



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

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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



Inform Technology Efficacy and Investment Decisions



Inform Acquisition Requirements



<p>MISSION TO: Inform acquisition decisions with leading technical capabilities from key operational & technical capabilities and attributes for evaluation, in capability focus areas: Operational Effectiveness - Technical Performance, Set Ops Effectiveness - Usability & Interoperability, Supportability & Maintainability, Operational Suitability - Reliability & Specialty Engineering</p>	<p>MISSION TO: Inform programmatic decisions regarding ITC assets for evaluation and decision support</p>
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Block I Blk II Blk III



Evaluation Continuum

Systems Engineering Process

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MS A
MS B
MS C
Rapid Acquisition

Enable Capability Portfolio Manager (Inform Acquisition Decisions)

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Inform Concept Maturation



Inform Prototypes



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

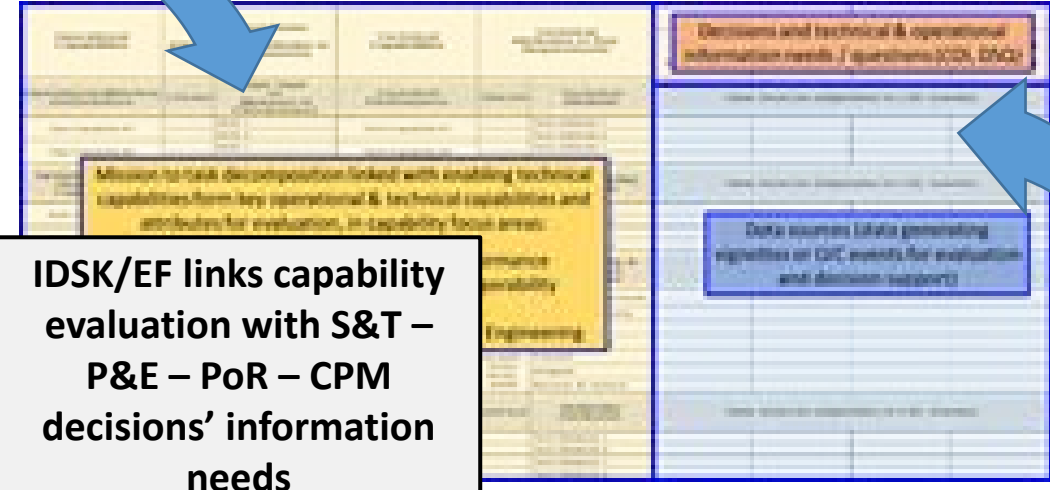
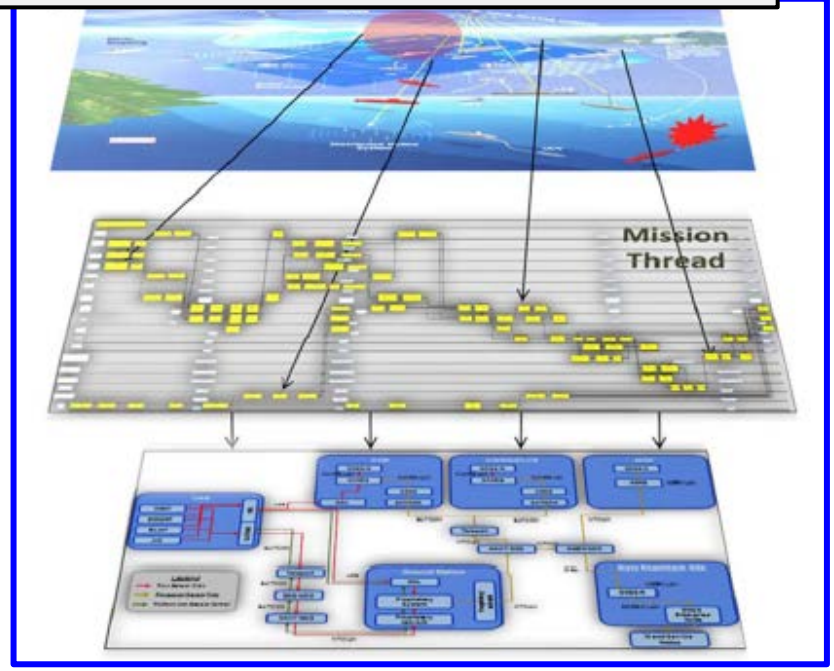
P&E: Prototyping & Experimentation
PoR: Program of Record
CPM: Capability Portfolio Management



Mission Engineering – IDSK-EF – Digital Engineering Vision

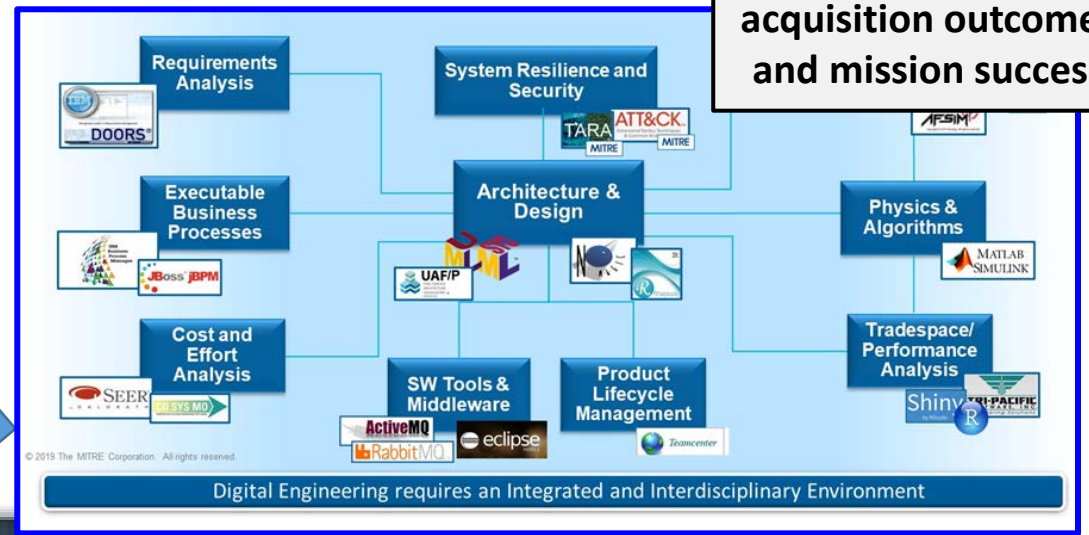


ME study defines operational architecture to mission thread (MT) to mission engineering thread (MET) – validates warfighter-identified operational capability gaps, proposes optimal technical solutions, identifies evaluation measures of effectiveness



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

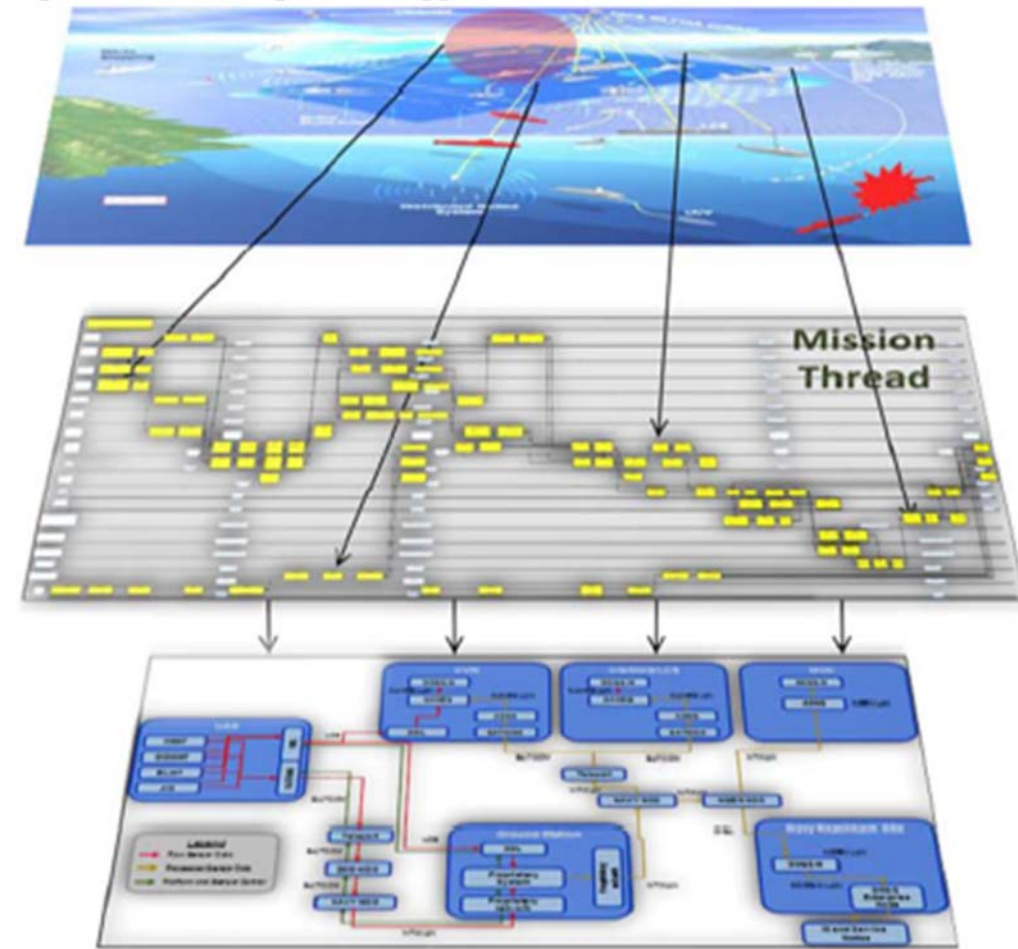
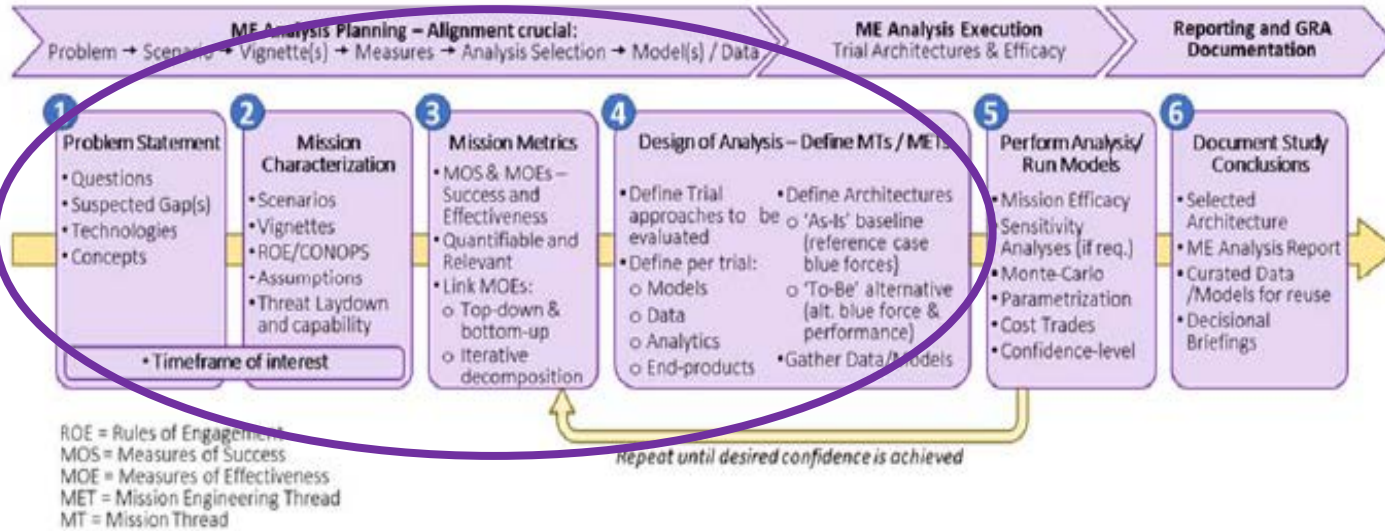




Mission Engineering Links Mission Gaps with Technical Solutions



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

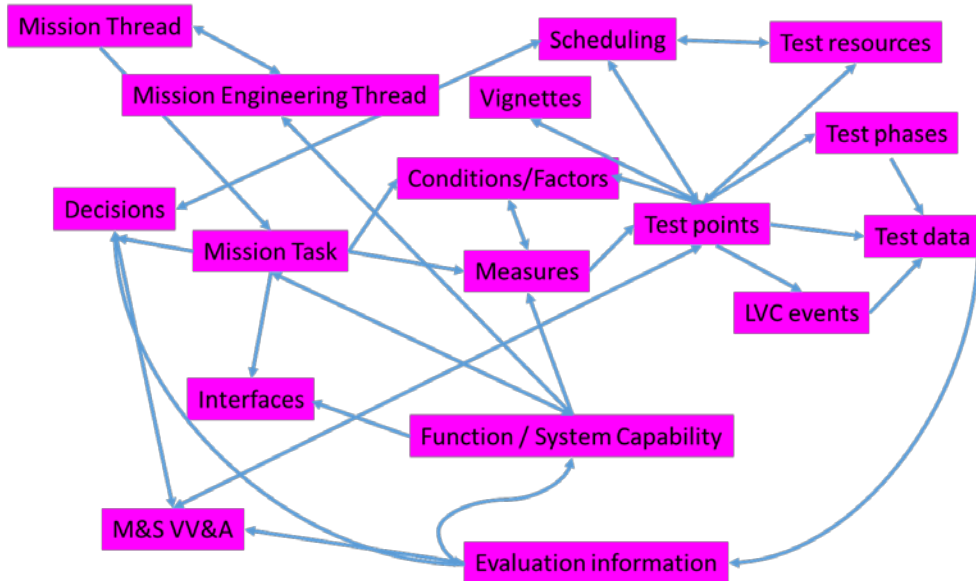


- Holistic, flexible evaluation framework tailorable for decision-support throughout S&T – P&E – PoR – CPM lifecycle
- Decisions, knowledge points and information needs guide evaluation planning
- Evaluation focused to inform decisions across technology, design, development and mission continuum
- Evaluation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

Operational Capabilities	Operational Tasks (Operational Attributes or Key Requirements)		Technical Capabilities	Technical Attributes or Key Requirements		Decisions, Knowledge Points & Information Need Focusing Questions			
	CDD Ref	Ops Task or Measure of Effectiveness		Technical Performance	SRD Ref	Technical Attribute	Data Sources (Vignettes or LVC events)		
Operational (Mission) Performance						Data Sources (Vignettes or LVC events)			
Ops Capability #1		MOE 1	Tech Capability #1		Tech Attribute 1				
		MOE 2			Tech Attribute 2				
Ops Capability #2		MOE 1	Tech Capability #2		Tech Attribute 1				
Capability Evaluation Definition: Mission to task decomposition linked with enabling technical capabilities, attributes and measures						Data Sources (Vignettes or LVC events)			
System Operational Capability					Ability 1				
SoS Capability					Ability 2				
SoS Capability		SOS MOE 2			Interop Attribute 2				
Survivability Capabilities	CDD Ref	Measure of Survivability	Survivability & Resilience Capabilities	SRD Ref	Survivability & Resilience Attributes	Data sources (wargames, experimentation, MS&A, LVC test events)			
Ops Survivability Cap #1		MOS #1	Tech Survivability Cap #1		Survivability Attribute				
Data Security	DODI 8510; PPP	Data confidentiality Data integrity Data availability	Data Security	DODI 8510; PPP	Data confidentiality Data integrity Data availability				
Operational Resilience and System Survivability	SS-KPP, DODI 8530, 8500	Prevent Mitigate Recover & restore	Operational Resilience and System Survivability	SS-KPP, DODI 8530, 8500	Prevent Mitigate Recover & restore				
Suitability Capabilities	CDD Ref	Measure of Suitability	Reliability & Specialty Engineering Capabilities	SRD Ref	Reliability Attributes	Data Sources (Vignettes or LVC events)			
Suitability Capability #1		MOS 1 MOS 2	RM&A or Specialty Engineering Capability #1		Tech Measure 1 Tech Measure 2				
Suitability Capability #2		MOS 1 MOS 2	RM&A or Specialty Engineering Capability #2		Tech Measure 1 Tech Measure 2				

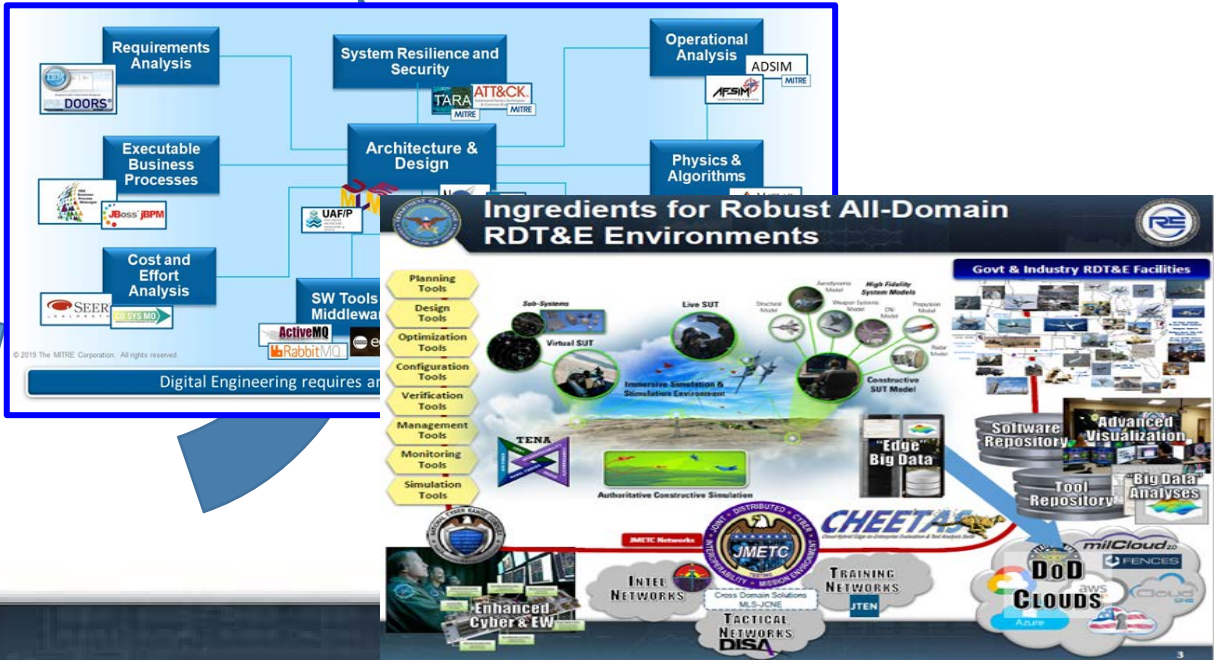


Digital Engineering Manages Data Complexity & Provides Evaluation's Analytical Rigor



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

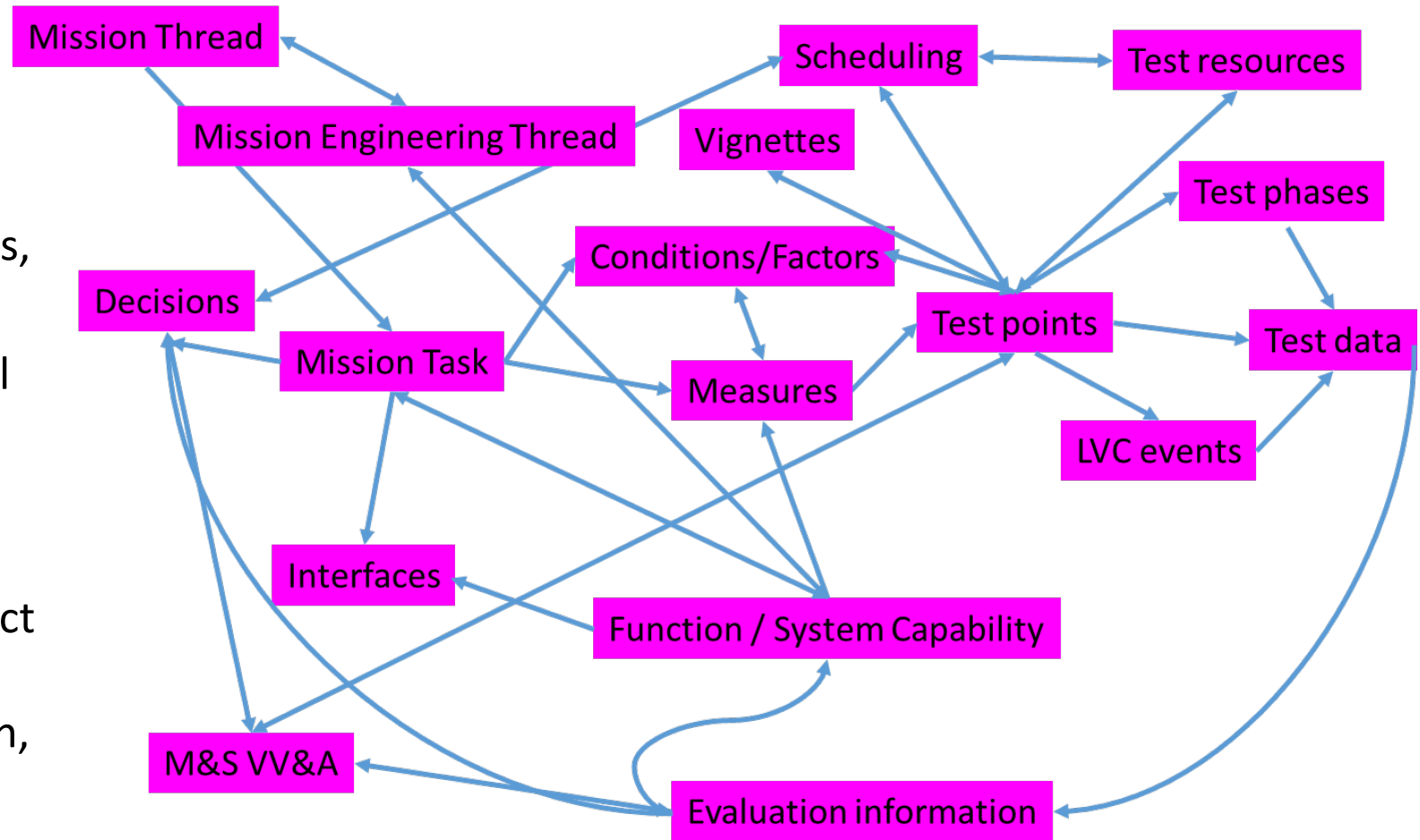




Digital Engineering Accelerates Capability Delivery to the Warfighter



- 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?

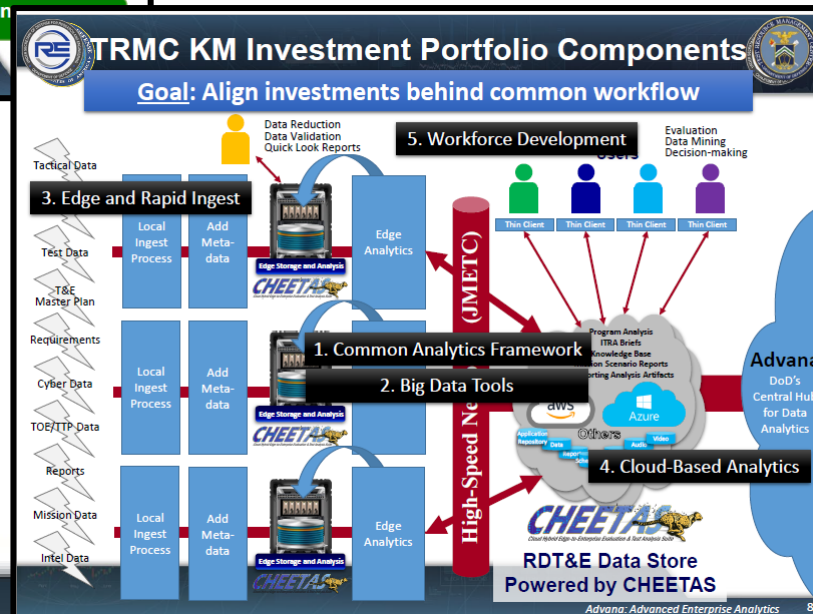
- The product of RDT&E is technical data & knowledge, not applications
 - Example: A single F-35 mission generates 0.4TB-1.0TB+ of technical data
- **Goal:** Inform decision-making with system capabilities & limitations
 - Operational data: how we use a system
 - Technical data: "truth" of what a system 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

Decision-Making (RDT&E Informs)		
Cost (RDT&E Contributes)	Schedule (RDT&E Contributes)	Operational (RDT&E Contributes)
Technical (RDT&E Mission)		
Policy / Administrative / Govern (RDT&E Informs)		

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**



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