USD(R&E)

Aligning to Industry Best Practices; UAF @ OSD

OMG UAF Summit March 22, 2023

Daniel Hettema
Director, Digital Engineering, Modeling & Simulation
Office of Systems Engineering and Architecture (SE&A)
March 2023

"How could an AI perform analysis on an architecture"

"An AI can perform analysis on an architecture by using algorithms and machine learning techniques to analyze data and make predictions. For example, an AI can analyze spatial networks to help architects solve complex problems more efficiently than traditional methods. This can involve using software such as Depth map X that uses AI to perform this analysis.

To leverage AI in architecture, it is important to accumulate as much data as possible and use it in the design process. This can help architects make informed decisions and create more efficient designs."

-Bing Chat

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
Office Under Secretary of Defense (OUSD) for Research and Engineering (R&E)

Tom Simms
Acting, Principal Deputy, SE&A

Daniel Hettema
Director

OUSD(R&E) - Critical Technologies

SE&A
Systems Engineering & Architectures

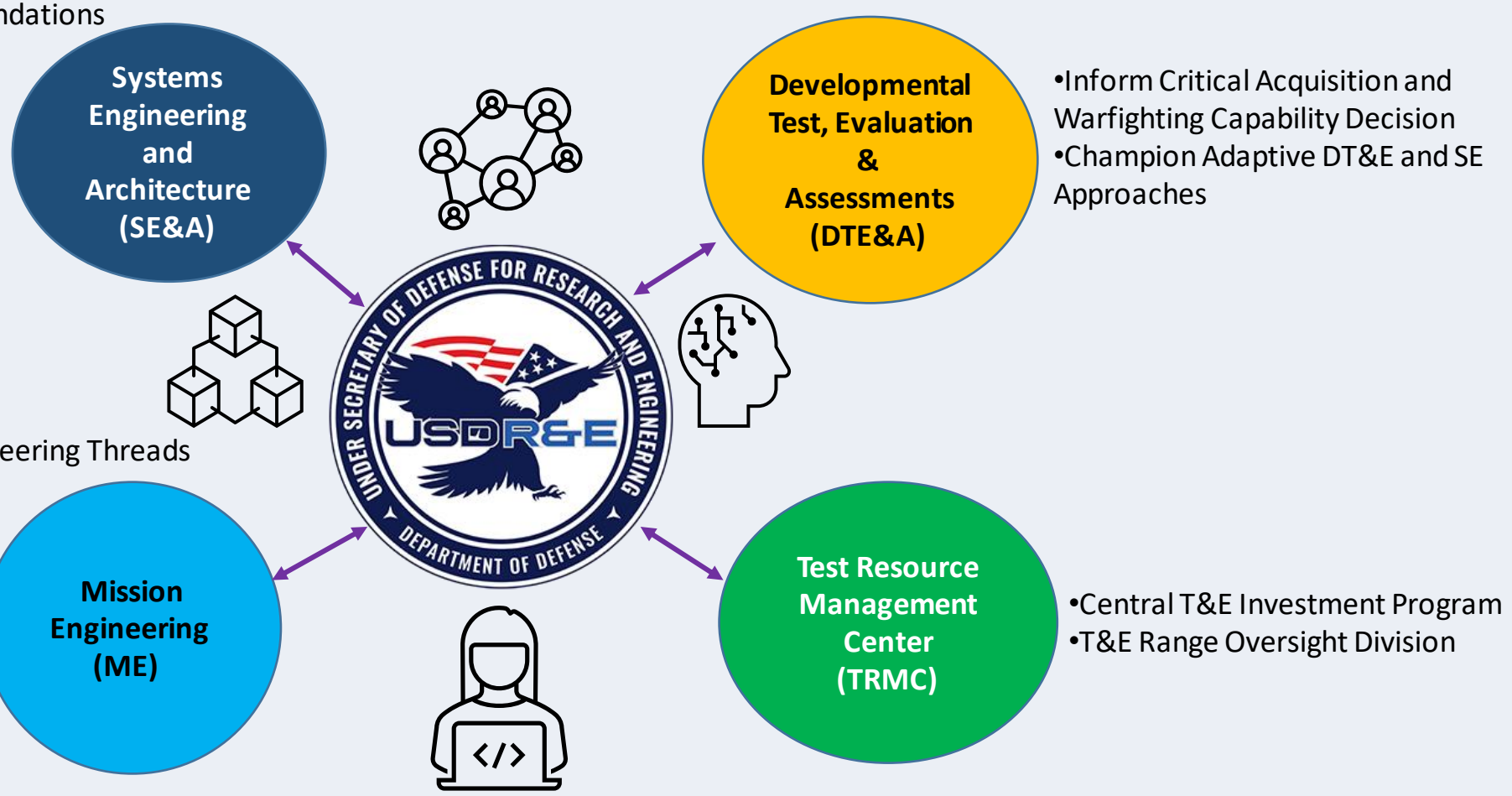
DEM&S
DIGITAL ENGINEERING
MODELING AND SIMULATION

OUSD(R&E) - Engineering Activities

SE&A
Systems Engineering & Architectures

DEM&S
DIGITAL ENGINEERING
MODELING AND SIMULATION

•Engineering Applications
•Engineering Foundations



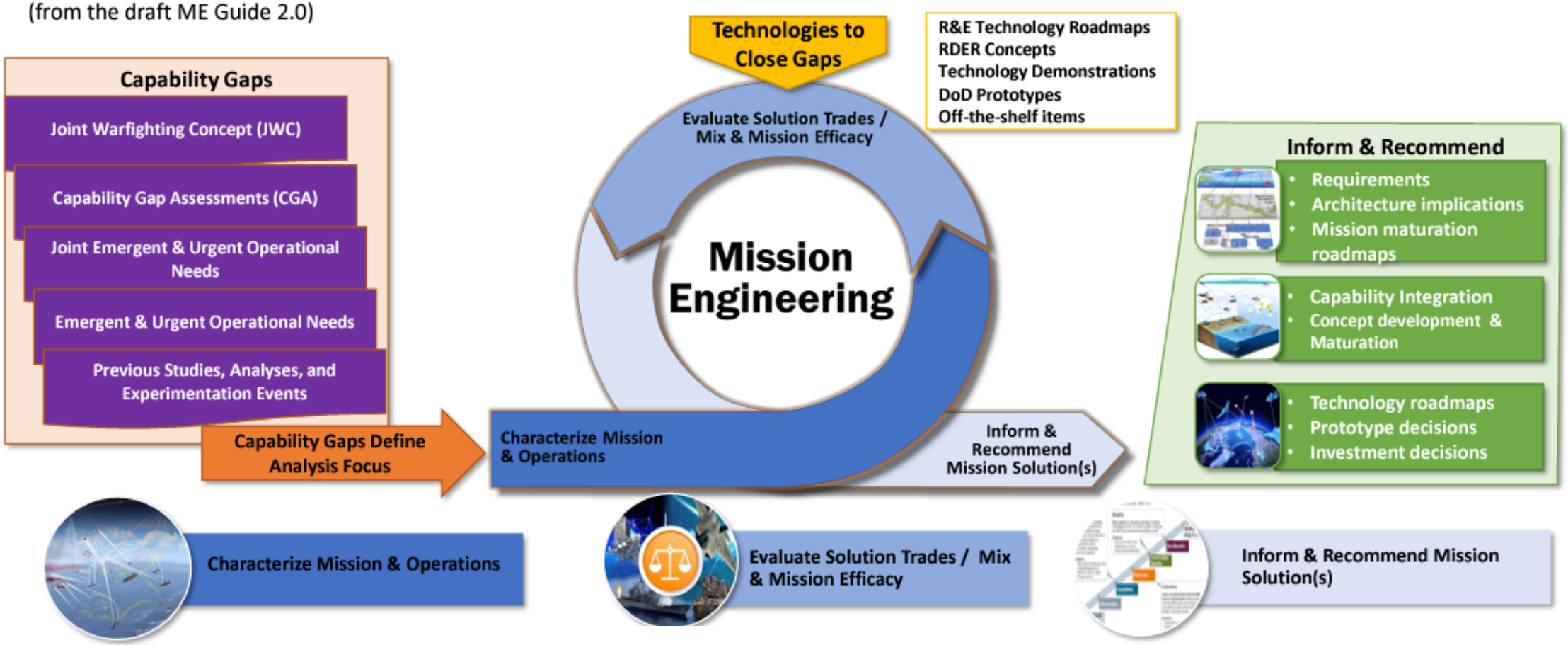
•Inform Critical Acquisition and Warfighting Capability Decision
•Champion Adaptive DT&E and SE Approaches

•Analyze Mission Engineering Threads
•Data Curation and Modeling & Simulation Tools

•Central T&E Investment Program
•T&E Range Oversight Division

Mission Engineering (ME)

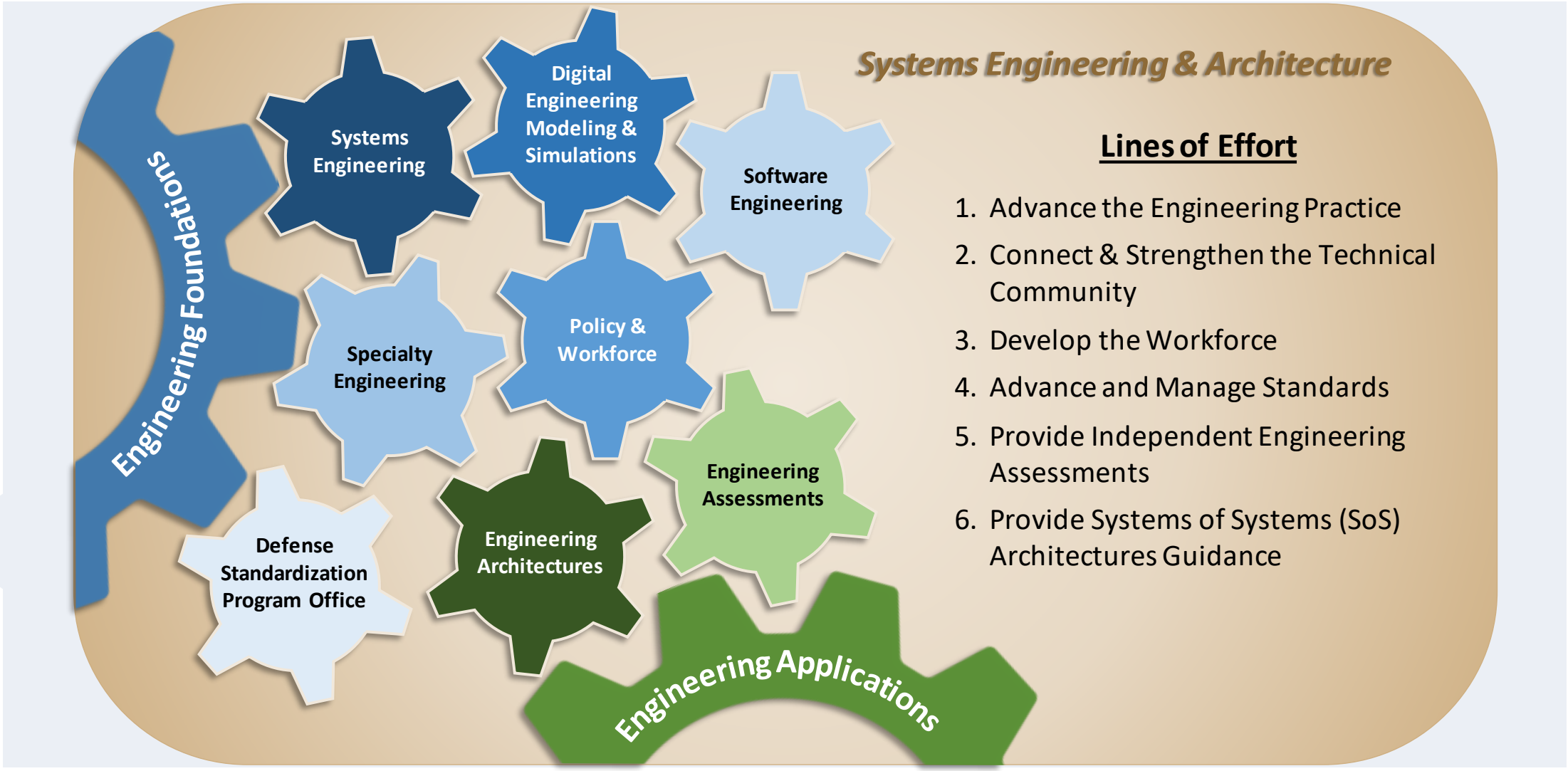
Mission Engineering (ME) – An interdisciplinary approach and process encompassing the entire technical effort to analyze, design, and integrate current and emerging operational needs and capabilities to achieve desired mission outcomes.
(from the draft ME Guide 2.0)



Executive Directorate for Systems Engineering & Architecture

SE&A
Systems Engineering & Architectures

DEM&S
DIGITAL ENGINEERING MODELING AND SIMULATION

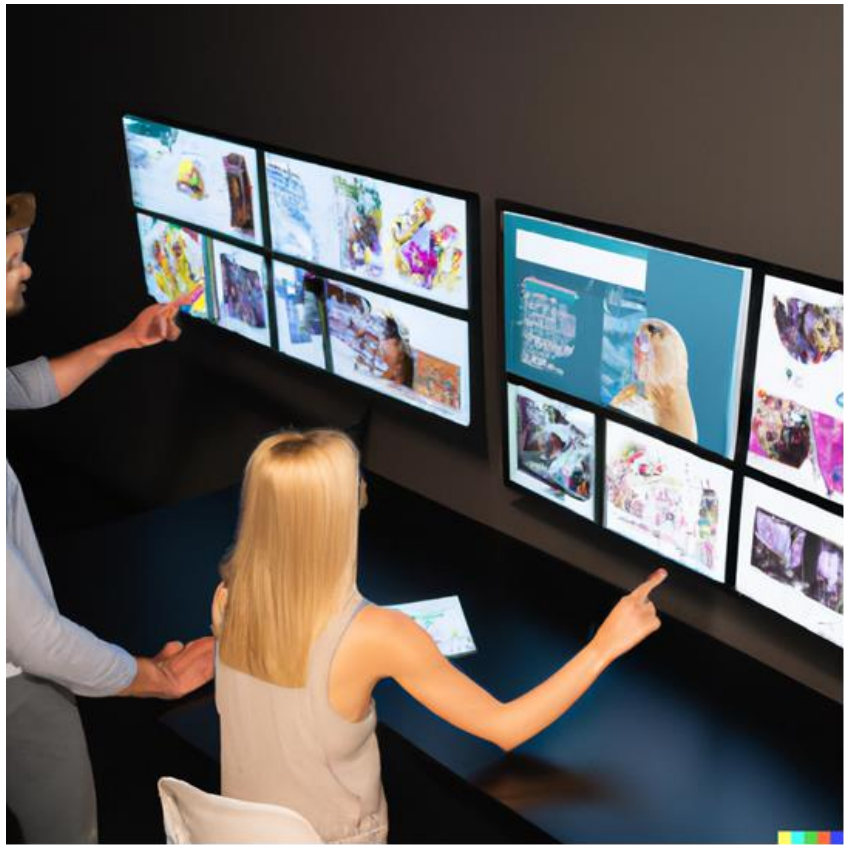


Lines of Effort

1. Advance the Engineering Practice
2. Connect & Strengthen the Technical Community
3. Develop the Workforce
4. Advance and Manage Standards
5. Provide Independent Engineering Assessments
6. Provide Systems of Systems (SoS) Architectures Guidance

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



Used with Dall E 3/9/3023

Outcomes

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

DEM&S Portfolio to Achieve the Vision

AIAA DEIC

FFRDC Studies

Draft DoDI.US - DE

SERC/AIRC

M&S Strategy

ModSim BoK

SISO

Testing & MBSE

Community of Practice

NDAA FY 2020- 230/231 Congressional response

Standards

Update DE Strategy

OMG

Mission Engineering Ecosystem

FED DEF

Workforce development

INCOSE

DODI 5000.61 VV&A

DEBoK

DE Tool Criteria

MBE - FMECA

SysML v.2 Transition Guide

DAU Courseware Support

UAF 2.0

Hypersonic

IITSEC

ISO

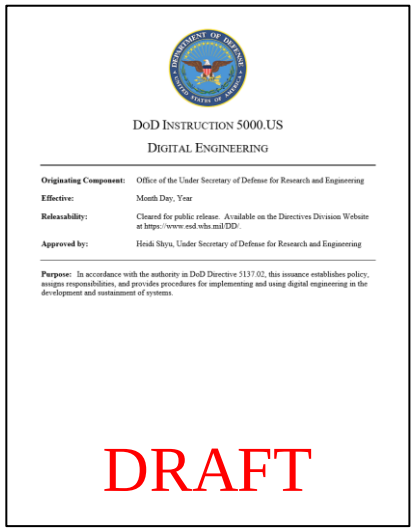
NDAA FY 2022- 117-118 Congressional response

SW & MBSE Alignment

Undergrad / Graduate Engagement

NDIA

DRAFT DoDI 5000.US: Digital Engineering


DoD Instruction 5000.US

Digital Engineering

Originating Component: Office of the Under Secretary of Defense for Research and Engineering

Effective: Month Day, Year

Releasability: Cleared for public release. Available on the Directives Division Website at https://www.esd.whs.mil/DD/.

Approved by: Heidi Shyu, Under Secretary of Defense for Research and Engineering

Purpose: In accordance with the authority in DoD Directive 5137.02, this issuance establishes policy, assigns responsibilities, and provides procedures for implementing and using digital engineering in the development and sustainment of systems.

DRAFT

First Draft
Jan 22

Second
Draft
Jun 22

Third Draft
to WHS
SEP 22

Fourth Draft
to OGC
OCT 22

Fifth Draft
Formal
Coord
NOV 22

Initiated
WHS Coord
JAN 23

Comments
WHS Coord
FEB 23

Pre-Signature
Coord
APR 23

Expected
Publication
April 2023

"3.4 IMPLEMENTATION OF DIGITAL ENGINEERING

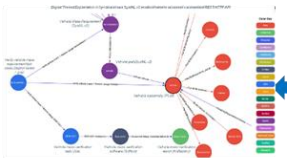
a. The PM is responsible for implementing digital engineering procedures as early in program planning as possible and across the system lifecycle.
   1) Major Capability Acquisition…
   2) Middle Tier of Acquisition …
   3) Software Acquisition…
   4) Defense Business System Acquisition…
   5) Urgent Capability Acquisition…
   6) Acquisition of Services…

b. The PM will identify digital models and artifacts as deliverables in the contract…

c. The PM will consider implementing the following key elements…

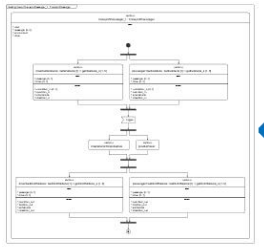
d. … PMs should consider using existing DoD digital engineering resource before investing in new digital engineering capabilities."

Systems Modeling Language (SysML) v2 Transition Guide



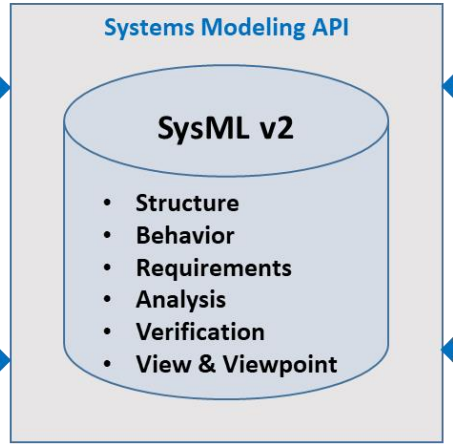
PLM/Version Mgmt

Source: Syndeia with SysML v2



Graph Visualization

Source: Tom Sawyer with SysML v2

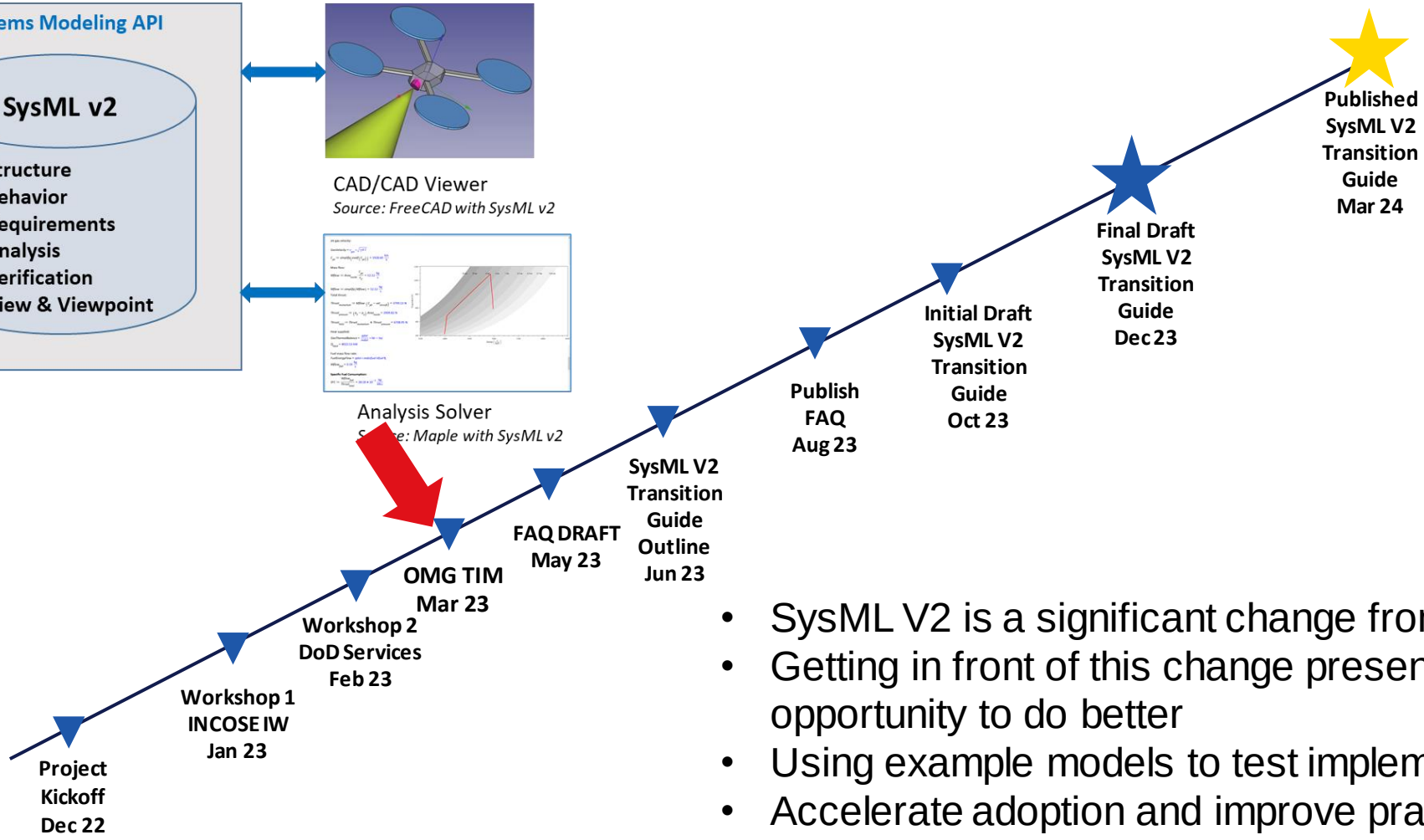


CAD/CAD Viewer

Source: FreeCAD with SysML v2

Analysis Solver

Source: Maple with SysML v2



- SysML V2 is a significant change from SysML V1
- Getting in front of this change presents an opportunity to do better
- Using example models to test implementation
- Accelerate adoption and improve practice consistency when v2 releases

Digital Engineering Body of Knowledge

DEBoK

Digital Engineering Body of Knowledge

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

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

Full Operating Capability **Dec 2022**

Conduct DEM&S CoP **Feb 2023**

Complete DTIC content Migration **Mar 2023**

Conduct Governance Board **Mar 2023**

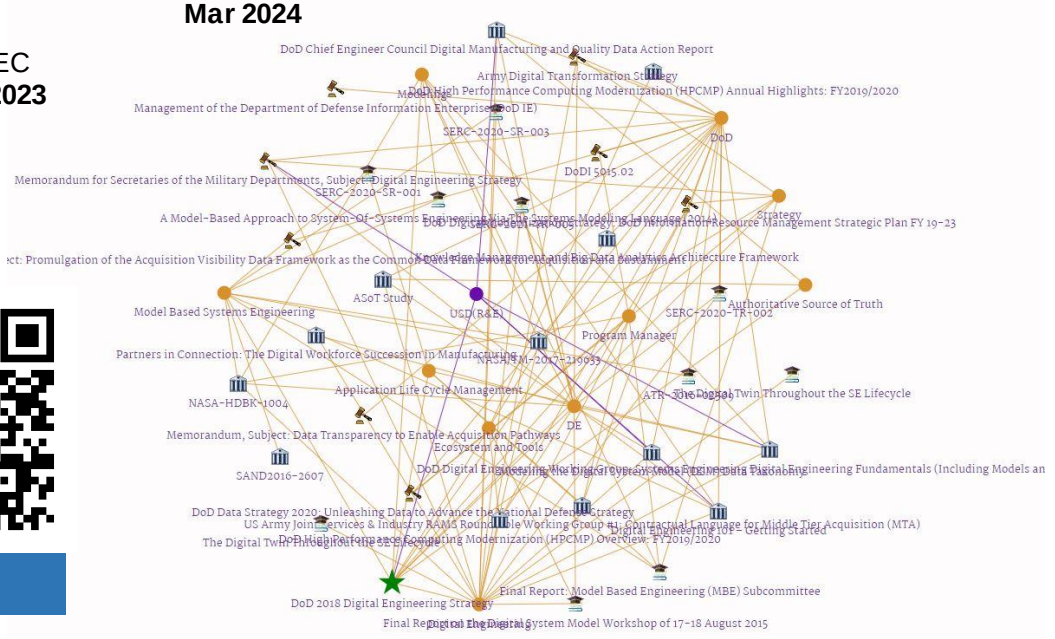
Continue Business practice development **Apr 2023**

IITSEC **Nov 2023**

CUI Baseline **Mar 2024**

SIPR Baseline **Jun 2024**

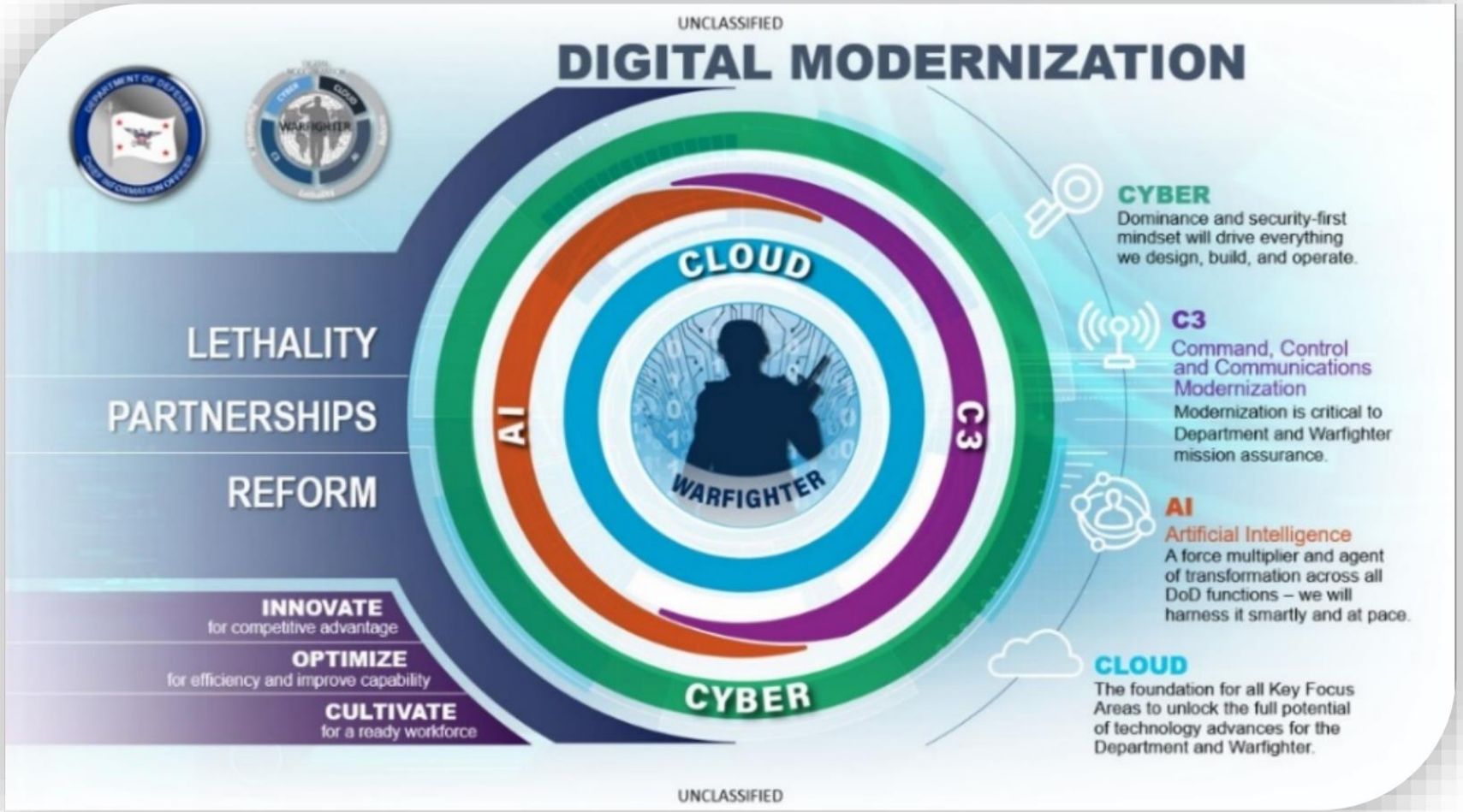
Classified capability **Sept 2024**



https://de-bok.org/

Continuous Capability Maturity | **Continuous Content Curation** | **Continuous Outreach Activities**

CIO Digital Modernization



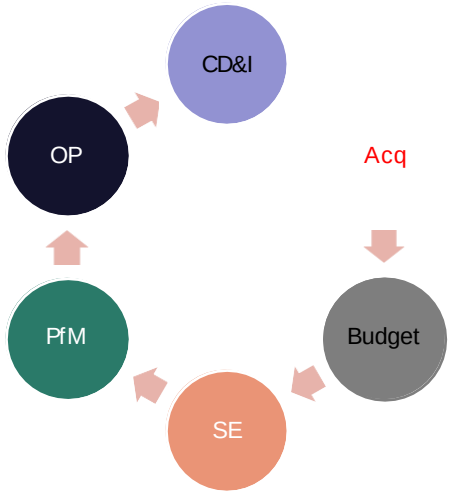
General Successes and Shortcomings

Successes

- AF familiarity is near ubiquitous
- Planned for used in many processes:

• Capabilities integration and development
• Acquisition
• Interoperability assessment and certification
• IT standards
• Systems engineering
• Portfolio management
• Defensible budget
• Operations planning

- Concept of Integrated architecture appreciated:
  - Vertically
  - Horizontally



Shortcomings

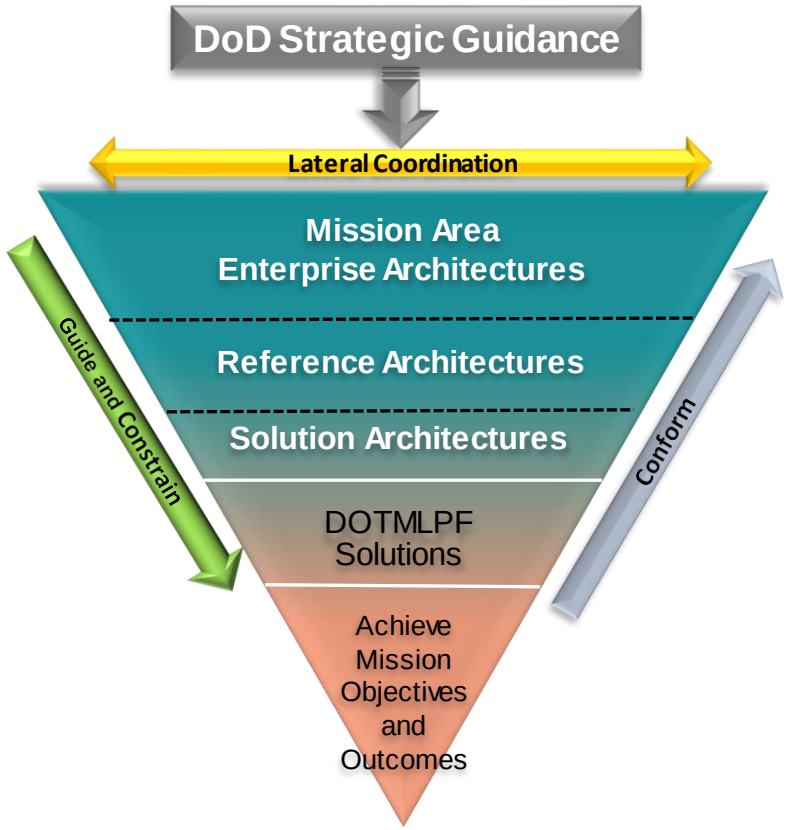
- Architecting is often a checkbox drill
- Use in processes has issues:

• Yes, but slow paperwork drill
• Use is not rigorous, some pathways do not use
• Slow, manual
• Disconnected
• Often disconnected
• Attempting for IT PfM, CPM still TBD
• Didn't happen, too hard to integrate
• After initial push (CISA), fizzled out

- Integrated architecture has many mechanical issues
  - Vertical path is assertional, not provable
  - Horizontal has never been achievable, even on Joint Information Environment with a Joint Technical Synchronization Organization
- Not integrated into DevSecOps, not considered agile
- Not considered rigorous

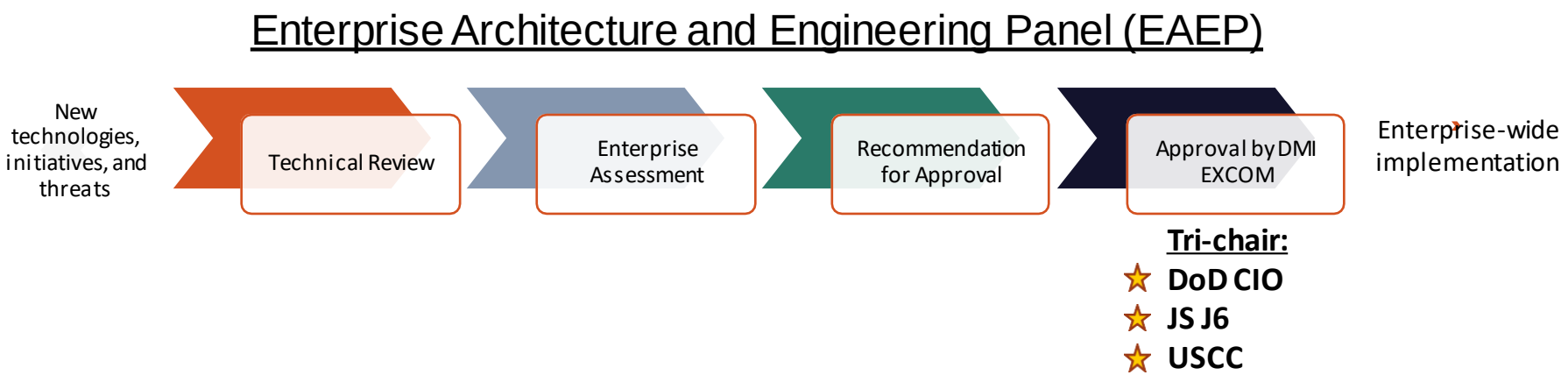
Sample Goals for New AF

- General:
  - Not just another update with more views
  - Support modernization, optimization, and integration
  - Dovetail with R&E's digital engineering / MBSE
  - Fit into DevSecOps
  - Enable simulation and analysis (MS&A)
- Specific:
  - No books, a digital model and a readme
  - Model accessibility for M&S and analytics such as ADVANA, Portfolio Management tools, …, simpler than XMI
  - Solve the Integrated architecture problem
  - Force/encourage Fit For Purpose (FFP)
  - Eliminate "the administrative burden of architectures"
  - Eliminate checkbox architecting
  - Break away from view-based template filling → Usage focus –
  - But still be accessible to operators/users, analysts, as well as systems and software engineers and usable by specialties, e.g.,
    - RMA
    - CS vulnerability
    - BPR
    - Workflow analysts
    - Capacity analysts



Orchestrating Development of New AF Across DoD

- After each OMG quarterly TC, DoD CIO rep reports back to EAEP
  - CIO reps from most DoD Components
- Collect requirements and feedback on our approach and progress
- Submit incremental drafts for formal comment (via DoD's tasking system)
- OMG adjudicate comments
- Upon final, EAEP recommends to one-star tri-chair (DoD CIO, JS J6, and USCC)
- Issue as guidance



Importance of UAF to OUSD (R&E)

Mission Engineering

Mission: Perform studies and analyses to seek answers to key technical challenges identified by the OSD, Joint Staff, Services, and Combatant Commands

Vision: Evaluate missions and assess efficacy of advanced technology from the modernization areas and to drive research, engineering and investment decisions.

Priorities: Support in R&E in developing:

- Solution Architectures
- Mission Maturation Roadmaps
- Technology Investment Decisions
- Requirement Settings

Joint Architectures for Capabilities & Systems (JACS)

Mission: Promote the fielding of systems of systems with speed, fidelity and adaptability to enable continual evolution of U.S. warfighting dominance.

Vision: Make R&E a partner-of-choice for system of systems in pursuit of warfighting dominance.

Priorities: Support R&E in:

- Leading enterprise SoS Architectures and Engineering
- Defining SoS Architecture delivery responsibilities and authorities
- Accelerating joint capability delivery through SoS Architectures
- Advancing Joint Warfighting Concepts through SoS Architectures

UAF is an key enabler to effective Mission Engineering and JACS

Steps to Migrate to UAF

1. Assessment of Policies / Guidance that mandate DoDAF views
2. Insert initial language to get ball rolling:
   "When permissible, the Unified Architecture Framework (UAF) profile may be used to generate DoDAF views per the mapping within the UAF specification."
3. Develop / coordinate training around the use of models in support of architecture
4. Update contractual language

Success Through Teamwork

- **Start** using models to support architecture
- **Share** lessons learned and best practices
- **Advance** the use of digital architecture to enable the digital thread

Contact Info

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https://ac.cto.mil/engineering