USD(R&E)

Advancements in Digital Engineering for Test and Evaluation Panel Discussion

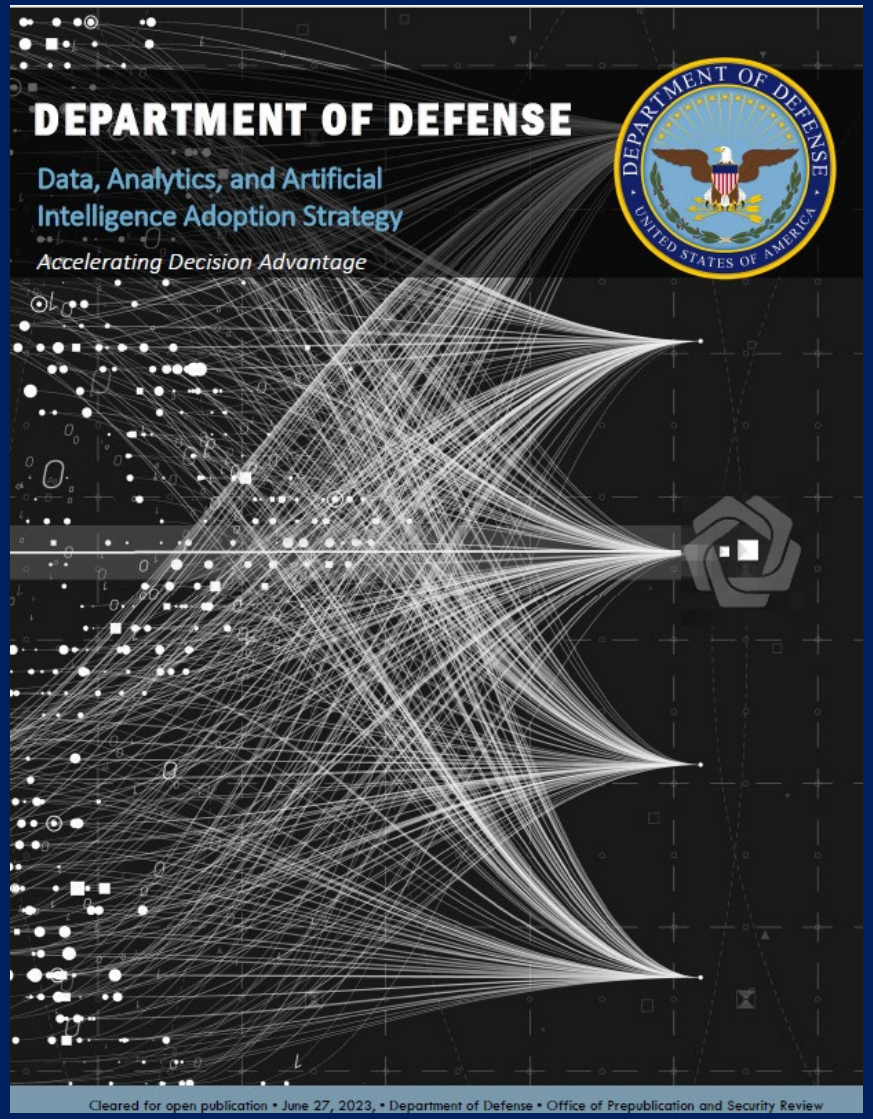
May 9th, 2024

Panel Chair:
Christopher C. Collins
Executive Director
Developmental Test, Evaluation, and Assessments (DTE&A)
Office of the Under Secretary of Defense for Research and Engineering (OUSD(R&E))

Introduction

Christopher C. Collins is the Executive Director, Developmental Test, Evaluation, and Assessments (ED,DTE&A) within the Office of the Under Secretary of Defense for Research and Engineering. DTE&A provides support to DoD acquisition programs in the use of innovative and efficient DT&E strategies to ensure production readiness and fielded systems meet Warfighter/User needs; improve the Defense Acquisition Test and Evaluation (T&E) workforce “practice of the profession”; and advance T&E policy and guidance. DTE&A also conducts Independent Technical Risk Assessments and Milestone Assessments for major acquisition programs.

T&E as a Campaign of Learning



FOREWORD

The Department of Defense (DoD) has been investing in artificial intelligence (AI) and responsibly fielding data- and AI-enabled systems for over 60 years. Today, data, analytics, and AI technologies are increasingly available to DoD Components and providing value to our service members.

Alongside industry's advancements, DoD has for years made steady and swift improvements to its data foundation and analytics capabilities: experimenting with AI through research and development, integrating these technologies into business and warfighting functions, and laying the foundation for their use at scale. As our investment, experimentation, and innovation continues and accelerates, our task now is to drive the diffusion of these technologies across the enterprise.

Although our strategic competitors have ambitious aims for AI, the United States and its military possess strong structural advantages in talent, warfighting experience, technology availability, and systems integration — not to mention the values that guide everything we do. Equipping our people with the tools and resources to make better decisions faster will increase the efficiency of DoD business

> Responsibly and rapidly realizing the full promise of data, analytics, and AI is not the sole job of a single organization or program; it's on all of us. Providing DoD data as an enterprise resource, for instance, requires more sharing and collaboration, not less. We seek an agile strategic approach that guides decentralized action across DoD, inspires campaigns of learning, and leverages all our people, processes, and enabling technologies.

strengthen the organizational environment in which DoD deploys data, analytics, and AI capabilities for enduring decision advantage.

Successfully defending the nation depends on our people. As we have always done, DoD will continue to trust, support, empower, and invest in our people. We will not outpace our adversaries through imitation. We will succeed by leading with our strengths: our democratic values, our diverse and open society, our culture of ingenuity, our second-to-none innovation base, and our globe-spanning network of Allies and partners. Together, we will harness data, analytics, and AI for the defense, security, and prosperity of the American people and the world.

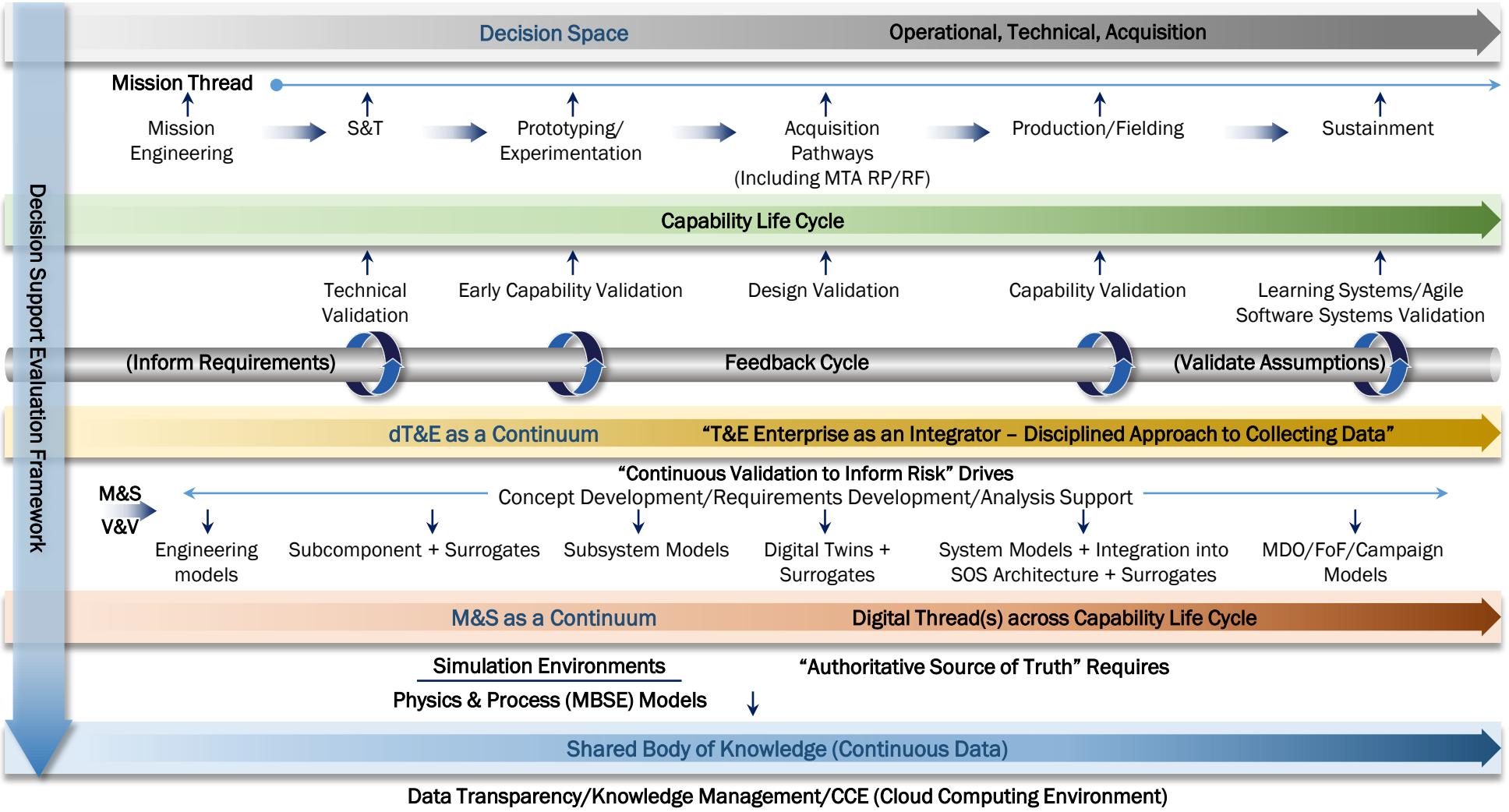
Kathleen H. Hicks
Deputy Secretary of Defense

Shifting the Traditional Testing Paradigm to a "Testing Continuum"

- A critical change in how Test and Evaluation (T&E) supports capability delivery is needed to support the agile strategy
- Making this change requires a new paradigm in which:
  - T&E provides focused and relevant information supporting decision-making *continually* throughout capability ***development*** from the earliest stage of Mission Engineering (ME) through Operations and Sustainment (O&S)
    - Starting at the earliest phases of S&T and experimentation to ***develop*** and mature technology
    - Into traditional program of record ***developmental*** test (both contractor and govt)
    - Beyond fielding for systems that continue to ***develop*** (learning and agile software)
  - A foundation of data and analytics across the capability ***development*** continuum is established
- This new approach moves T&E from a serial set of activities conducted largely independently of Systems Engineering (SE) and ME activities to a new integrative framework focused on a continuum of activities termed a **developmental T&E as a Continuum (dTEaaC)**
- dTEaaC has key attributes and enablers critical in the conduct of T&E as a continuum and delivery of capability at the *Speed of Need*

Data Driven vs Event Driven

Decision Support Across the Capability Delivery Continuum



dTEaaC + DSEF and the Capability Delivery Continuum

Decision Support Evaluation Framework (DSEF)

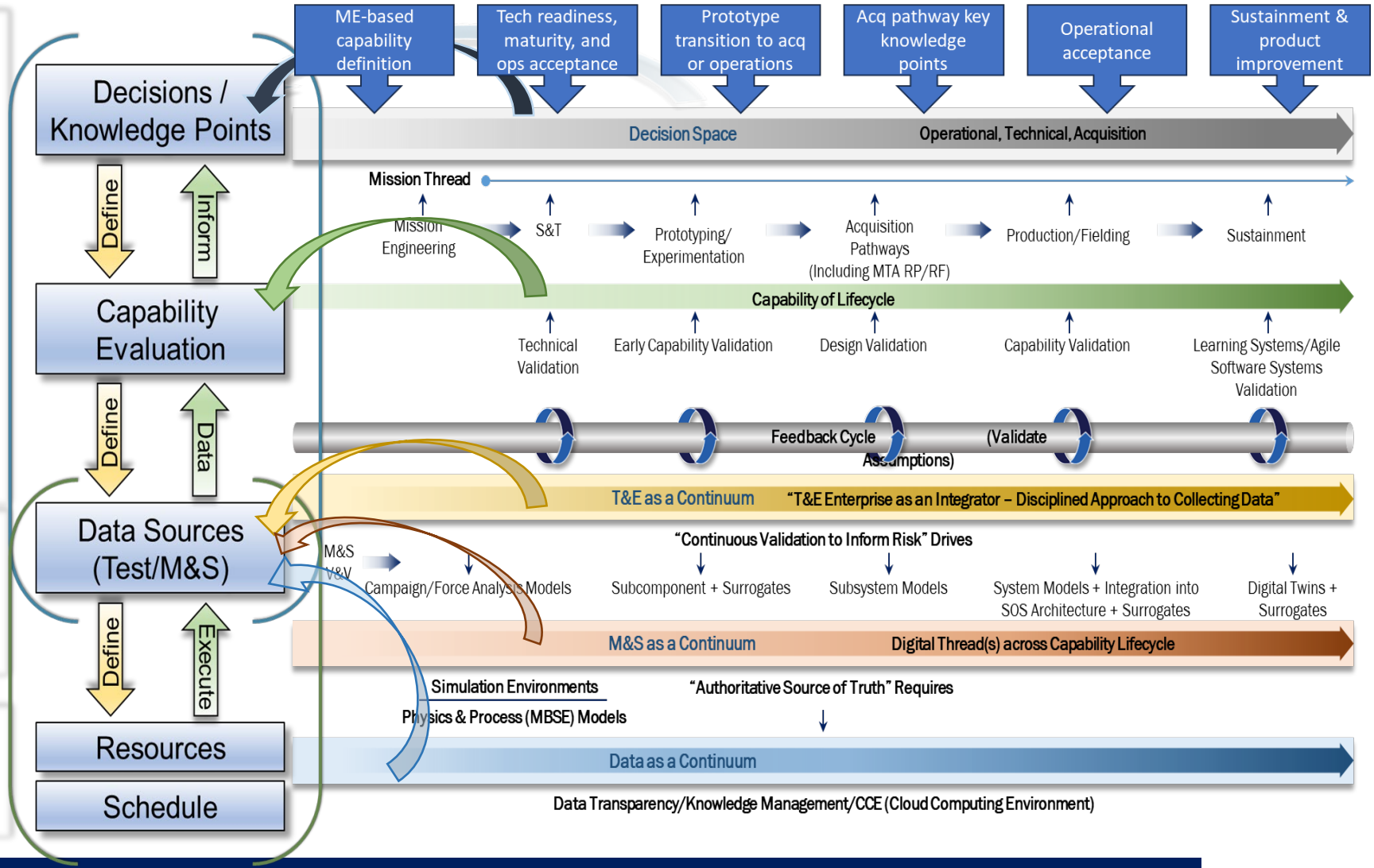
- Full Capability Delivery Continuum ***decisions*** (technical, transition, operational, enterprise architecture, acquisition, investment) to be informed by evaluation
- Operational and technical capabilities to be ***evaluated*** to generate the knowledge needed to inform decisions
- Wargames, experiments, exercises, tests, modeling and simulation (M&S) and Live, Virtual, Constructive events to provide ***data*** for evaluation and decision support

Evaluation drives dTEAAC event design

- Capability evaluation and decision-support data needs drive TEAAC event design (wargame, experiment, exercise, test, M&S)

Model-based DSEF enables agility

- Digital Engineering DSEF enables agility in decision-support and test execution



Inform full continuum (ME – to – retirement) decisions with capability evaluation of TEaaC data

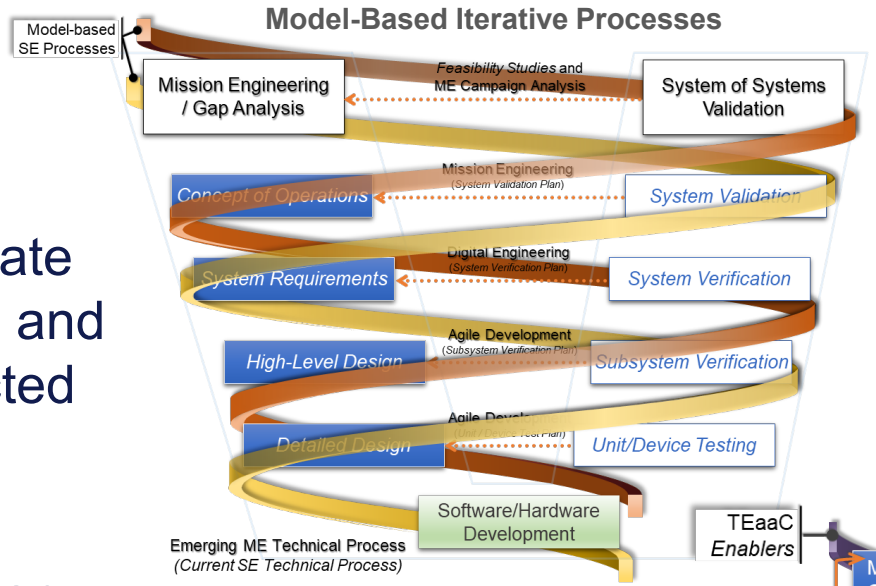
dT&E Continuum and the Model-Based Systems Engineering "V"

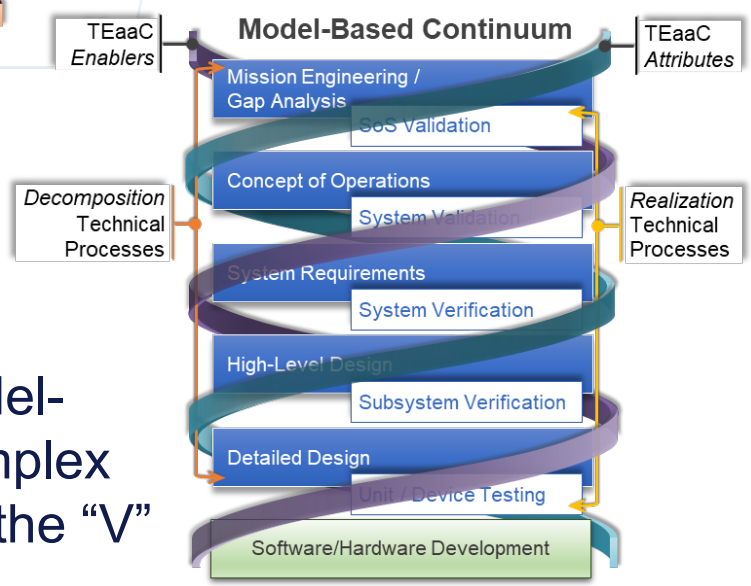
- The SE community has historically used a serial interpretation of the SE "V"

- Executing **dT&E as a Continuum** will integrate ME, SE, and T&E into parallel, collaborative, and combined efforts through a dynamic, connected new model-based SE "V" Environment

- Using this model-based environment, DoD can transition to a "model-test-validate-design-test" process providing early and continual information on expected mission capability

- "Collapsing" of the SE "V" does not negate good SE practices. The model-based continuum will allow the SE community to manage the many complex activities being conducted simultaneously within this continuum across the "V"





Shifting the Traditional Testing Paradigm to a "Testing Continuum"

Continuum Attributes

DOT&E Strategic Pillar:
Test the Way We Fight

CAPABILITY AND OUTCOME FOCUSED TESTING

DE Strategy Pillar:
Establish Infrastructure and Environments

DOT&E Strategic Pillar:
Accelerate the Delivery of Weapons That Work

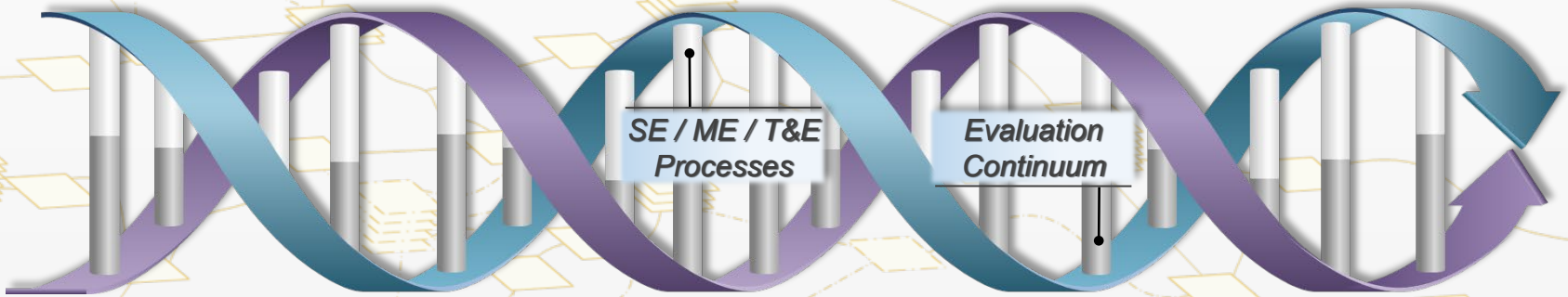
EARLY, AGILE, SCALABLE FRAMEWORK

DE Strategy Pillar:
Provide Authoritative Source of Truth

DOT&E Strategic Pillar:
Pioneer T&E of Weapon Systems Built to Change Over Time

ENHANCED TEST DESIGN

DE Strategy Pillar:
Incorporate Technological Innovation



Continuum Enablers

DOT&E Strategic Pillar:
Improve the Survivability of DoD in a Contested Environment

LIVE, VIRTUAL, CONSTRUCTIVE (LVC) TESTING

DE Strategy Pillar:
Provide Authoritative Source of Truth

DOT&E Strategic Pillar:
Pioneer T&E of Weapon Systems Built to Change Over Time

MODEL-BASED ENVIRONMENT

DE Strategy Pillar:
Formalize Development, Integration & Use of Models

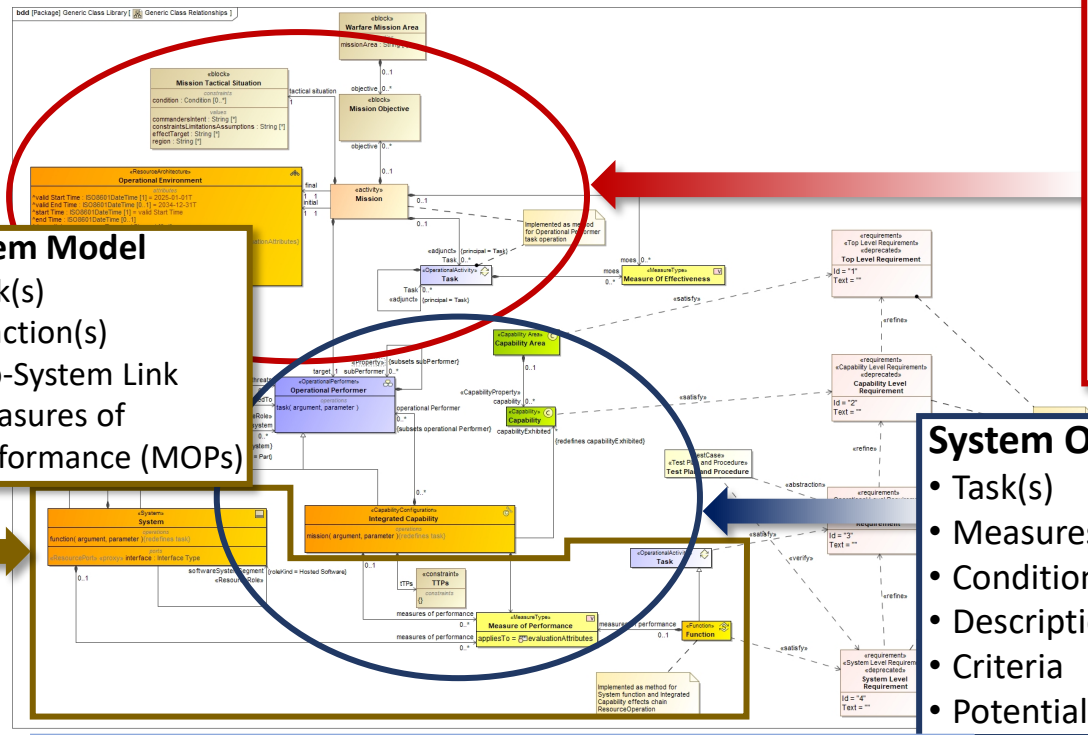
DOT&E Strategic Pillar:
Foster an Agile and Enduring T&E Enterprise Workforce

"DIGITAL" WORKFORCE

DE Strategy Pillar:
Transform Culture / Workforce

dT&E as a Continuum expands the DoD 2018 Digital Engineering Strategy and 2023 DODI 5000.97 as an integral part of the Systems Engineering and Mission Engineering processes.

Enabler – Model - Based Environment ME / SE / T&E Model Interconnections

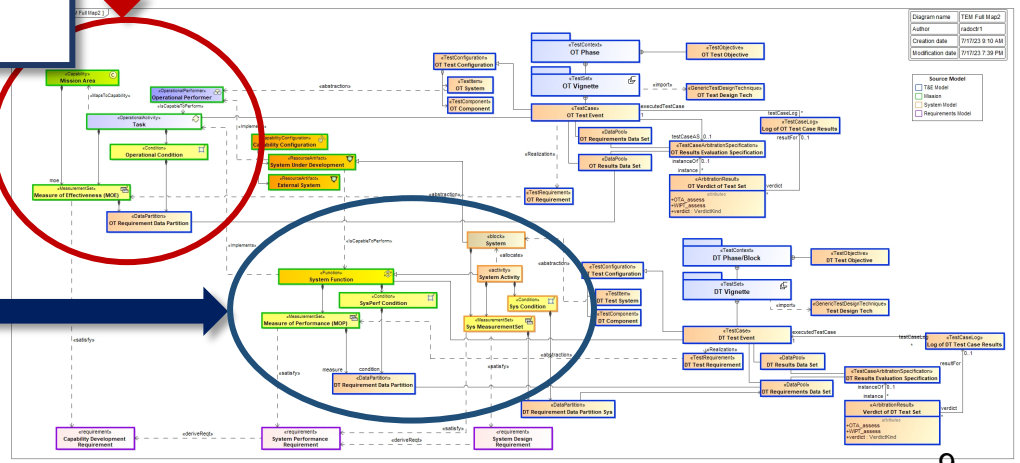


System Model
- Task(s)
- Function(s)
- Sub-System Link
- Measures of Performance (MOPs)

Mission Model
- Mission Definition
  - Desired Effect
  - Threat
  - Scenarios
  - Tasks
  - Measures of Effect (MOEs)

Mission model provides:
- Mission
- Tasks
- Conditions
- Measures

System Of Systems
- Task(s)
- Measures of Performance (MOPs)
- Conditions
- Descriptions
- Criteria
- Potential Performers



T&E model:
- Incorporates the mission information
- Contains the CT/DT/OT test framework
- The interconnection of the models will allow the test data to flow back to the mission level for assessment to support technical and operational decision making

Panel

- Dr. Awele Anyanhun – GA Tech
  - ***Model-Based Integrated Decision Support Key (MB-IDSK): A Standardized Approach to Mitigating Decision Support Challenges during Acquisition Test and Evaluation***
- Dr. Craig Arndt – GA Tech & Dr. Jeremy Werner DOT&E
  - ***Roadmap for the integration and implementation of Model Base Test and Evaluation Technologies***
- Mr. Milo Taylor – GA Tech
  - ***The use of Digital Twins in mitigating challenges of testing emerging technology programs: space system challenges***