Mission Engineering, Capability Evaluation & Digital Engineering Informing DoD Technology, Prototyping and Acquisition Decisions

Mr. Christopher Collins
Director, Developmental Test Evaluation & Assessment
Office of the Deputy Director for Engineering
Office of the Under Secretary of Defense for Research and Engineering

Dr. Suzanne Beers
Department Manager, Defense Systems Engineering & DTE&A IDSK/EF Initiative Champion
The MITRE Corporation

National Defense Industrial Association Systems and Mission Engineering Conference
December 2021

Purpose & Concept Overview

Purpose: **Apply Integrated Decision Support Key - Evaluation Framework (IDSK-EF) post Mission Engineering (ME) to evaluate capabilities and inform concept, S&T, P&E, PoR, CPM, and operational fielding decision-making**

Concept: **Mission Engineering study identifies/validates mission capability gaps and proposed technology solutions. IDSK-EF frames capability evaluation to inform decision-making throughout the concept-to-fielding continuum:**

- **Science & Technology (S&T) develops technical solutions**
  - **IDSK-EF evaluates technical capabilities; informs investment and maturity decisions**
- **Prototyping & Experimentation (P&E) operationalizes technical solutions**
  - **IDSK-EF evaluates prototype performance; informs transition decisions**
- **Acquisition Programs of Record (PoR) develop, acquire operational capability**
  - **IDSK-EF evaluates technical and operational capabilities; informs acquisition decisions**
- **Capability Portfolio Management (CPM) manages fielding of capability portfolios**
  - **IDSK-EF evaluates SoS performance; inform capability portfolio management decisions**

Mission Engineering and Continuous Evaluation Inform S&T-P&E-POR-CPM Decisions

ME: Study validates operational capability gaps; evaluates efficacy; proposes technology solutions

IDSK-EF: Tailors capability evaluation for decision-support throughout the S&T – P&E – POR – CPM continuum

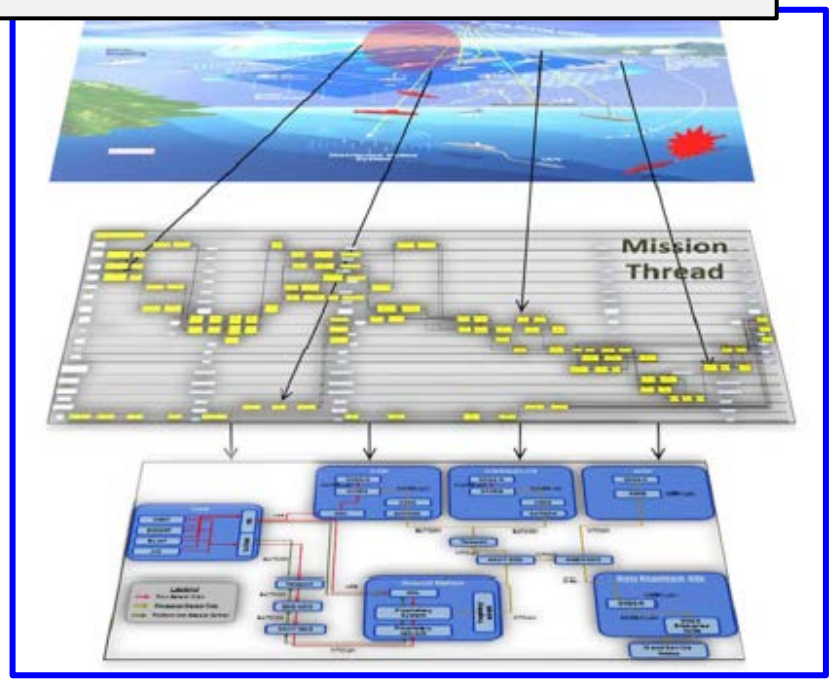
- S&T: develops technology solutions
  - S&T-focused IDSK/EF informs tech investment and maturation decisions
- P&E: operationalizes advanced concepts and technologies
  - P&E-focused IDSK/EF informs transition from S&T to PoR
- PoR and CPM: deliver integrated capabilities meeting Warfighter requirements at speed of need
  - PoR or CPM IDSK/EF informs program or portfolio decisions

IDSK: Integrated Decision Support Key
EF: Evaluation Framework
S&T: Science and Technology

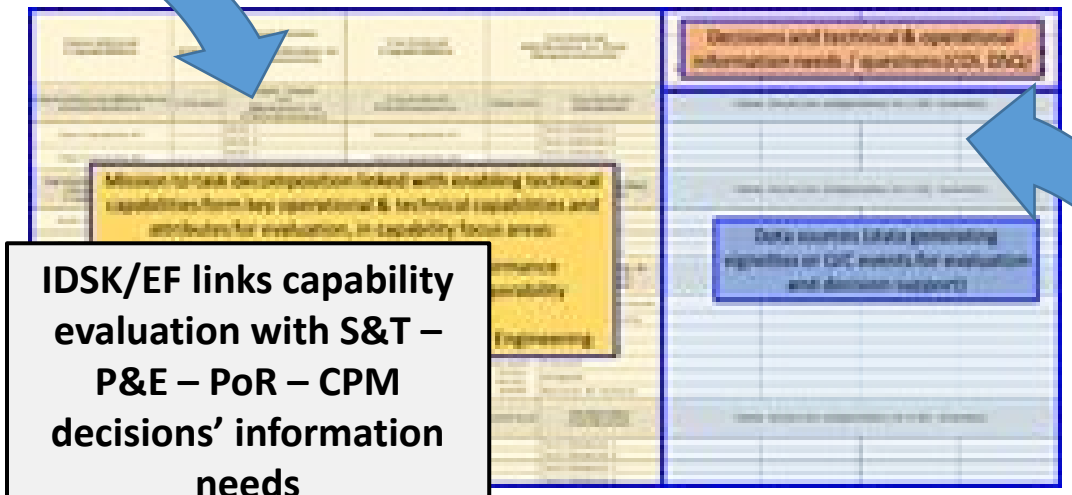
P&E: Prototyping & Experimentation
PoR: Program of Record
CPM: Capability Portfolio Management

Mission Engineering – IDSK-EF – Digital Engineering Vision

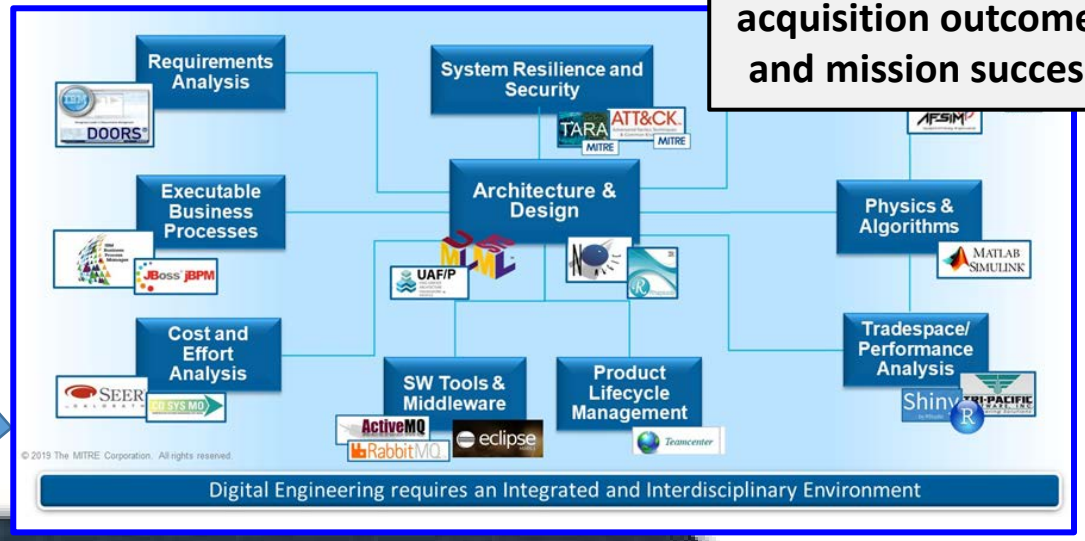
ME study defines operational architecture to mission thread (MT) to mission engineering thread (MET) – validates warfighter-identified operational capability gaps, proposes optimal technical solutions, identifies evaluation measures of effectiveness



IDSK/EF links capability evaluation with S&T – P&E – PoR – CPM decisions' information needs



DE manages data complexity and relationships; provides the analytical evaluation engine; feeds back evaluation results to inform decisions, improving mission-focused technology development, acquisition outcomes and mission success

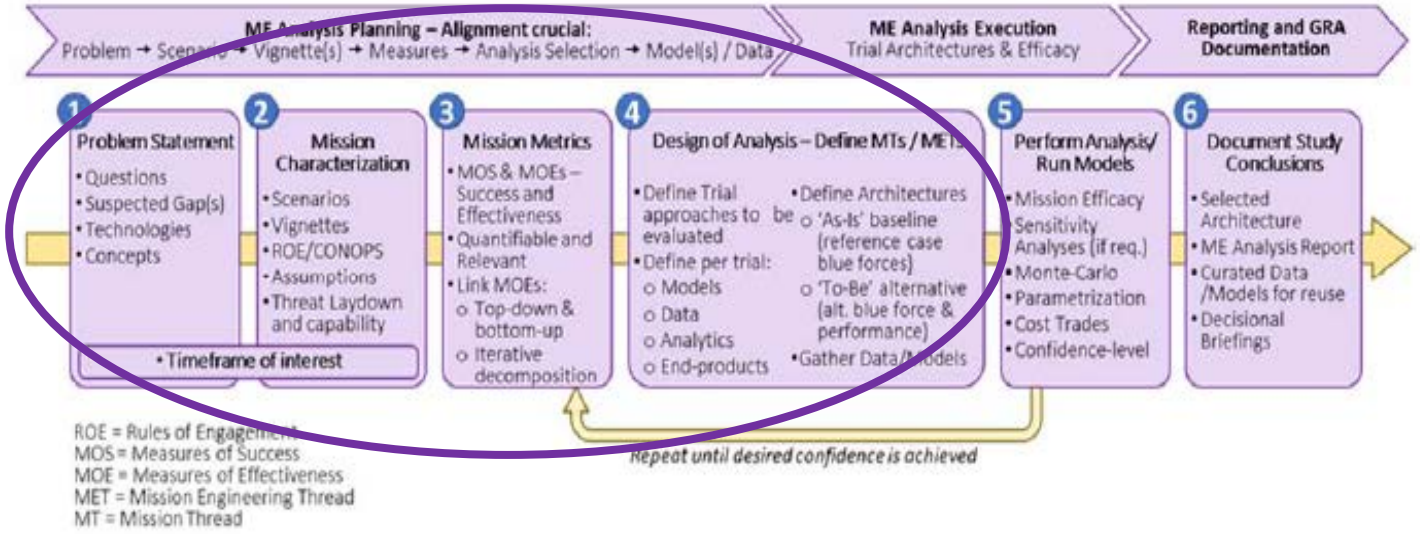


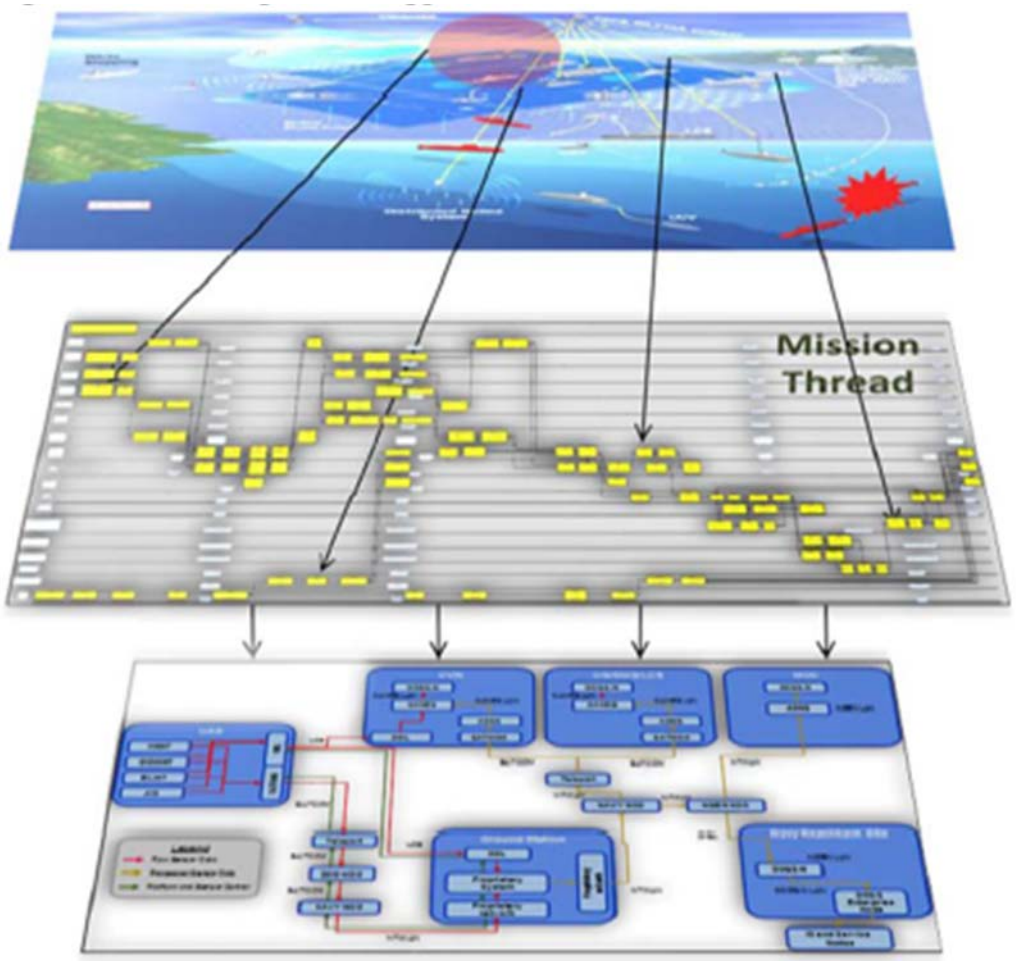
MT: Mission Thread
MET: Mission Engineering Thread

IDSK: Integrated Decision Support Key
EF: Evaluation Framework

Mission Engineering Links Mission Gaps with Technical Solutions

ME process defines problem statement, characterizes mission, defines operational and engineering metrics

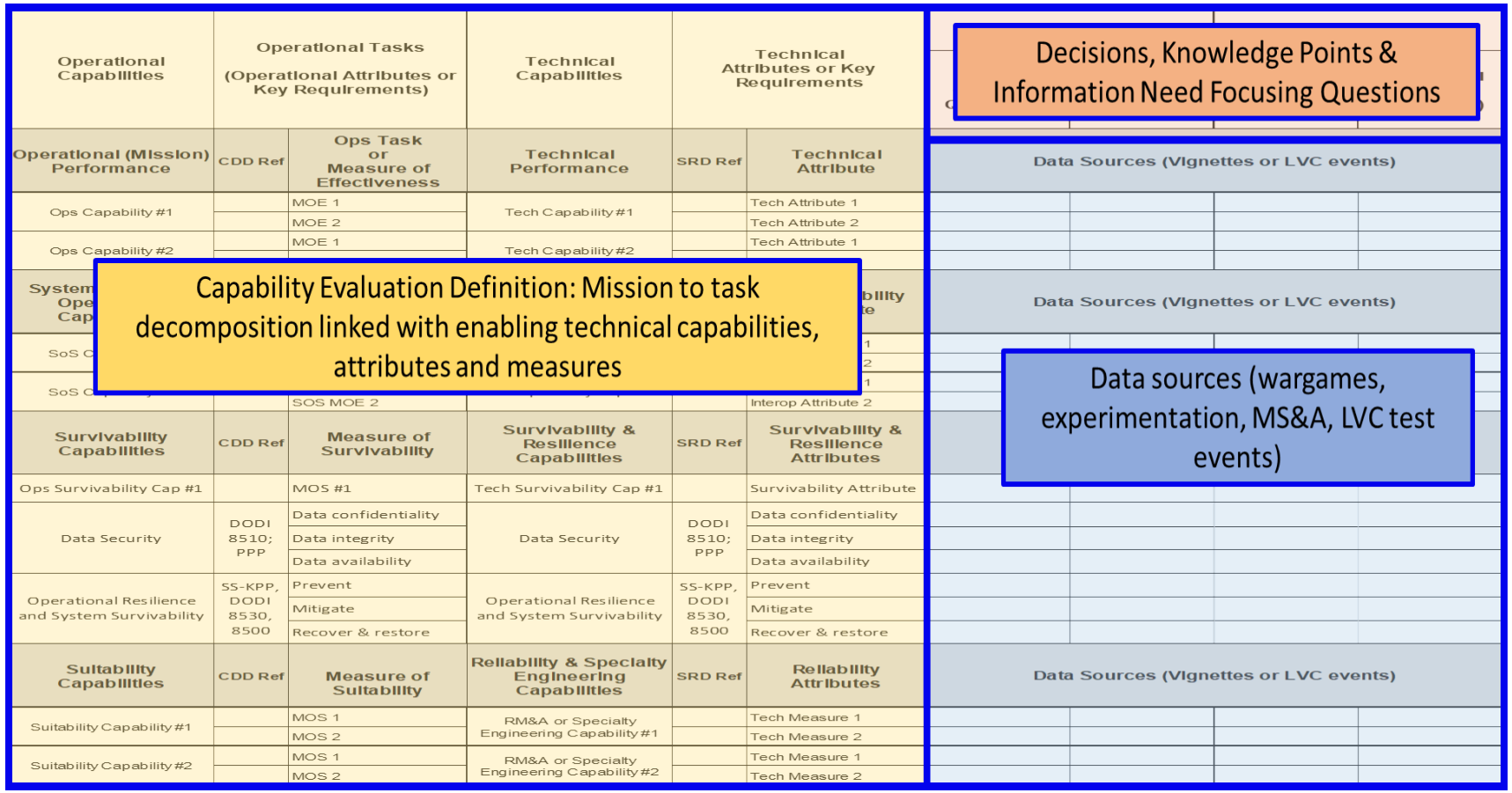




- ***Mission architecture defines the operations, systems, and data flow within the constraints of the scenario***
- ***"As-Is" mission approach represents current mission execution, provides a reference for analysis and evaluation***
- ***Variable changes (i.e., technologies, systems, performance, tactics, etc.) lead to alternate technical solutions and mission approaches – the "To-Be" for evaluation***

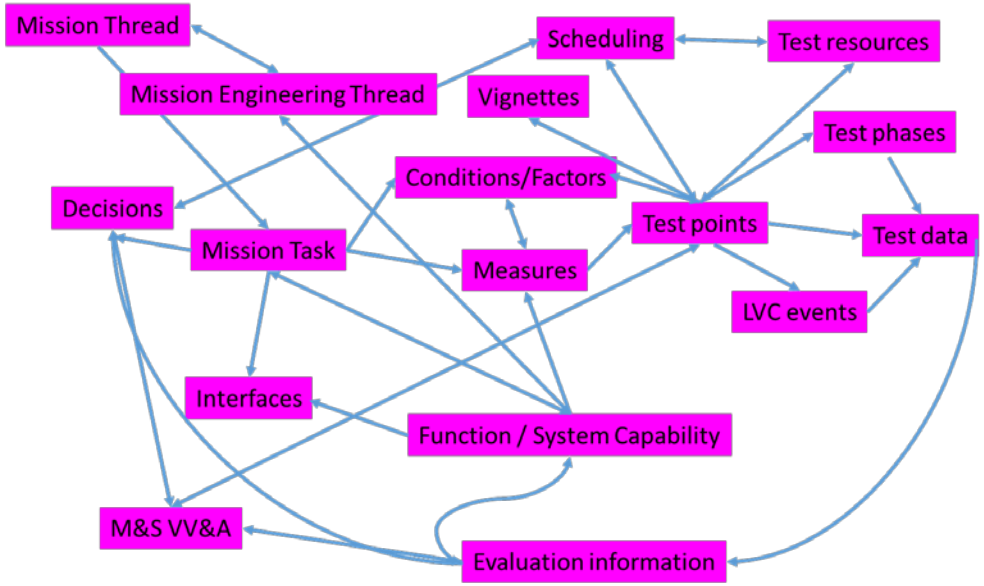
Reference: OSD(R&E) Mission Engineering Guide, Figure 2.1, pg 5; Figure 2.8, pg 18

Integrated Decision Support Key – Evaluation Framework (IDSK-EF) guides Capability Evaluation for Decision-Support



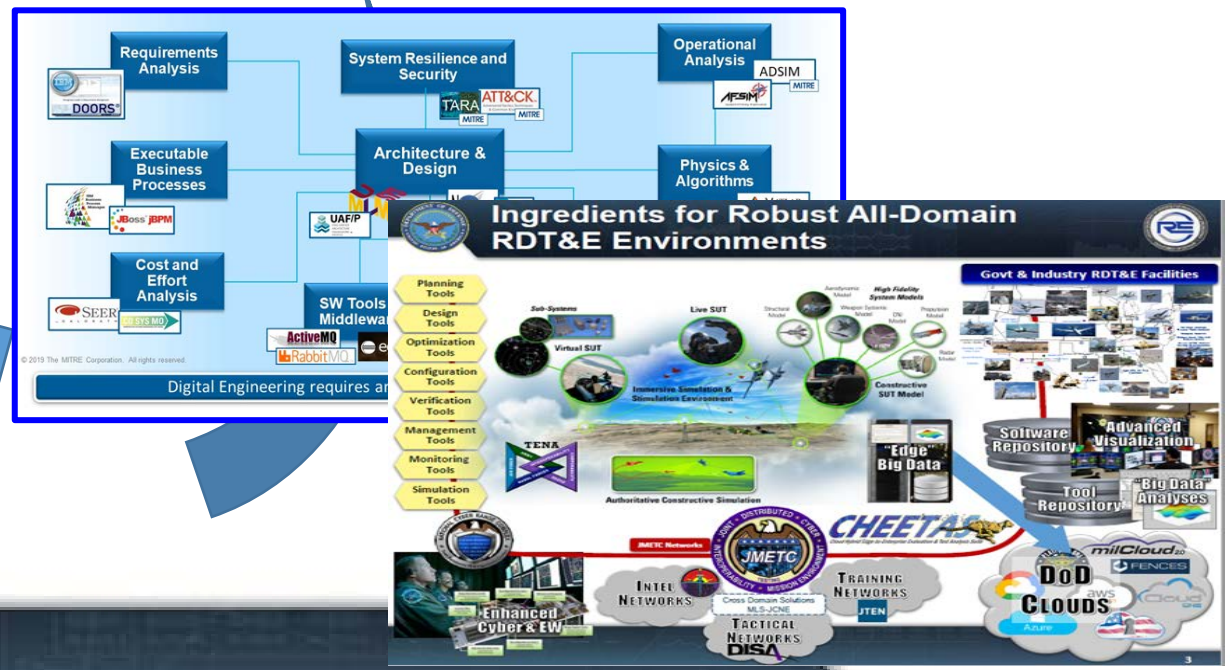
- Holistic, flexible evaluation framework tailorable for decision-support throughout S&T – P&E – PoR – CPM lifecycle
- Decisions, knowledge points and information needs guide evaluation planning
- Evaluation focused to inform decisions across technology, design, development and mission continuum
- Evaluation plan guides wargaming, experimentation, MS&A, test design providing evaluation's data

Digital Engineering Manages Data Complexity & Provides Evaluation's Analytical Rigor



DE model houses detailed data and interfaces, generates views for decision-support, evaluation planning and test design

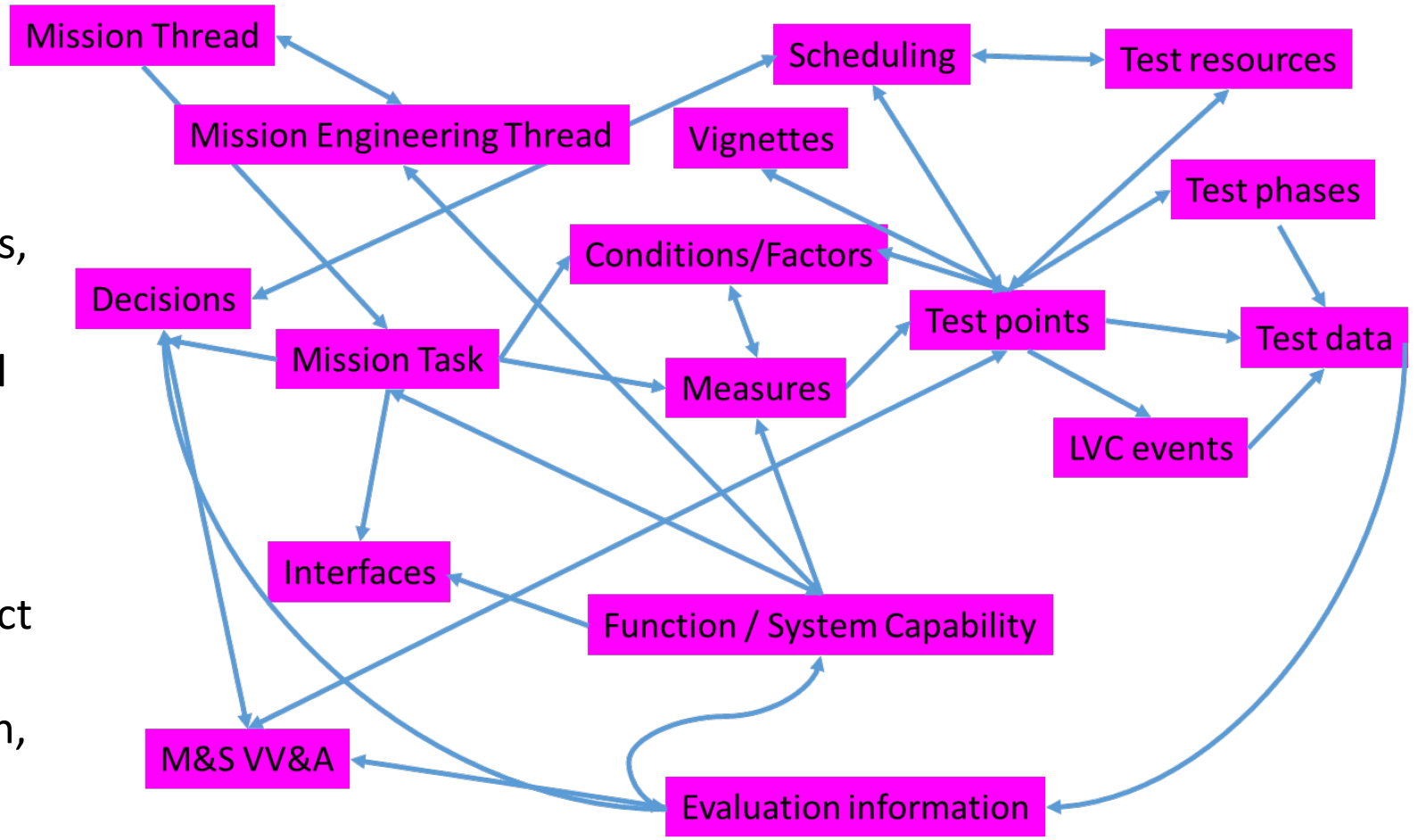
DEE is evaluation's analytical engine; informs decisions with capability evaluation results, improves mission-focused technology development, acquisition outcomes, and mission success



DE: Digital Engineering
DEE: Digital Engineering Environment

Digital Engineering Accelerates Capability Delivery to the Warfighter

- MBSE tools use object-oriented methods and an underlying relational database to define and maintain reusable, digital representations of multi-dimensional elements: mission threads, SoS configurations, capabilities, measures, test design, etc.
- Queries and manipulation of the digital model generate IDSK-EF views based upon stakeholder information and documentation needs
- Power of DE in ME-IDSK/EF-DE construct informs decision-making to accelerate mission-focused technology maturation, operationalization, and capability delivery to the warfighter at the speed of need

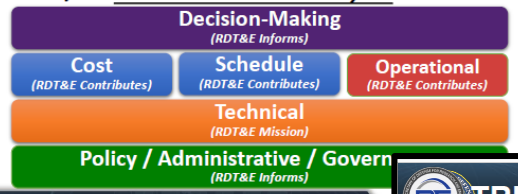


Partnering with TRMC Knowledge Management Investment Portfolio

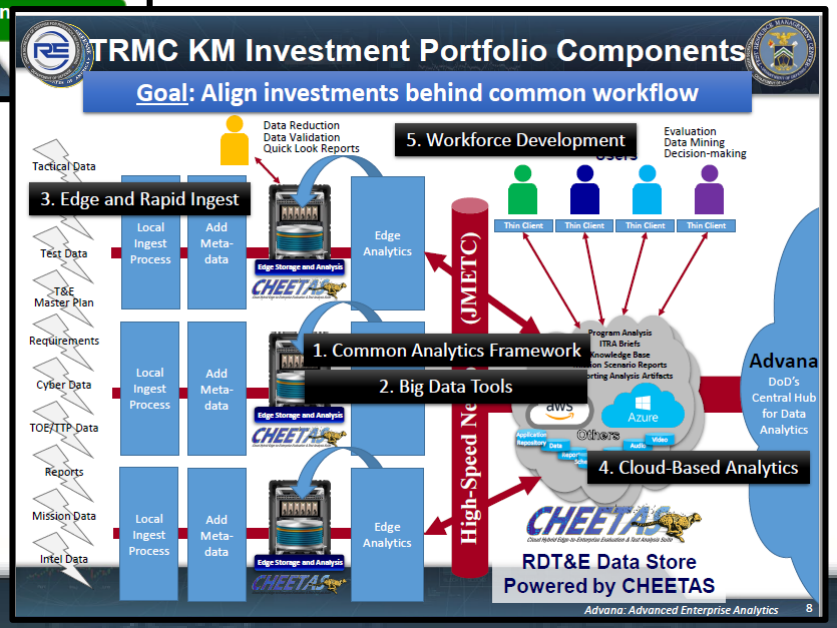
Why is RDT&E Data Different?

- **The product of RDT&E is technical data & knowledge, not applications**
  - Example: A single F-35 mission generates 0.4TB-1.0TB+ of technical data
- **Goal: Inform decision-making with system capabilities & limitations**
  - Operational data: how we use a system
  - Technical data: "truth" of what a system can do
- **Key RDT&E Tenets:**
  - Enable analysts to spend more time analyzing data – and less time gathering data
  - Maximize collaboration between government and industry
  - Accept & Federate our communities' distributed data repositories
  - Start small and grow aggressively
- **Challenge: How much data do we share?**

Notional DoD Data Layers



Discoverable, Accessible, & Understandable technical data is critical to operational & acquisition decision-making



- TRMC developing CHEETAS - integrating RDT&E infrastructure into cohesive knowledge management enterprise
- Modernize RDT&E practices & processes to leverage big data analytics techniques
- Apply big data analytics tools & techniques to the RDT&E mission space
- Enables existing analysts to become data scientists
- Emphasizes user time spent on analysis rather than data gathering
- Provides consistent access regardless of data location and/or amount
- Promotes sharing & reuse of tools & techniques across the community
- Implements the DoD Data Strategy for RDT&E

Summary – Good Decision-Making Delivers Exquisite Solutions to Warfighter Needs

ME – IDSK-EF – DE provides mission focused, capability evaluation-based decision support across S&T – P&E – PoR – CPM continuum

Evaluation-informed decision-making accelerates delivery of solutions to close Warfighter mission gaps at the speed of need

- IDSK/EF focuses the continuum of T&E activities on evaluating operational and technical capabilities to inform decision-making
- ME puts analytical rigor into operational – technical capabilities linkage; provides mission context to technical and acquisition decision-making
- DE underpinning provides thorough, consistent and rapid evaluation of complex operational and technical solutions

Contact

For more information, please contact:

Mr. Christopher Collins,
Director, Developmental Test, Evaluation & Assessment
christopher.c.collins4.civ@mail.mil

Dr. Suzanne Beers
sbeers@mitre.org
719-418-1047

https://ac.cto.mil/dte/
https://ac.cto.mil/engineering