USD(R&E)

2025 Virtual Federal Digital Engineering Forum (FED DEF) Measures of Success WG

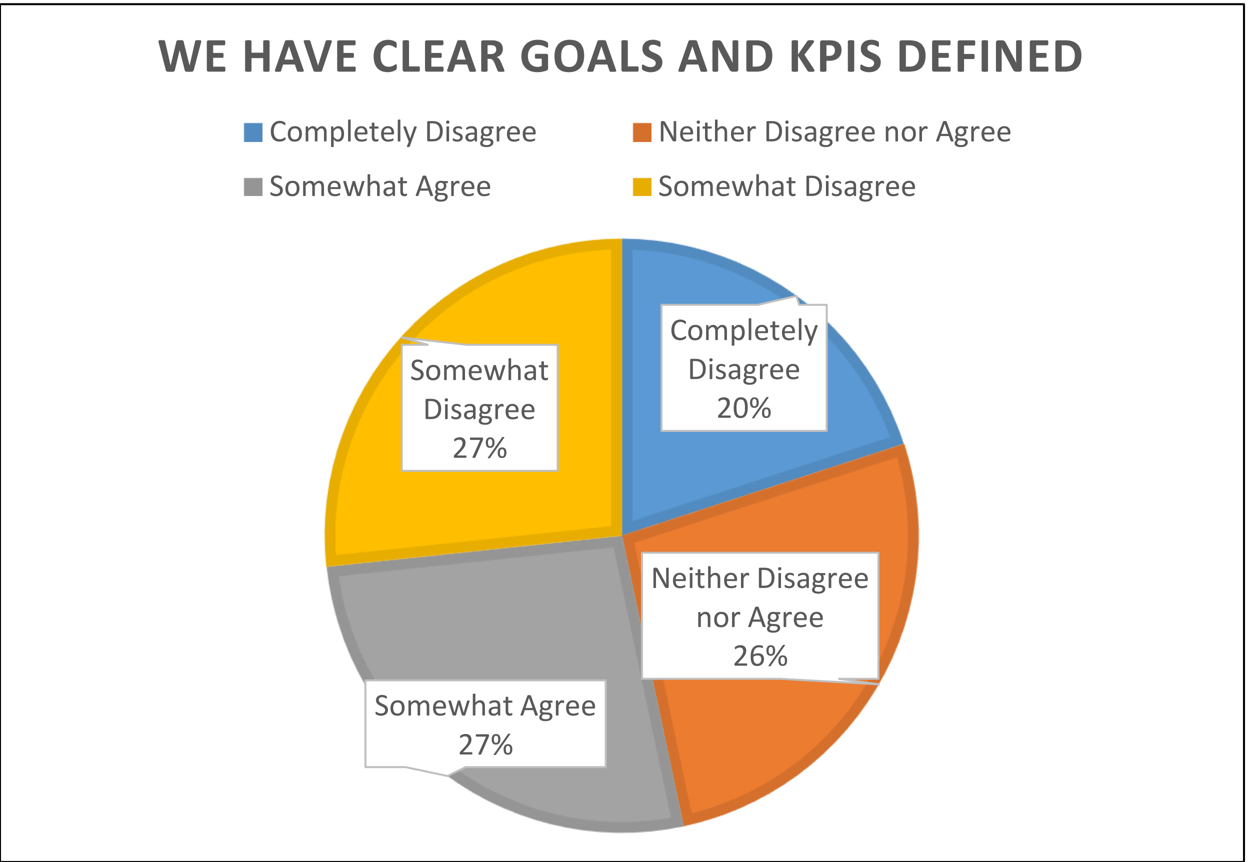
July 2025

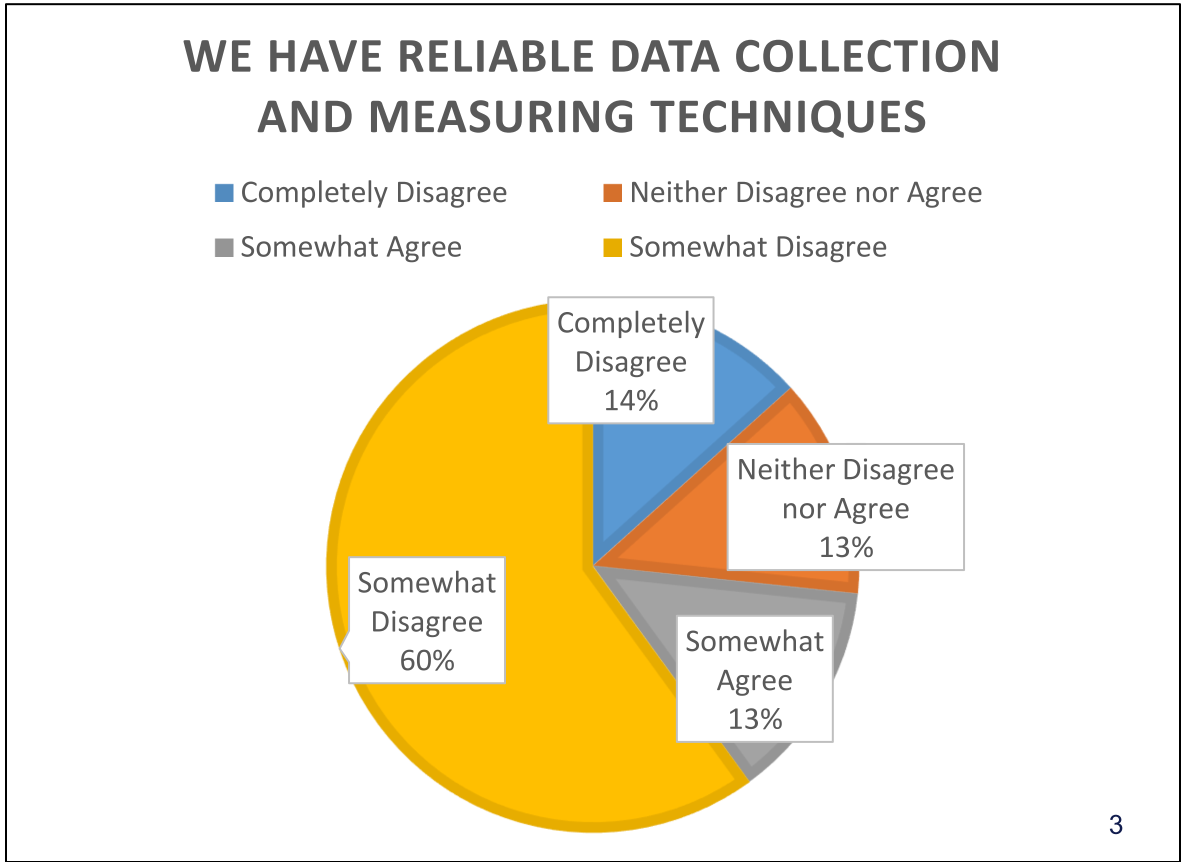
Agenda

- Overview of Survey Results
- DoD Measures of Success (Frank Salvatore)
- Examples of Success Stories
  - MIT LL Measures of Success (Stephanie Sposato)
  - SSC Measures of Success (Marilee Wheaton)
  - Army’s generalized lessons learned (Owen Eslinger)
  - NAWCWD China Lake visualization data dashboards (Wendy Chang)
  - SERC’s Measuring success of DE implementation (Stephanie Chiesi)
- PSM v2 DE Measurement Framework (Sal Bruno)
- Questions/Discussion

How does your organization define DE Success?

- MoS WG conducted quick-turn survey to pulse the DE community on how their organizations are measuring success
  - 15 respondents: 5 DoD, 6 Other Fed Agency, 4 Industry/Academia
- Only 27% of respondents agree that their organization has clearly defined DE goals.
- Only 13% of respondents agree that their organization has reliable data collection and measuring techniques.





How does your organization define DE Success?

	Theme	Description
1	**Implementation and Integration**	Successful DE involves readiness for integration and collaborative transition.
2	**Model-Based and Data-Centric Approaches**	Emphasis on model-based and data-centric processes.
3	**Decision Making and Issue Discovery**	Enhanced decision-making and early issue discovery are critical indicators
4	**Adoption and Usage**	Success is linked to widespread adoption and proper usage of DE tools and concepts.
5	**Efficiency and Continuous Processes**	Efficient data-driven decision-making and continuous processes are valued.

Challenges in DE Adoption

- Difficult to define DE success
- Still in early stages; difficult to assess progress
- Continuing to work on shifting culture
- Combatting resistance to change
- Challenging the traditional approach is uncomfortable

How is your organization or project measuring DE success?

Tracking quality and quantity of responses to engineering questions

Using dashboards for visualization

- ✓ China Lake data dashboards

Tracking number of people using digital tools; number of licenses

- ✓ MIT Growth in Utilization

Bringing real data into reviews and discussions

- ✓ Army's lessons learned

Moving toward model-based technical reviews

- ✓ Army's lessons learned
- ✓ SSC Measures

Increased development of Digital Twins & Threads

- ✓ MIT Growth in Digital Thread

Many respondents communicated that their project or organization is still too early in their DE journey to truly assess success.

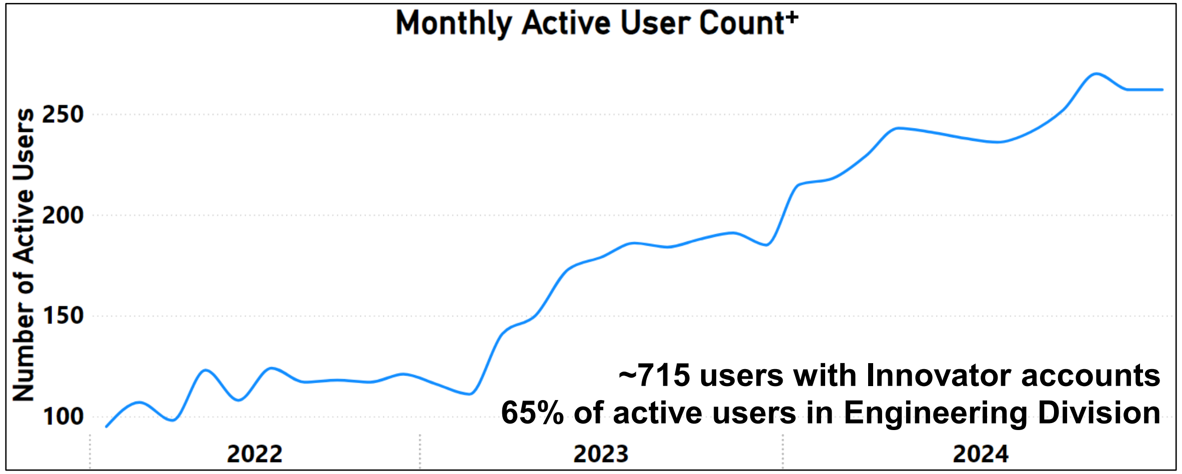
DoD Measures of Success

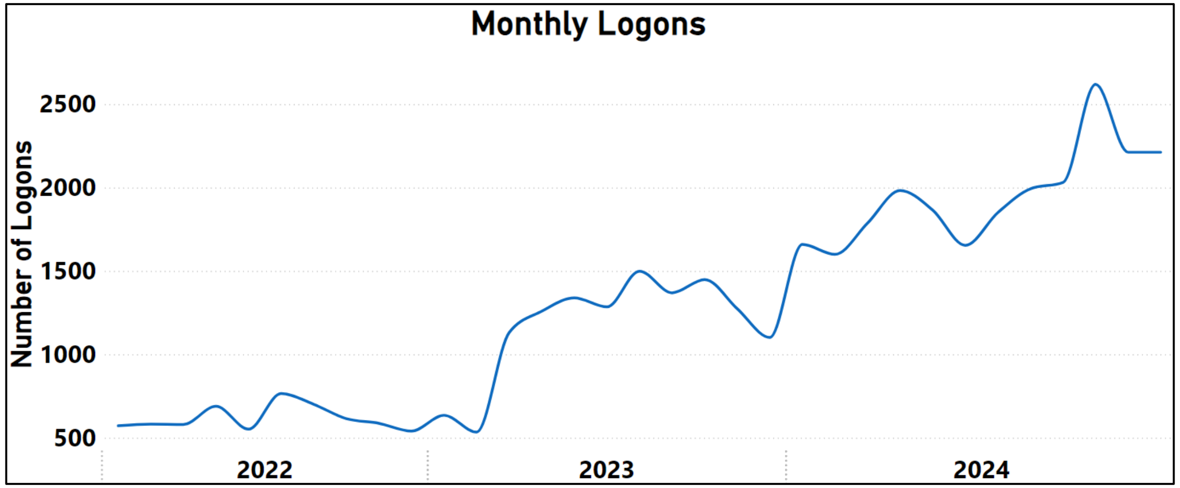
	Design	Development	Sustainment Enterprises
Time Savings	• 10x reduction in workload and problem setup for modeling tasks. • 10x-20x time saved in design evaluation. • 10x risk reduction in designs evaluated. • Reduced inconsistencies accelerated artifact development time from 120 workdays to 30 workdays. • Reduced technical review preparation time from 120 workdays to 30 workdays. • 6-month reduction in time to System Requirements Review. • > 60-day reduction in time to Preliminary Design Review.	• Provisioning: 3 years reduced to 1 day. • Months to weeks prep time for acquisition reviews. • Months saved in virtual validation of assembly and MX. • ~1 year saved in design qualification. • Problem resolution times improved 4x. • Reduced change request development time by 90%.	• Reduced ECR response time by 75%. • ~60% reduction in sustainment engineering response time.
Cost Savings	• Savings of $2.5M to $3M. • Increased life equal $25M reduced costs and up to $185M in savings. • Up to $50M cost savings on a given project. • 20 % reduction in manpower. • 75 % reduction in computational costs.	• Reduced life cycle costs on the order of $5-10B. • Saved $50M in flight-test and evaluation. • Auto check part dimensions cost saving of $125K per year across.	• $409M savings due to improved safety factor. • Repair of components annual cost savings of $1.93M, and $180M savings over 5 years. • Issues solved with digital engineering at fleet; savings of $1.75M per day. • $3M/year cost savings to sustain production.
Improved Quality	• Able to evaluate >10 variations for improved design optimization. • Reduced >100 inconsistencies. • increased life by 4x-10x.	• 10x reduction in audit errors.	• Increased safety factor by 25%. • A/C downtime reduced to 700 hours.

Table derived from Department of Defense Assessment and Support for Establishing Digital Engineering Centers of Excellence (DE COE) , Report to Congressional Defense Committees in Response to House Report 118-125, page 76, accompanying the National Defense Authorization Act for Fiscal Year 2024 (H.R. 2670), December 2023

Examples of Growth in Utilization
Laboratory-Wide

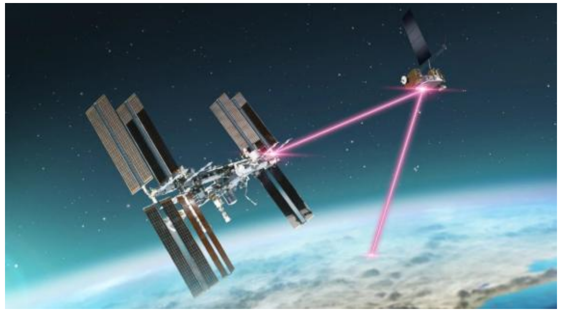
Laboratory Wide Utilization



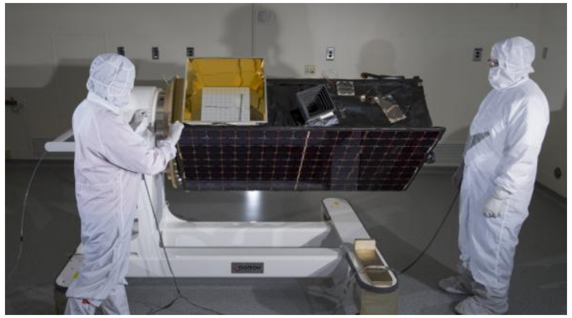


4X increase in users and log-ons over last three years

Complex Prototyping Program Utilization



ILLUMA-T Optical Communications



ORS-5 Sensor-Sat

- **Complex systems, aggressive performance targets, and faster design cycles driving digital approach**
- **Digital engineering benefits - streamlined data management, collaboration, efficient execution, and early risk reduction**

Example Complex Program			
	Team Members	**Active Users**	**Percentage**
Lab-wide	70	42	60%
Engineering	38 (54%)	26	68%

Refining initiatives and actions to grow complex program utilization

+Active User: Logged-on at least once a month

Growth in Digital Thread

Increase in Innovator functionality use and Digital Thread connecting Design to Fabrication to Simulation*

Program Level	Mechanical Parts	Cable Parts	Electronic Parts	ECNs	CATs	Build Plans	Documents	FSRs	Physical Parts	Inspection Reports	Deviations	Simulations
1	>100%	>100%	>100%	>100%	25-100%	>100%	>100%	>100%	>100%	>100%	>100%	25-100%
2	25-100%	>25%	>100%	N/A	>100%	>100%	>100%	>25%	>25%	>25%	>25%	N/A
3	>100%	>100%	>100%	N/A	>100%	>100%	>100%	>100%	>100%	25-100%	>100%	25-100%
4	>100%	>100%	25-100%	N/A	25-100%	25-100%	25-100%	25-100%	25-100%	>100%	25-100%	N/A
5	>100%	25-100%	25-100%	N/A	N/A	N/A	>25%	25-100%	>25%	N/A	25-100%	N/A

N/A	>25%	25-100%	>100%

*Compared to Jan 2023

- **11,000 parts procured or fabricated through 1400 FSRs with 2600 inspection reports**
  - **Connects unit engineer to planner to technician to inspector**
  - **All part data linked in one location**
  - **Reduces time to get needed information from days to minutes**

Example Digital Thread

- LENS Assembly
  - Lens
    - CAD
    - ECN
    - Fabrication Request
      - Physical Part
  - Assess Thermal Performance at CDR
    - Design Environments
    - Thermal Model
      - Thermal Margins Results

Achievements and Next Steps

What did we achieve?

✓Established a Standard to guide govt/contractor MBSE development

✓Built MBSE models that prescribe design documentation

✓Demonstrated document generation from MBSE model (TEMP, SRD, STP, ICD)

✓Collaborated with industry to achieve acceptance and understanding of MBSE vision

✓Proved that industry has capability and interest to respond to proposal with digital model products

✓Demonstrated industry can leverage MBSE products developed on other programs to communicate technical solution

✓Proved proposal evaluators can better understand solution maturity and mission alignment using MBSE approach

✓Proved standardized digital products enable evaluation equivalence across proposals

✓Set program execution up for success by having mature MBSE solution models on Day 1

What we plan to achieve:

❑Maximize prescription of design documentation to streamline solution evaluation and enable continuous reviews

❑Continue to push forward and improve digital products (Digital Thread, Digital Twin, LLM)

❑Collaborate with SSIO and peer programs to help them leverage our digital baseline

❑Collaborate with down and up stream customers and partners on how they will benefit from this approach

❑Demonstrate MOSA-based digital acquisition lowers price of entry into new mission areas and helps non-incumbents gain equivalency

"The MBSE effort leap-frogged the program by 6 months to a year. The MBSE approach enabled program start at ~preliminary design review or beyond maturity by performing requirements traceability, interface definitions, and operations concept at proposal!"

DE has provided greater insight into vendor designs, leading to improved milestone reviews

DATA | ENGINEERING | SOFTWARE

Technical Challenges:

- **Model Size & Performance:** Large models can lead to significant loading time issues during reviews (e.g., PDR). The preferred review tool for descriptive models, Cameo Collaborator, has proven difficult to implement for some programs. However, most have reported great success.

Benefits of Model-Based Reviews:

- **Enhanced Design Review:** Pathfinders found that utilizing models during reviews enabled more effective assessment of overall design quality using fundamental systems engineering principles.
- **Iterative Review Process:** The iterative nature of model-based reviews, while potentially extending the overall review period, was viewed positively, leading to a more comprehensive understanding of the system.

Adjusting to a Model-Based Approach:

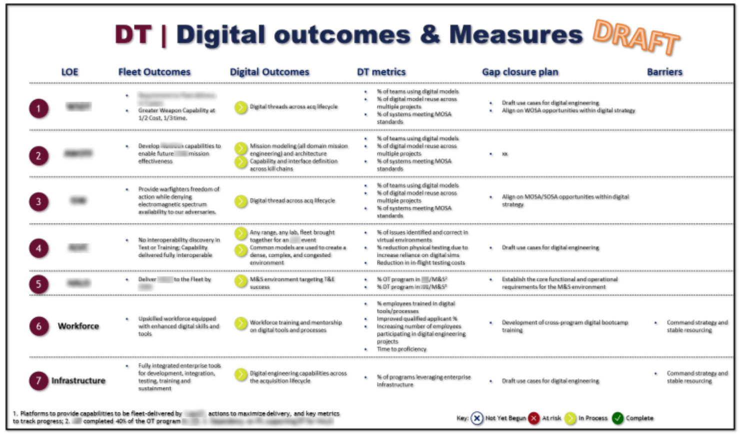
- **Time Allocation:** Model-based reviews require additional time and effort due to the increased depth and complexity of information.
- **Patience and Adjustment:** Adopting an MBSE-driven review process requires patience and a willingness to adjust traditional timelines and expectations.

Leveraging MBSE for Improved Outcomes:

- **Enhanced Data Accessibility:** MBSE provides reviewers with easier access to a greater volume of information, enabling more in-depth analysis and understanding.
- **Qualitative Assessment Tools:** Leverage MBSE tools specifically designed for qualitative assessment of vendor architectures, leading to more informed decisions.

NAWCWD Digital Engineering Metrics Dashboard

"You can't improve what you don't measure."



LIFT PORTAL

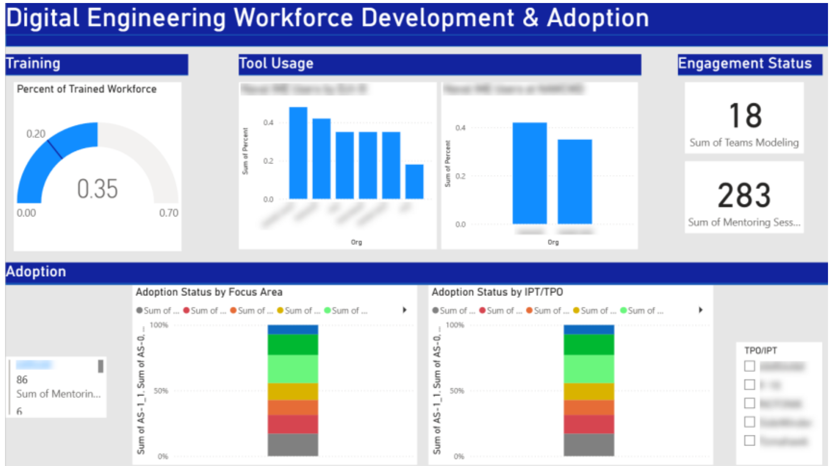
ATLASSIAN

Jira

Waypoints

Confluence

Forms



Initiate

Action: Identify digital outcomes and measures tied to strategic goals.

Outcomes: Four enterprise categories identified. One selected for implementation.

Lessons Learned: Engage your stakeholders early. Identify a champion. Keep them engaged and informed.

Implement

Action: Identify data sources for metrics.

Outcomes: Transforming data sources is a significant bulk of the work effort.

Lessons Learned: Data governance requires collaboration.

Improve

Action: Iterate on the dashboard

Outcomes: Dashboard shared with leadership. Feedback provided. Continue prototyping on the dashboard.

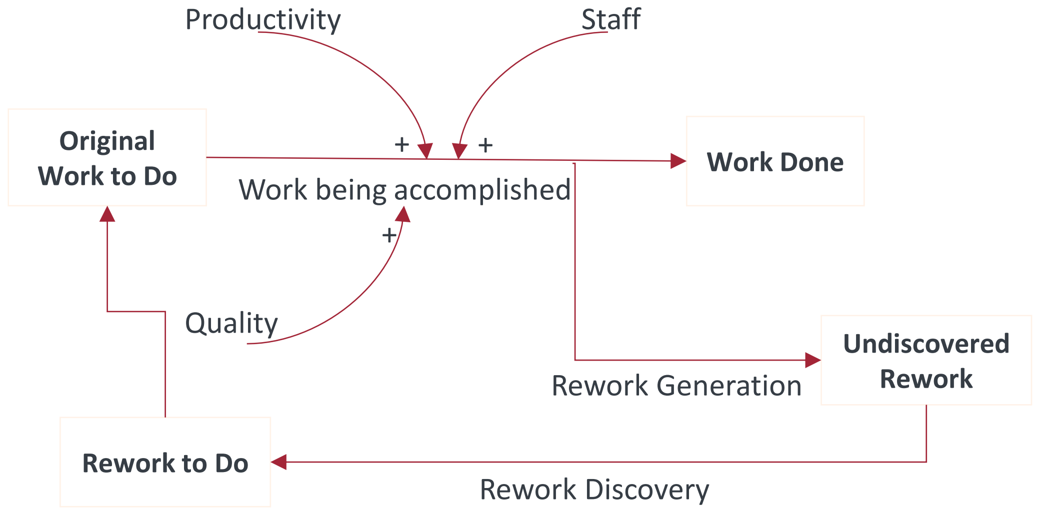
Lessons Learned: Continue communication and engagement with stakeholders. Embrace the red. Keep moving forward.

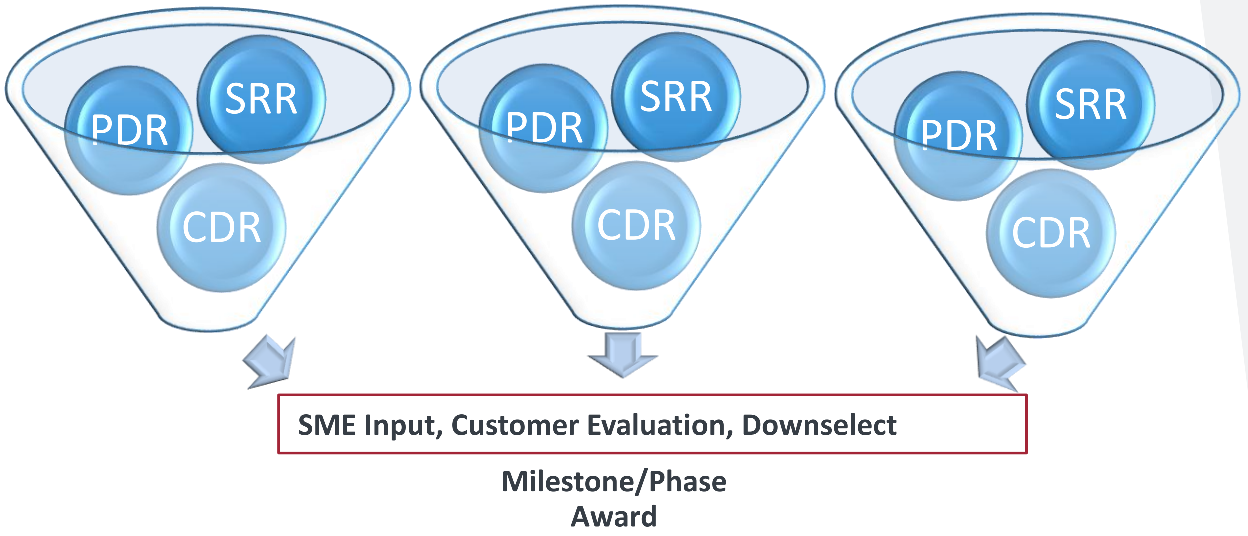
How do we measure success with Digital Engineering?

Reduced Cycle Time- But what defines reduction in cycle time? What cycle?

- DE Implementation Current Trends
  - Automated tasks work within design cycles
  - Reduce human touch time and human entry errors
  - Do not replace human decision-making
  - Does change how humans use the data to make decisions

- Lifecycle progression decision needs
  - May control more of the cycle development time and speed to capability delivery
  - Large human decision-making involvement
  - Decisions often by those who did not perform the design cycles
    - Outputs of DE and design cycles used to make decisions





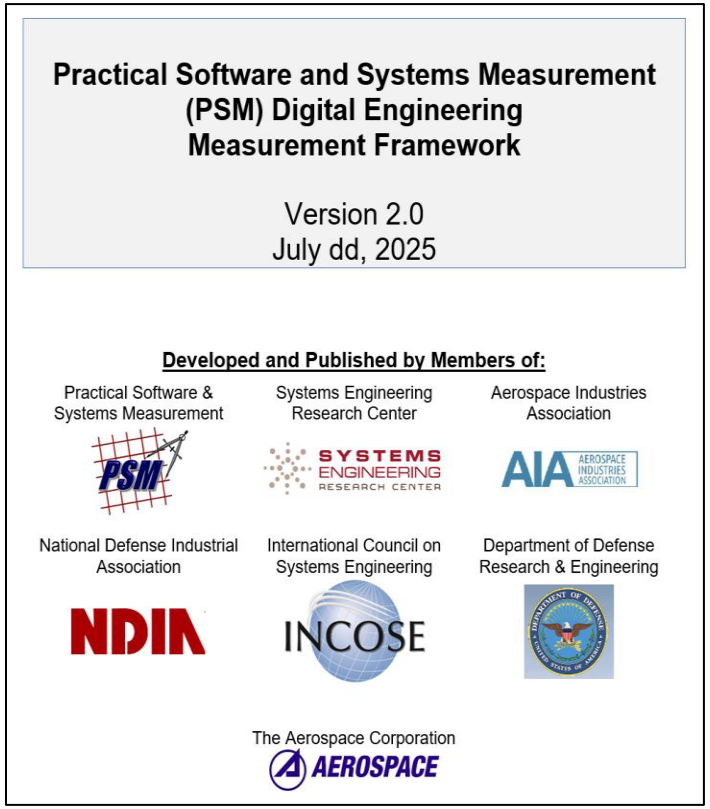
Digital Engineering Measurement Framework Changes


Practical Software and Systems Measurement (PSM) Digital Engineering Measurement Framework

Version 1.1
June 21, 2022

Developed and Published by Members of:

Practical Software & Systems Measurement
Systems Engineering Research Center
Aerospace Industries Association
National Defense Industrial Association
International Council on Systems Engineering
Department of Defense Research & Engineering
The Aerospace Corporation


Practical Software and Systems Measurement (PSM) Digital Engineering Measurement Framework

Version 2.0
July dd, 2025

Developed and Published by Members of:

Practical Software & Systems Measurement
Systems Engineering Research Center
Aerospace Industries Association
National Defense Industrial Association
International Council on Systems Engineering
Department of Defense Research & Engineering
The Aerospace Corporation

Initial Measures

- Functional Architecture Completeness and Volatility
- Model Traceability
- Model Product Size
- Digital Engineering Anomalies
- Adaptability and Rework
- Digital Engineering Automation
- Deployment Lead Time
- Runtime Performance

New and Update Measures

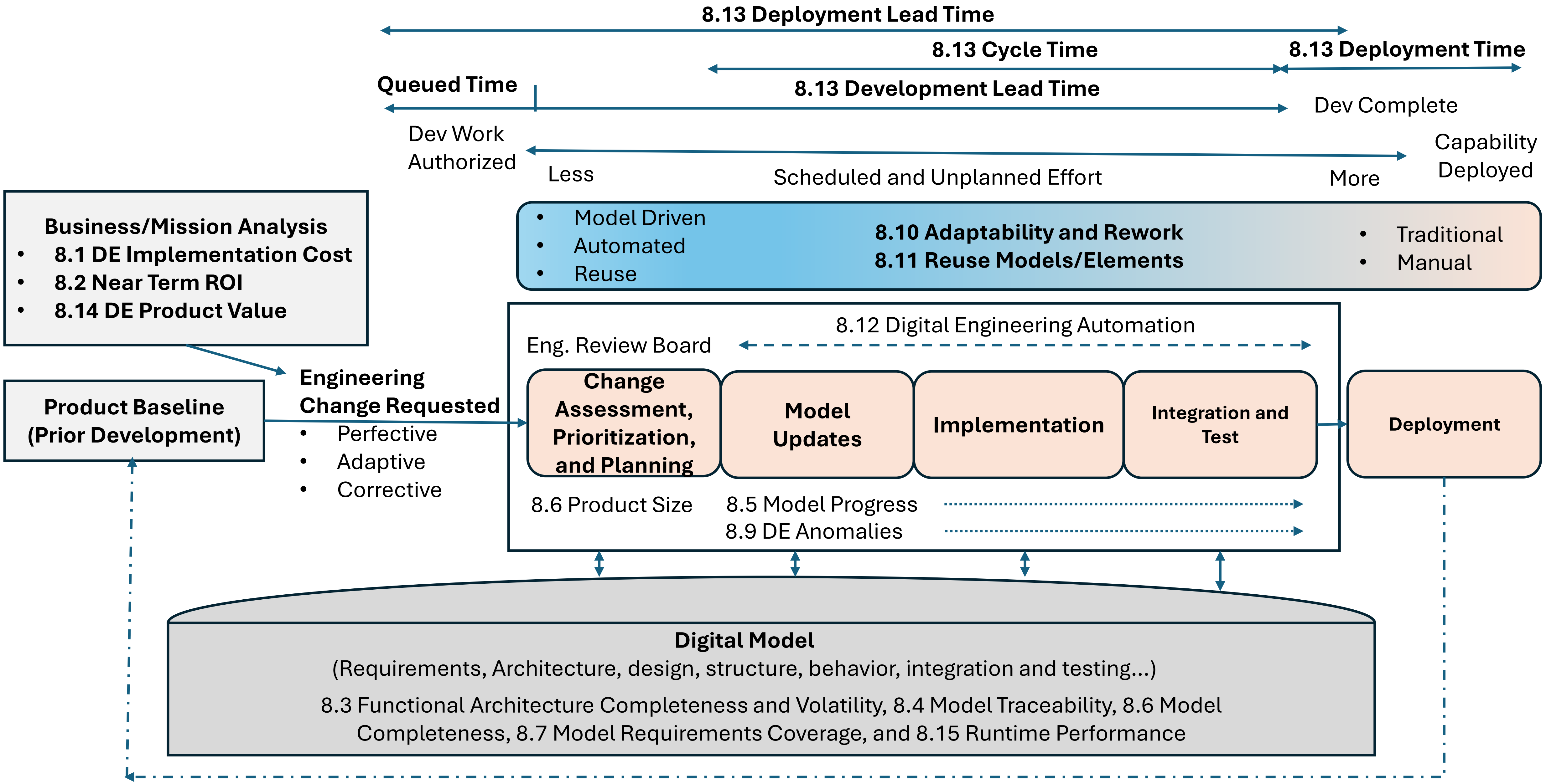
- Digital Engineering Implementation Cost
- Near-Term ROI
- Functional Architecture Completeness and Volatility
- Model Traceability
- Model Progress
- Model Completeness
- Model Requirements Coverage

New and Update Measures

- Model Product Size
- Digital Engineering Anomalies
- Adaptability and Rework
- Reused Models and Elements
- Digital Engineering Automation
- Deployment Lead Time
- Digital Engineering Product Value
- Runtime Performance

https://www.psmsc.com/DEMeasurement.asp

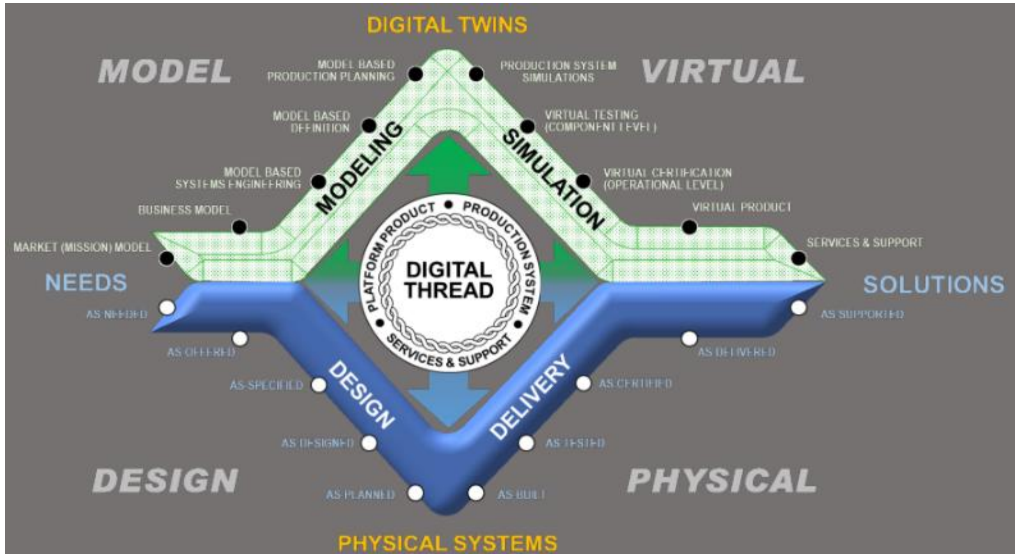
Digital Engineering Measurement Framework – 2.0



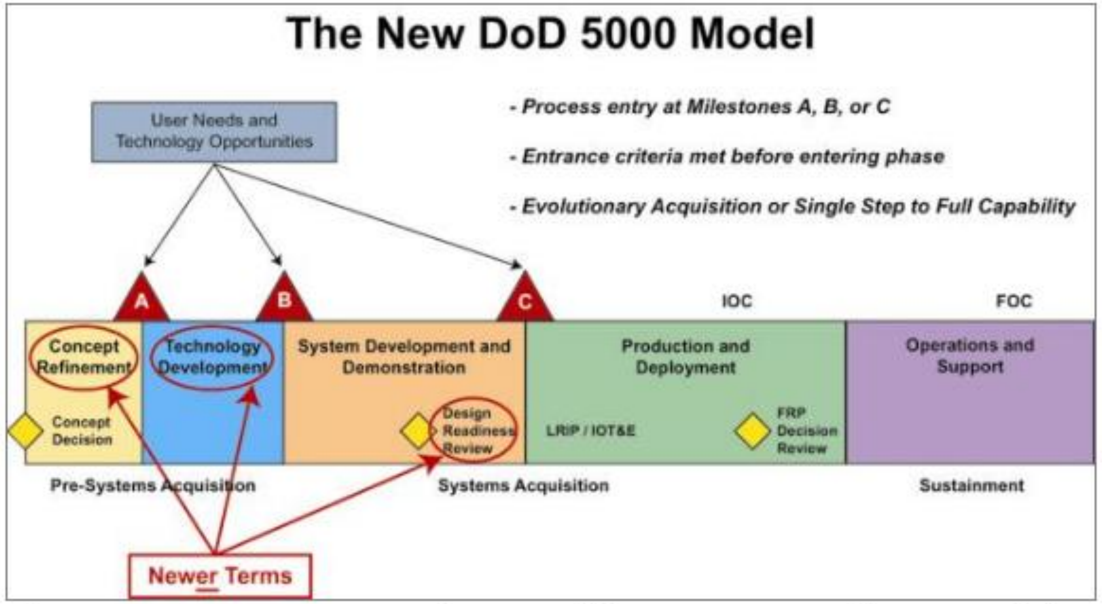
Questions

Digital Engineering Impact on Decision-Making

- Automated tasks within a lifecycle phase may not address enough time savings to realize faster capability delivery
- Lifecycle progression decision needs
  - May control more of the cycle development time and speed to capability delivery
  - Large human decision-making involvement
  - Decisions often by those who did not perform the design cycles
    - Outputs of DE and design cycles used to make decisions
- What is the human decision-making speed and accuracy impact of this automation and the DE Ecosystem?
  - Changes the impact of data on the decision
  - Changes the role of risk and trust in data usage
  - Changes the impact of domain knowledge in decisions



INCOSE: https://www.incose.org/docs/default-source/midwest-gateway/events/incose-mg_2018-11-13_scheurer_presentation.pdf



https://www.inflectra.com/Ideas/Whitepaper/Systems-Development-with-DOD-5000.aspx