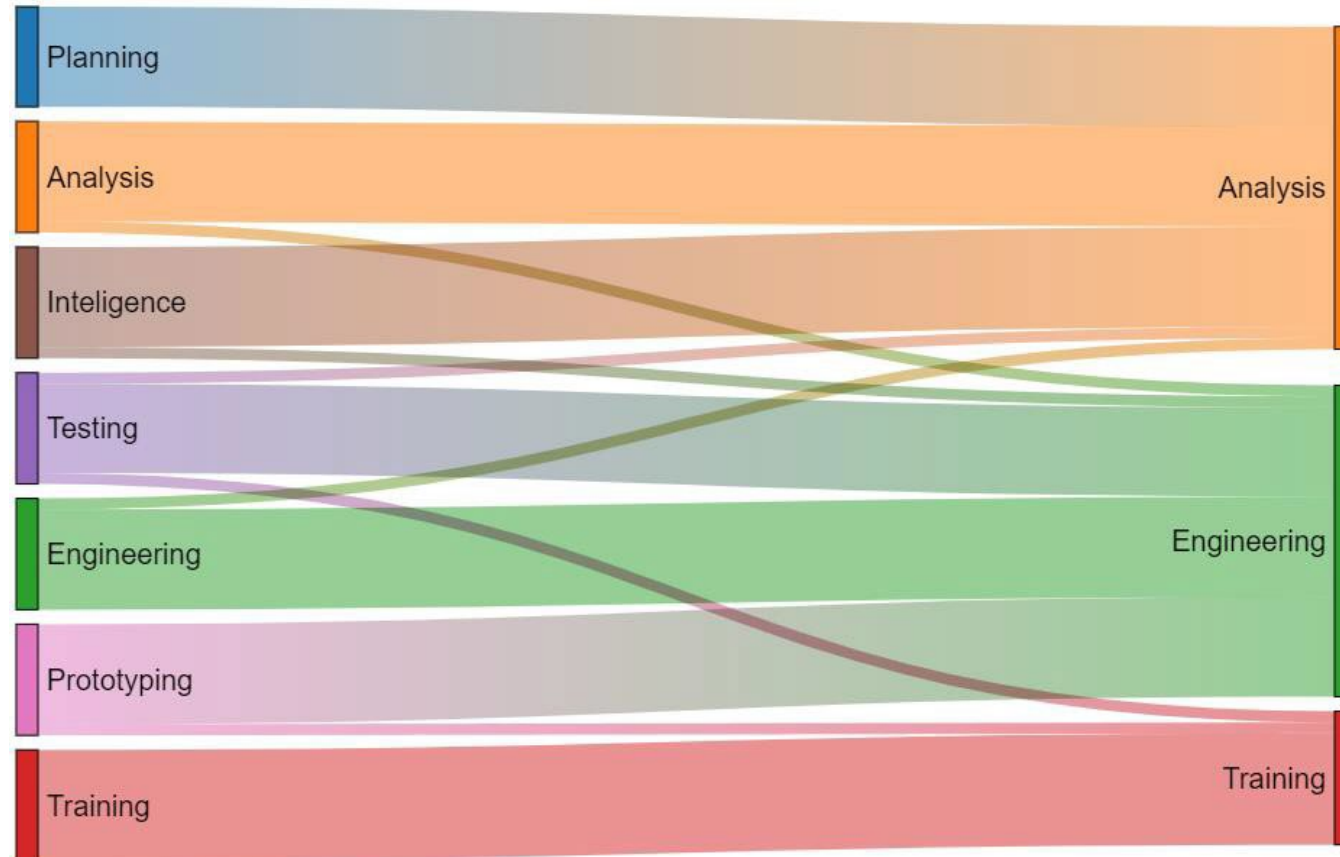
Outcomes

- Outpace rapidly changing threats and technological advancements
- Deliver advanced capabilities more quickly and affordably with improved sustainability to the warfighter





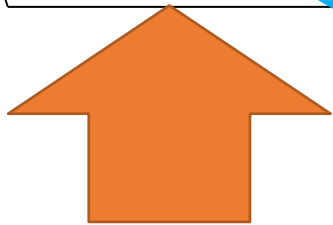
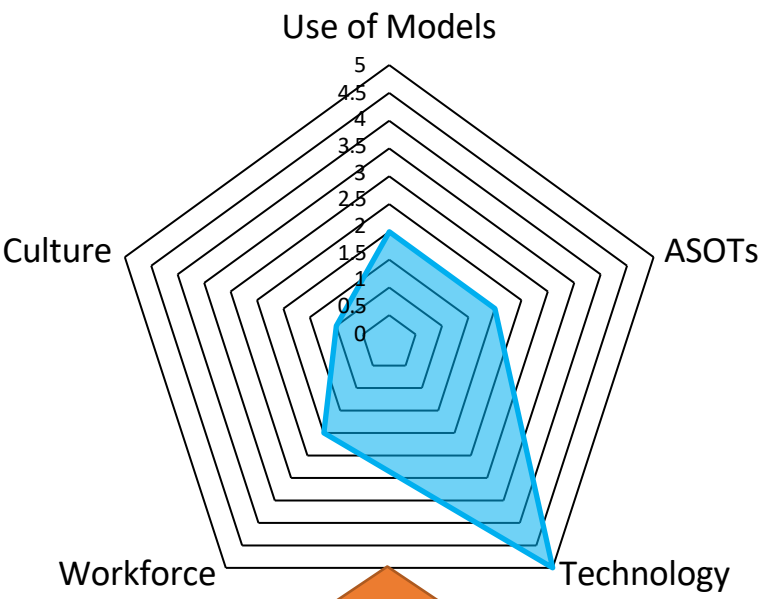
Back to the Future: Simplified Alignment





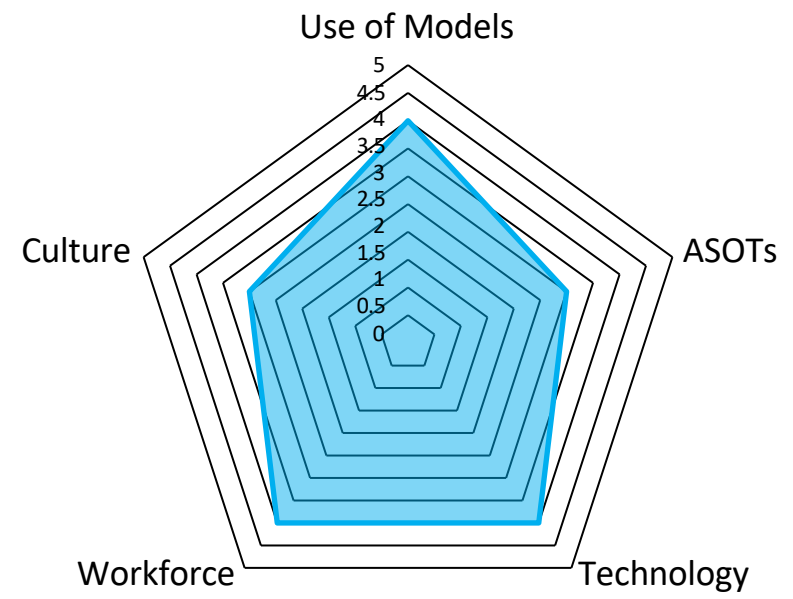
Perceived Maturity of M&S

Engineering

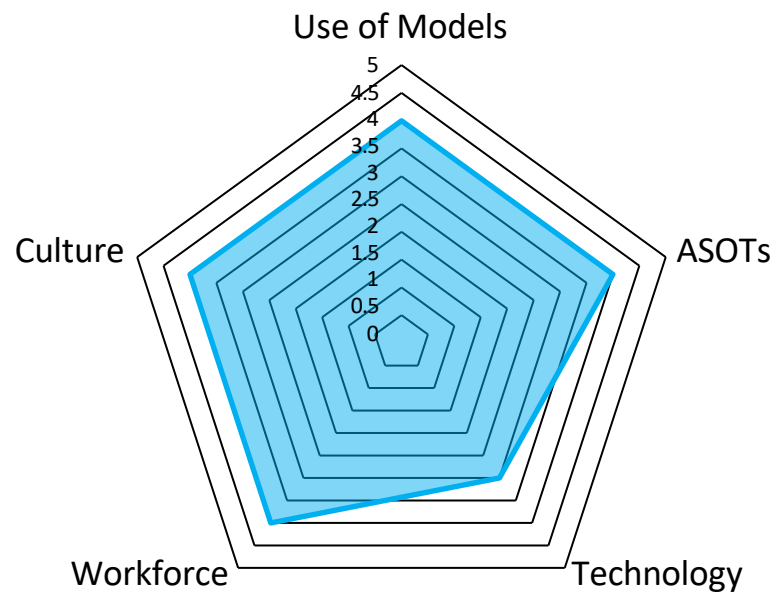


First focus for DEM&S

Analysis



Training



*based on community feedback & observations



Mission Engineering Success Story

Mission Engineering Guide

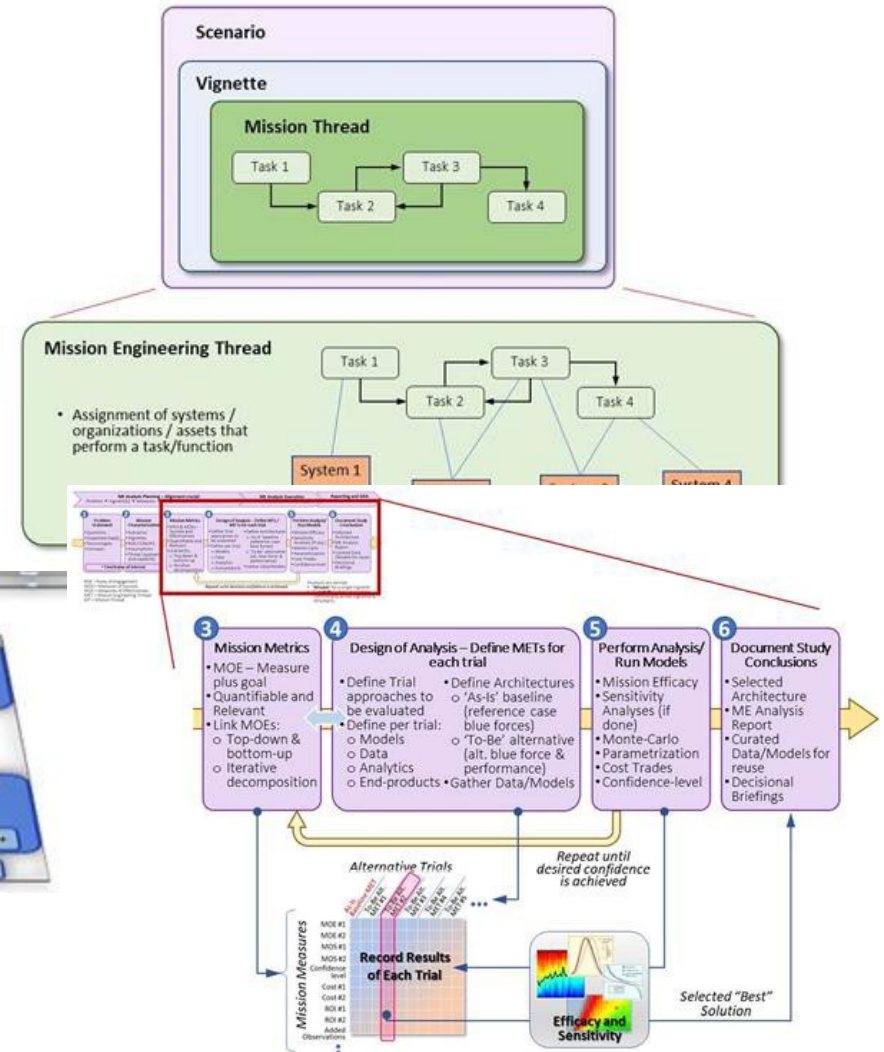
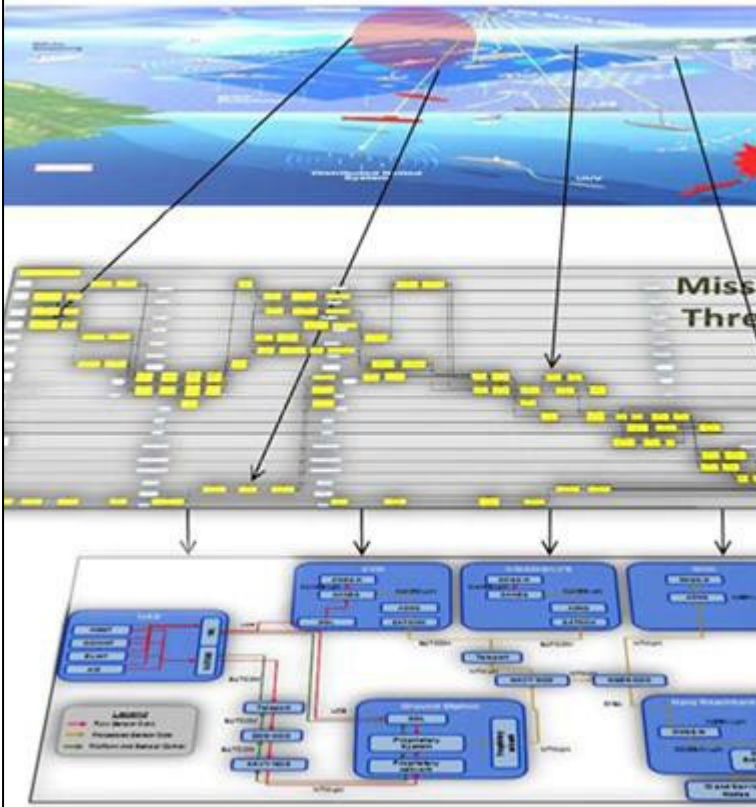


November 2020

Office of the Deputy Director for Engineering
Office of the Under Secretary of Defense
for Research and Engineering

Washington, D.C.

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5 Foundational Principles for the Next Chapter

1  Doing Over Planning

2  Leveraging Data over Existing Process

3  Upskilling Over Future Hires

4  Interoperability Over Tool Verticals

5  Information Sharing Over Organizational Silos



Development of Modeling & Simulation Strategy

Primary Goals:

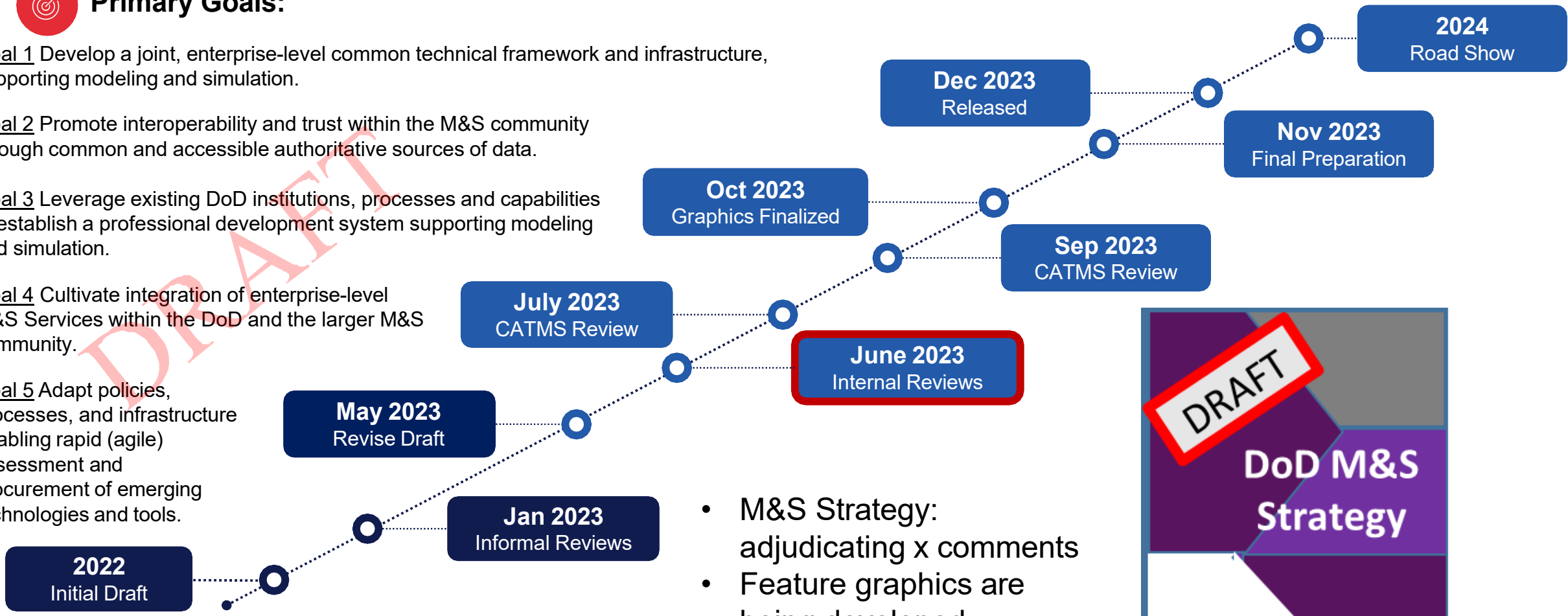
Goal 1 Develop a joint, enterprise-level common technical framework and infrastructure, supporting modeling and simulation.

Goal 2 Promote interoperability and trust within the M&S community through common and accessible authoritative sources of data.

Goal 3 Leverage existing DoD institutions, processes and capabilities to establish a professional development system supporting modeling and simulation.

Goal 4 Cultivate integration of enterprise-level M&S Services within the DoD and the larger M&S community.

Goal 5 Adapt policies, processes, and infrastructure enabling rapid (agile) assessment and procurement of emerging technologies and tools.



- M&S Strategy: adjudicating x comments
- Feature graphics are being developed



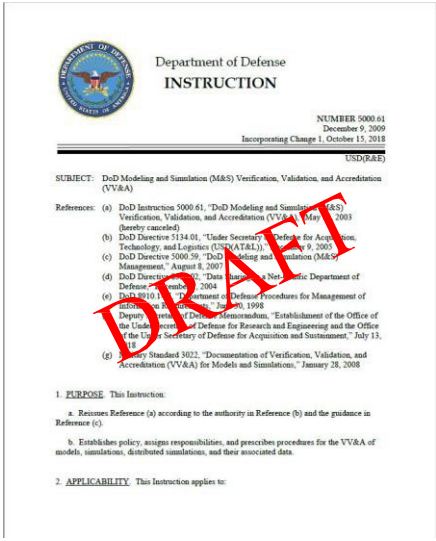


DODI 5000.61 Verification Validation & Accreditation (VV&A)

Establishes DoD policy for VV&A of M&S

- Requires VV&A of models, simulations and data used to support DoD processes, products and decisions
- Directs VV&A results be documented and made accessible
- Assigns Components and PAS* Officials as final validation authority for representations in their areas of responsibility

Establishes standards for documentation and accessibility of VV&A results

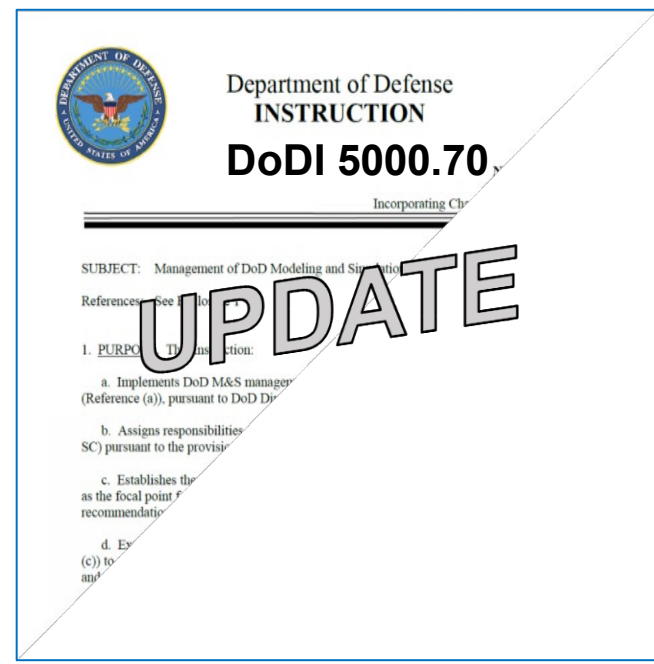
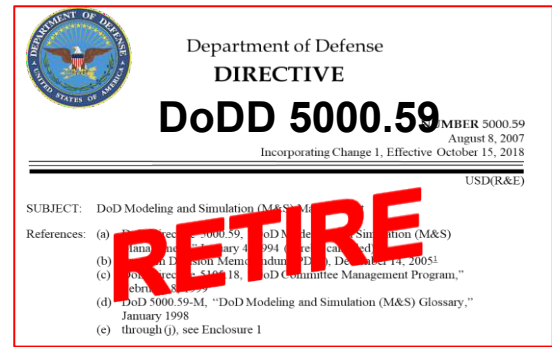




DoDD 5000.59 (Retired) / DoDI 5000.70 (update)

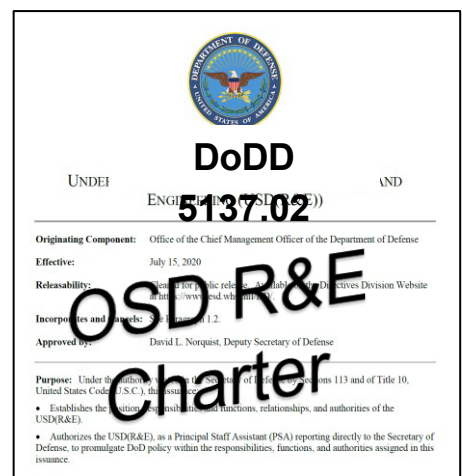
Organizational construct is OBSOLETE

- USD AT&L
- DMSCO/MSCO/MSE
- M&S Steering Committee, Coordination & Executive Agents
- MSCO Website
- M&S Catalog



Roles and Responsibilities

- M&S OPR maintained with OSD R&E
- Replaces 5000.59 for all M&S Authority and Responsibilities Management



Roles and Responsibilities

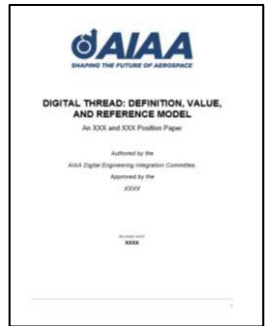
- Changes in Organizational construct & implementation
- Replaces 5000.59 for all Mgmt. of DoD M&S Activities
- Transposes some of 5000.59 Responsibilities
- Alignment with DE and M&S Strategies



Professional Engagements

AIAA DEIC

American Institute of Aeronautics and Astronautics(AIAA)
Digital Engineering Integration Committee (DEIC)



Key Initiatives:

- Digital Twin Position Paper
- Digital Thread Position Paper
- Digital Ecosystem Position Paper
- Digital System Model Position and Implementation Paper
- Workforce Development

SERC/AIRC

Systems Engineering Research Center (SERC)
Acquisition Innovation Research Center (AIRC)



Key Initiatives:

- Digital Engineering Transformation
 - Digital Engineering Measures
 - Enablers to Systems Engineering Modernization
 - Foundations for Model Based Portfolio Analysis

INCOSE



Key Initiatives:

- DE Primer
- DE Guide for IEEE
- DE Taxonomy for IEEE
- Digital Engineering View Model (DVM)
- Decision Analysis Data Model



Standards

ISO & SISO



Key Initiatives:

- Joint Enterprise Standards Committee (JESC) voting member
- JESC Modeling & Simulation (M&S) Technical Working Group (TWG) Chair Lead
- Support update of the High-Level Architecture (HLA) standard - Distributed Simulation Engineering and Execution Process (DSEEP) - IEEE 1730
- Support of completing Simulation Interoperability Readiness Levels (SIRL)
- Proactive Engagement with Simulation Interoperability Standards Organization (SISO) Innovation Workshops (IW)

OMG

Object Management Group



Key Initiatives:

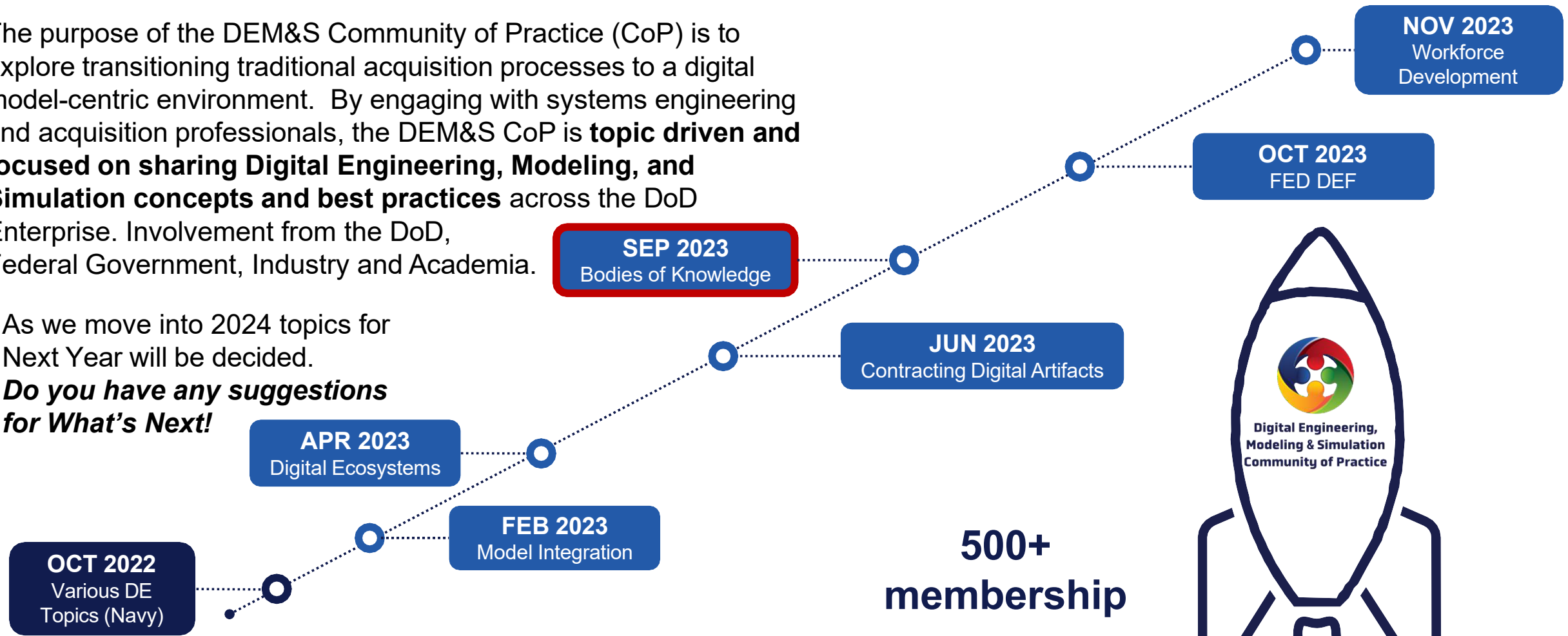
- OUSD (R&E) rep to OMG
- DODAF to UAF Collaboration with CIO
- MBAcq
- SysML V2 Specification
- SysML V2 Transition Guide
- Digital Twin Consortium



DEM&S Community of Practice

The purpose of the DEM&S Community of Practice (CoP) is to explore transitioning traditional acquisition processes to a digital model-centric environment. By engaging with systems engineering and acquisition professionals, the DEM&S CoP is **topic driven and focused on sharing Digital Engineering, Modeling, and Simulation concepts and best practices** across the DoD Enterprise. Involvement from the DoD, Federal Government, Industry and Academia.

As we move into 2024 topics for Next Year will be decided.
Do you have any suggestions for What's Next!



500+ membership



<https://web.cvent.com/event/c7b84de6-946b-4e48-bac0-90084d6ca458/summary>



Digital Engineering Body of Knowledge

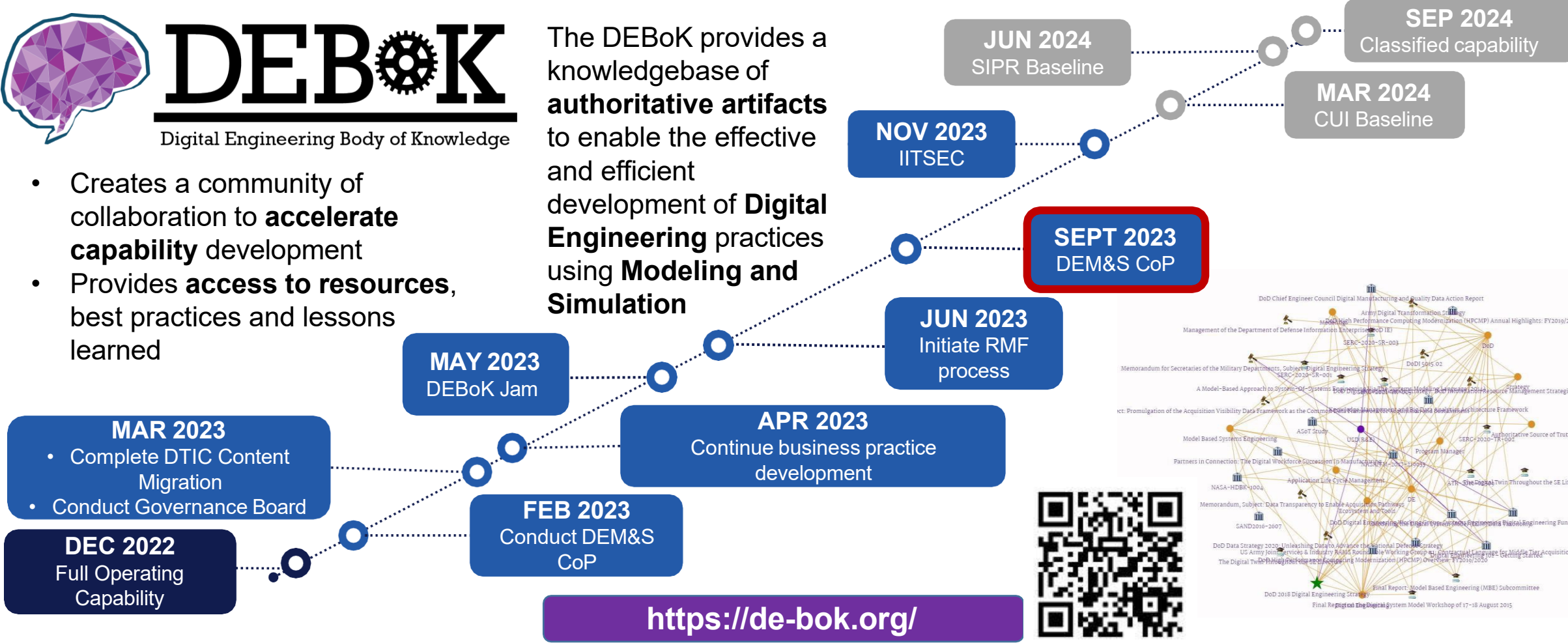


DEBoK

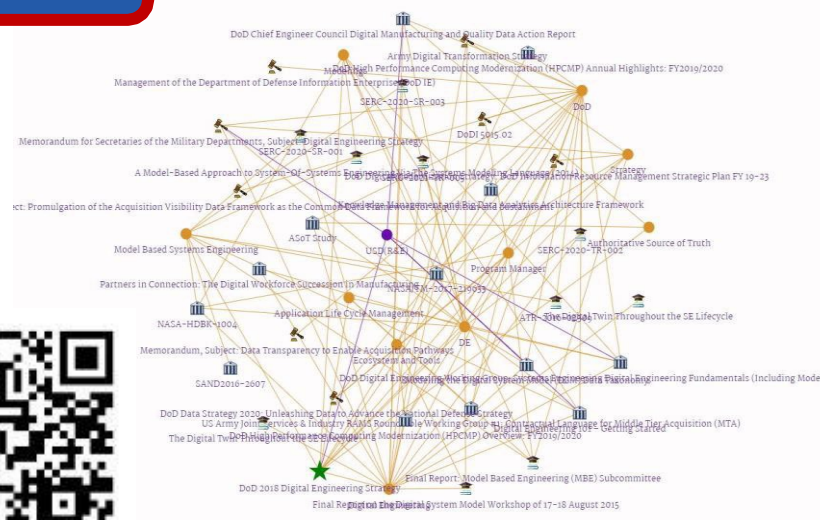
Digital Engineering Body of Knowledge

- Creates a community of collaboration to **accelerate capability** development
- Provides **access to resources**, best practices and lessons learned

The DEBoK provides a knowledgebase of **authoritative artifacts** to enable the effective and efficient development of **Digital Engineering** practices using **Modeling and Simulation**



<https://de-bok.org/>

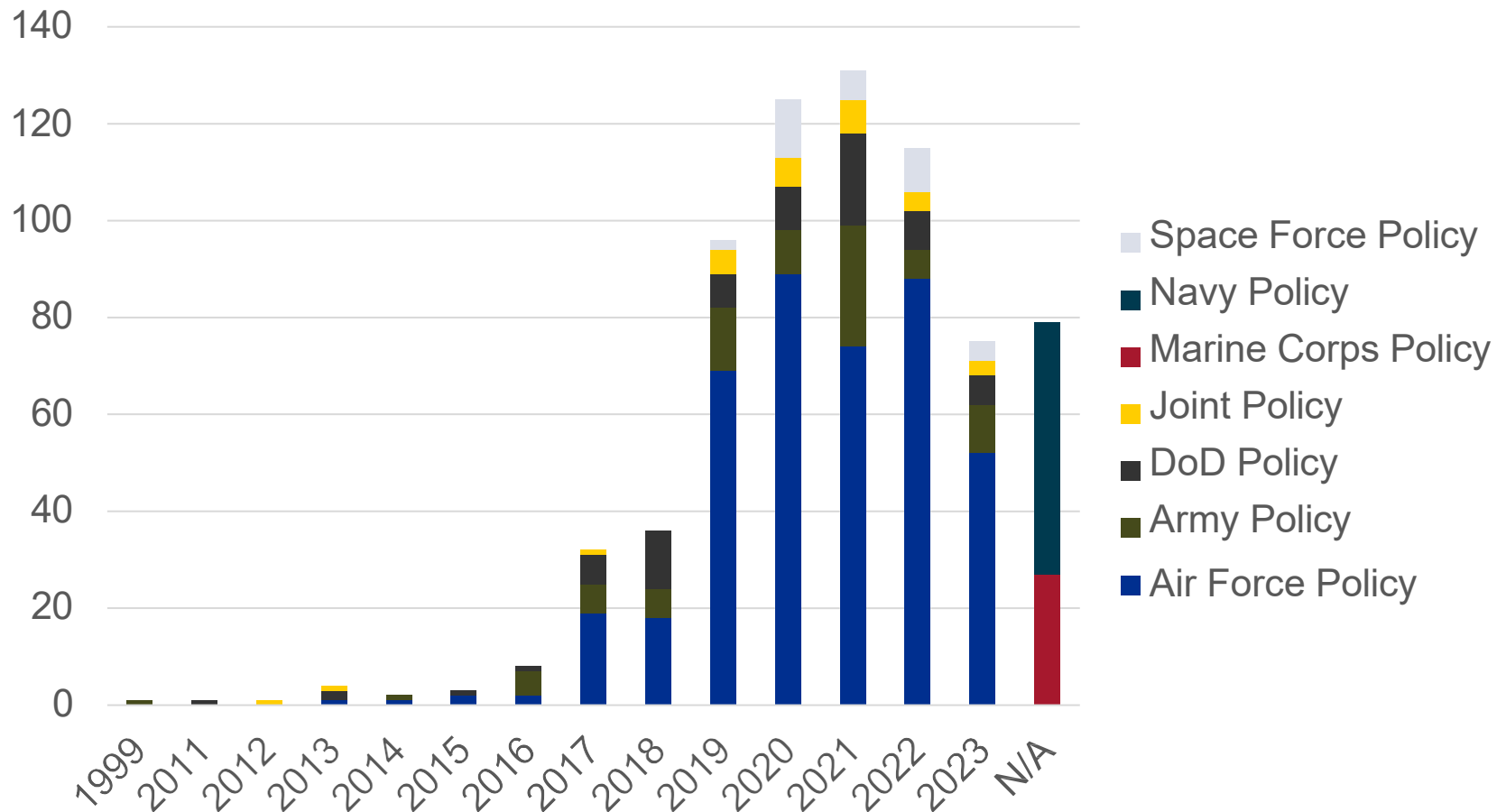


Continuous Capability Maturity | Continuous Content Curation | Continuous Outreach Activities



Community Feedback: Where can DEM&S Help?

M&S Policies By Year





Contact Info

DEM&S

DIGITAL ENGINEERING
MODELING AND SIMULATION

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Research and Engineering

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<https://www.cto.mil>

<https://ac.cto.mil/engineering>