SYSTEMS ENGINEERING RESEARCH CENTER

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ADVANCING TECHNOLOGY AND STANDARDIZATION IN A DIGITAL WORLD

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SERC/AIRC UNIVERSITY NETWORK

AFIT Air Force Institute of Technology

Carnegie Mellon University

NPS Naval Postgraduate School

The George Washington University Washington, DC

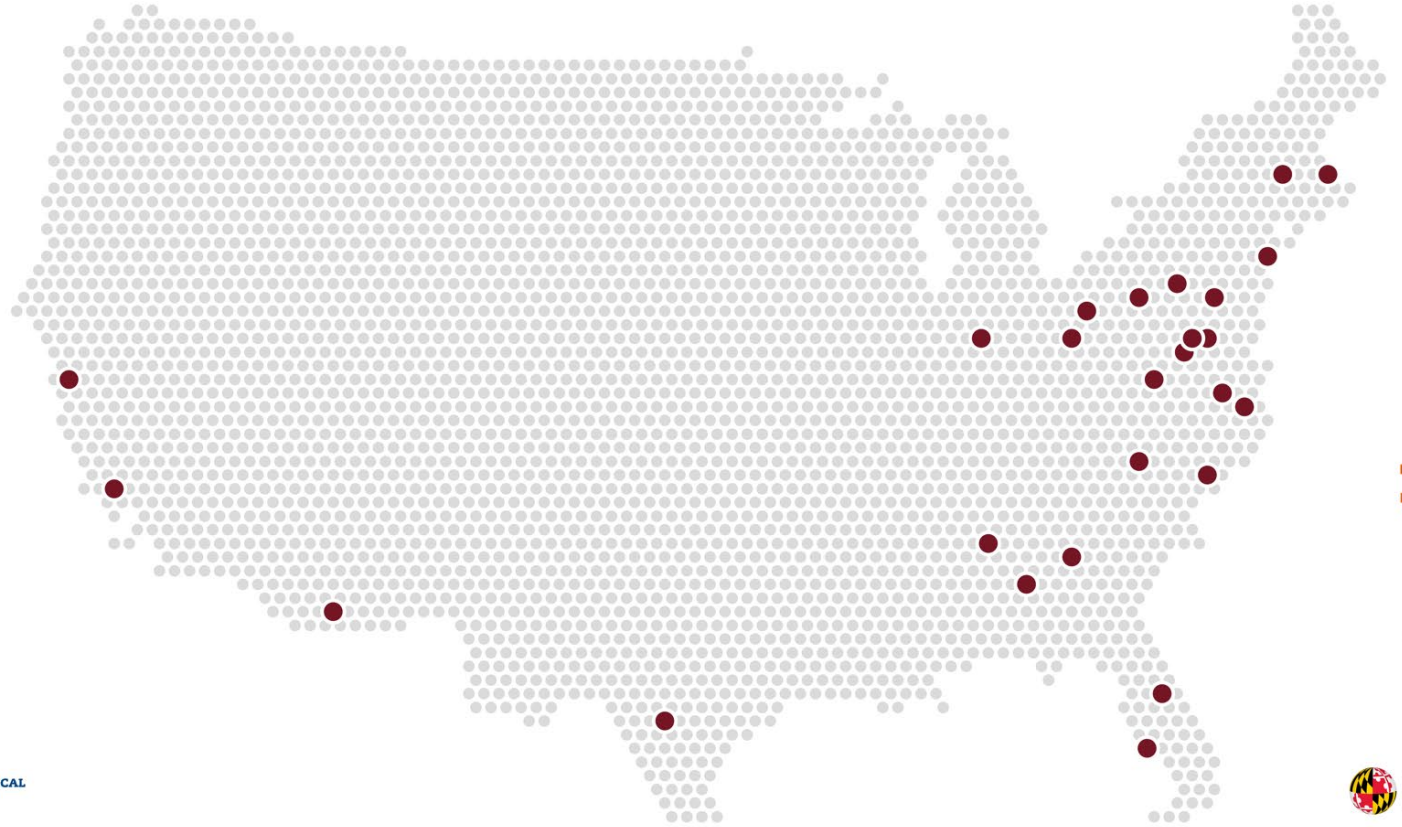
Georgetown University

Stevens Institute of Technology

PennState

The University of Arizona

University of Massachusetts Amherst



Massachusetts Institute of Technology

Old Dominion University

University of Virginia

USC

Virginia Tech

Purdue University

Auburn University

Georgia Tech

George Mason University

North Carolina Agricultural and Technical State University

University of Maryland

The Ohio State University

Texas A&M University

The University of Alabama in Huntsville

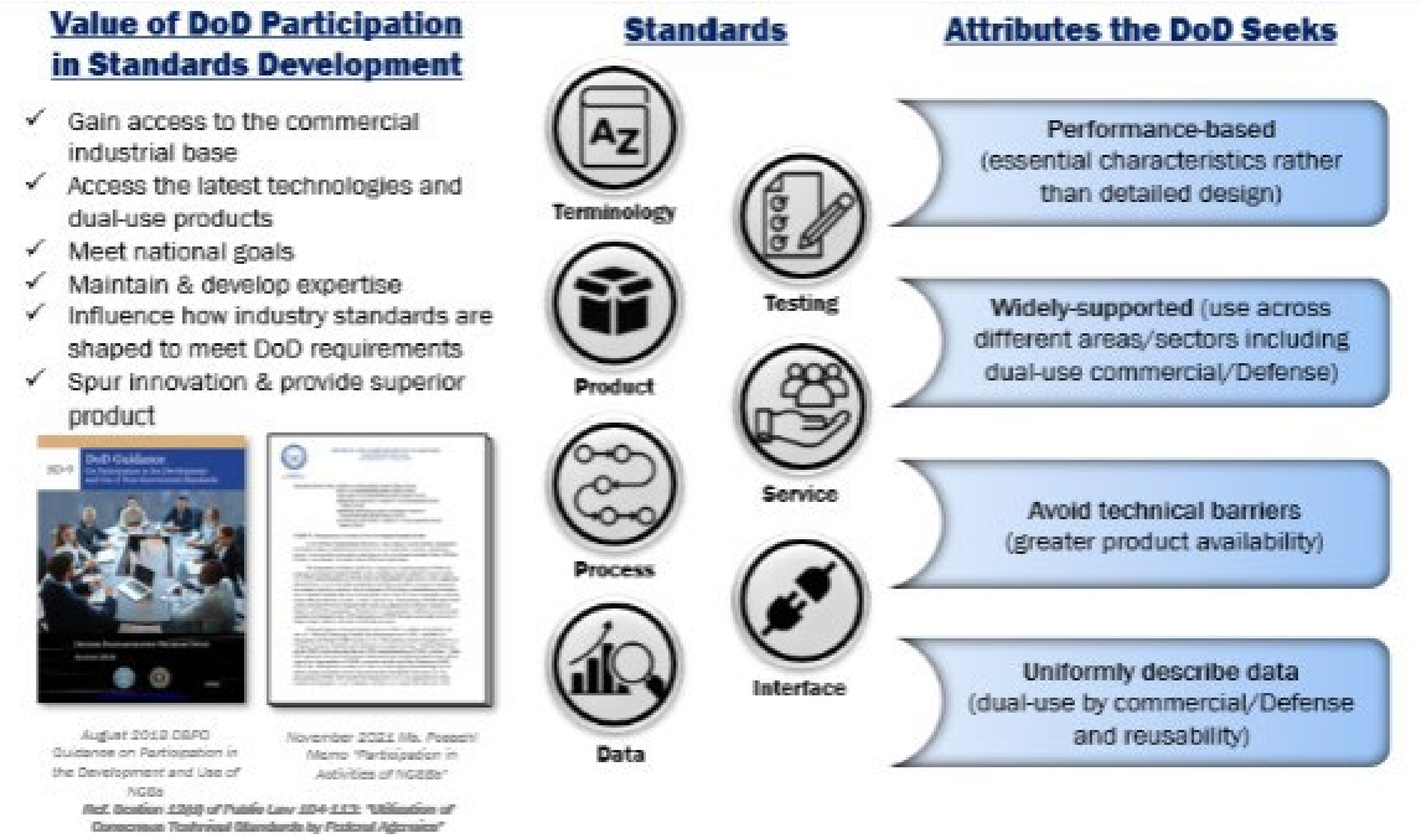
NC State University

UCF

University of South Florida

RECALL

- Be an active participant in standards development
- Resource, participate in, and apply standardization education
- Engage in the evolution of standards and standardization tools and practices
- <u>Select standards to achieve program goals</u>



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DIGITAL ENGINEERING TRANSFORMATION

Will change the way **Engineering** is done

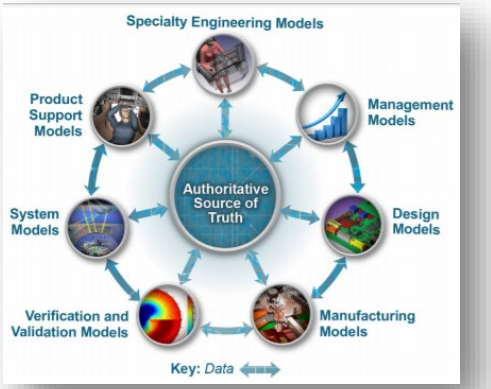
Systems engineering will lead the effort to **drive out unnecessary complexity** through well-founded architecting and deeper system understanding

A **virtual engineering environment** will incorporate modeling, simulation, and visualization to support all aspects of systems engineering by enabling improved prediction and analysis of complex emergent behaviors.

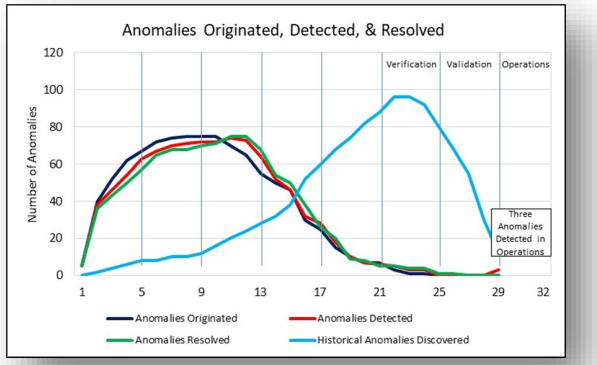
Composable design methods in a virtual environment **support rapid, agile and evolvable designs of families of products**. By combining formal models from a library of component, reference architecture, and other context models, different system alternatives can be quickly compared and probabilistically evaluated.

INCOSE SE Vision 2025/

Will change the way DoD **Acquisition** is done

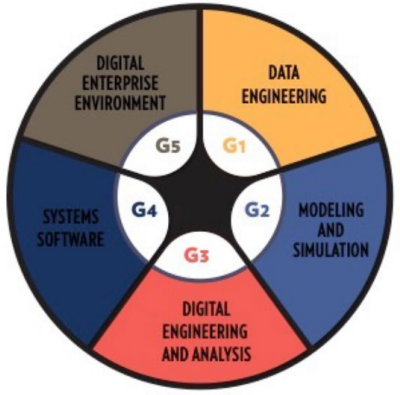


DoD Digital Eng. Strategy



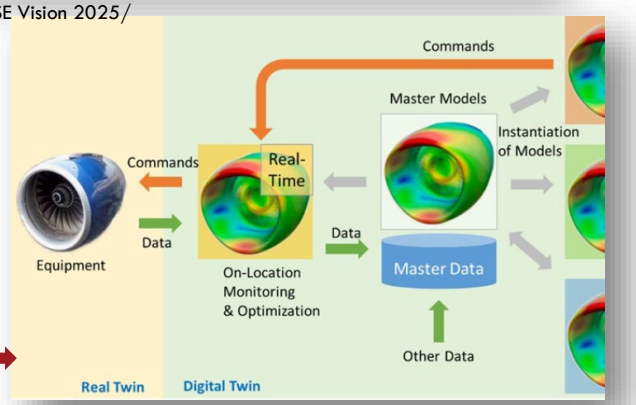
Will change the way we view **quality** and **agility**

Will change how we evaluate systems



Will change our **workforce**

Will change the way systems get **deployed**



Report: Industrial Internet Consortium: Digital Twins for Industrial Applications.

Standards to support data, data interoperability, as a start!

DIGITAL WORLD CHARACTERIZATION

Changing

Complex

Computational

Collaborative

Composable

Continuous

Convenient

Creative

Curatable

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 link digital models of the actual system with the physical system in the real world
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 across the lifecycle

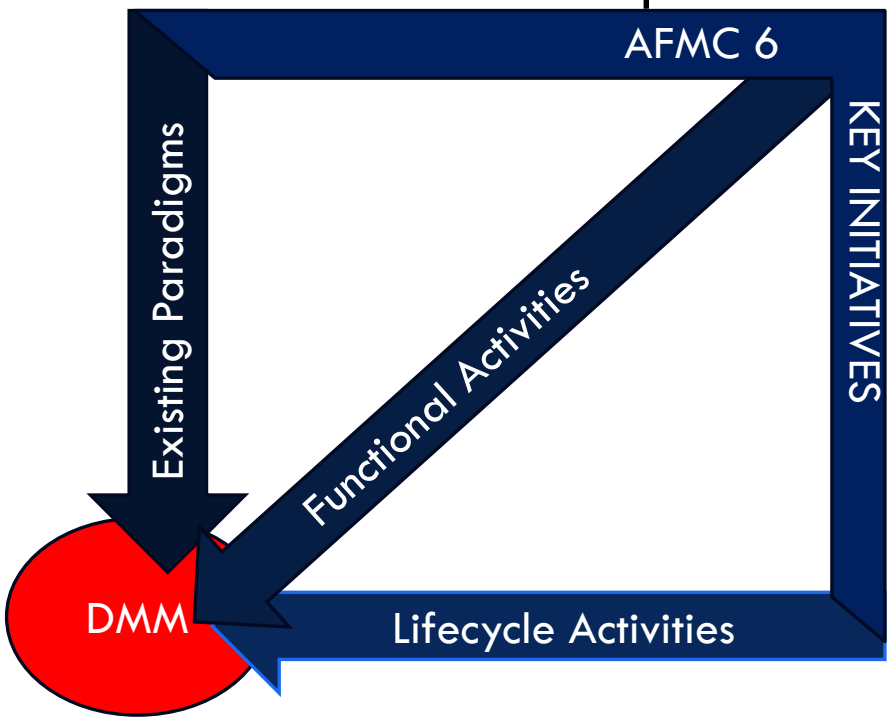
Standards to support data, data interoperability, as a start!

TODAY, TOMORROW, DAY-AFTER-TOMORROW

Expected Organizational and Process Changes:

- TODAY:
  - Each element could and does function independently (at a minimum)
- TOMORROW:
  - Digital enables each element to consider its impact on other elements – what it contributes
  - Digital enables each element to consider how it is impacted by other elements – what it needs
- DAY AFTER TOMORROW:
  - Inherently digital, each element functions independently, and synergistically, within a core infrastructure, on contextually relevant data within a continuum
  - Inherently digital, each element is no longer hampered by other elements functionality, infrastructure, or product delivery
  - Inherently digital, each element has current situational awareness of the context in which it is operating

As an Example



AFMC 6 Key Initiatives underpin DMM

1. Instill a Digital First Culture
2. Develop Digital Strategies
3. Structure and Secure our Data
4. Provide Access to DMM tools
5. Train our Digital Workforce
6. Modernize IT infrastructure

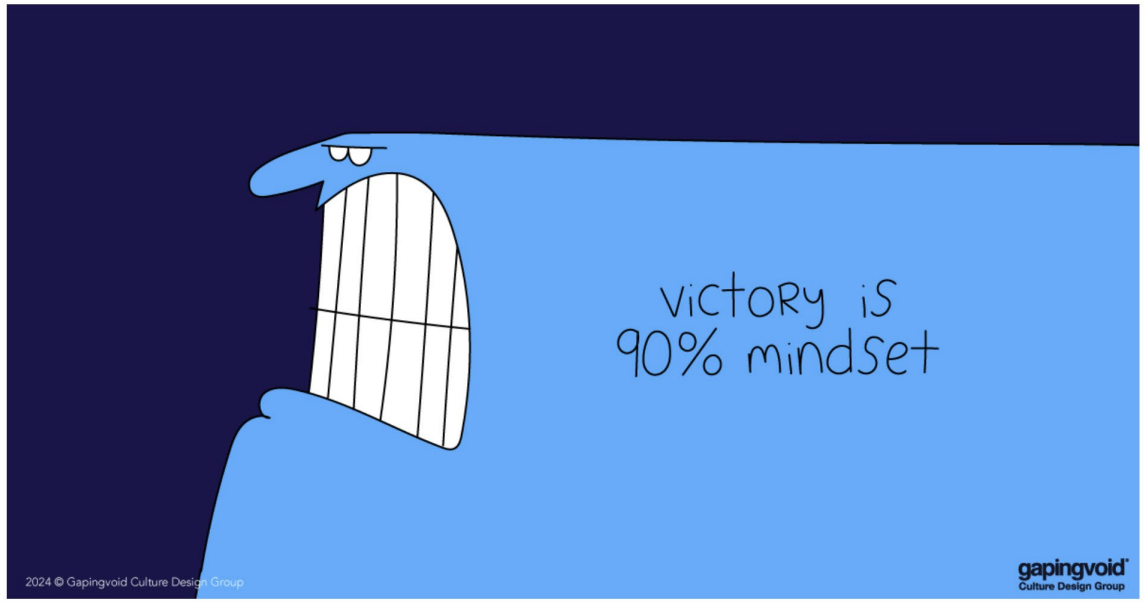
STANDARD USE, DEVELOPMENT AND MANAGEMENT

In a Digital World:

- Program Managers and personnel have sufficient technical knowledge of their (engineering) development programs to ensure program success by making informed, timely, and independent decisions to manage cost, schedule, and performance risk while ensuring disciplined program execution
- Fundamental …. is a shift from viewing systems (organizations) as sets of interrelated components to viewing them as a set of cause-and-effect relationships between components
- ….process of change in a system is a learning process. It begins with high levels of uncertainty and progresses toward an end state which results in a defined system structure and performance attributes which achieve the intended long-term goals
- All systems exist as part of a larger environment, and the behavior of systems will be influenced by the factors of the environment they are in. Such factors are decoupled from the system of interest but still influence its behaviors
- If a new technology (process/method) is adopted, it does not necessarily replace every instance of an old technology (process/method), and the installation may need the capability to maintain both new and legacy equipment for an extended period

PARTICIPATE IN APPLYING THE DIGITAL WORLD

The Clues to Success



"We live in an expected world…..pay attention more to the process of what we're doing"

gapingvoid.com

- **AIAA Digital Engineering Integration Committee (DEIC): engage.AIAA.org**
- **DAF Digital Transformation Office: DAFDTO.com**
- **DE BoK: de-bok.org**
- **DEM&S CoP: cto.mil/sea**
- **INCOSE Digital Engineering Information Exchange: INCOSE.org**
- **NDIA SE Division, Emerging Tech Institute: NDIA.org**
- **Object Management Group: OMG.org**
- **SERC/AIRC: SERCUARC.org**
- **…..et al**

QUESTIONS?

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