Digital Mission Architecture

Architecture-Based Decision Making for Mission Engineering and Integration

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Our Mission

To provide the military forces needed to deter war and ensure our nation’s security.

To ensure continuous advancement of technology and innovation within the Defense enterprise.

Deliver Joint Warfighting Concepts to Prototype Capabilities. Transition the Valley of Death.
What is Mission Engineering?

Not just modeling and simulation

The goal is to engineer missions

Model kill chains / webs and use advanced analysis methods to transition future capabilities
Why Digital Mission Architecture?

Disciplined approach to analyze capability gaps in a mission-relevant context

Model-based representation of doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy dependencies

Descriptive visualization of advanced technology capabilities in a mission context

Systematic understanding of model pedigree, information gaps, and related confidence levels

Repository for mission data and related measures

Backbone for federation/integration across various functional communities (e.g. test and evaluation, sustainment)

Inform key Defense policy and capability investment decisions
Mission Characterization

Scenario: Part of an overall campaign, comprising multiple operations, each with its own set of missions and objectives

Provides:
- Conflict timeframe (near, mid, far)
- Geo-political set-up
- Strategic mission objectives
- Mission area definitions (i.e., groupings of similar campaign operations)

Example authoritative sources:
- Defense Planning Scenarios (DPS)
- Joint Force Operating Scenarios (JFOS)
- Why use:
  - Standards future theater threat laydown and conflict for DoD planning
  - Provides top-level MOS
  - Common starting point for mission engineering activities and leadership decisions

Vignette: Subset of a scenario to focus the scope, details, and tactical objectives to address the needs of the mission problem or opportunity

- Setting, objective(s), commander’s intent
- Baseline forces, threats / intel, and order of battle
- Details of blue, green, and red CONOPS; Rules of engagement and operational tasks
- Clutter (e.g., neutral forces), contested, etc.
- Vignette measures (i.e., MOEs)
- Refining assumptions and conditions

Many vignettes can be derived from a single scenario

MOS = Measure of Success
MOE = Measure of Effectiveness
CONOPS = Concept of Operations
Mission Architecture Development

Organizing Construct (See para. 5.1)

Task / Activity

Sub-Task / Sub-Activity

Assigned System / Mission Element

MOS = Measure of Success
MOE = Measure of Effectiveness
MOP = Measure of Performance

Mission Objective

Targeting Adversary Cnd. Post for 100% Probability of kill ($P_k$) in 20 min

Measure of Success

Time to classify contact

Probability of correct classification ($P_c$)

False Positive

Mission-level (MOS)

Task-level (MOE)

System-level (MOP)

Example Mission breakdown into Mission Thread and MET

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Mission Integration Across the Defense Enterprise
• Establish a federated DoD catalog of digital mission architectures

• Stand up a Digital Mission Architecture Collaboration Group and exercise integration through practical use cases

• Develop a style guide that supports the Mission Engineering Guide and evaluate the application of the Unified Architecture Framework (UAF)
Prior Efforts
Reviewed existing style guides used by various organization for different applications
Participated in collaborative Digital Engineering / Model-Based Systems Engineering workshops and events to understand requirements and synergies

Status
Draft guidance to facilitate uniform development and presentation of model-based mission architectures across the Department
Unclassified examples of mission architectures of Operation Desert Storm, Task Force Normandy historical example using System Modeling Language (SysML)/Unified Architecture Framework (UAF)

Way Forward
Document recommendations to facilitate model and data exchange between stakeholders
Continue development to capture measures, represent behaviors
Coordinate draft guidance across Department
Publish the Mission Architecture Style Guide
Mission Architectures in the Unified Architecture Framework®
Baseline vs. Alternative Mission Engineering Threads

Baseline
The Combined Air Operations Center (CAOC) identified key enemy targets using multiple sources of intelligence. After planning, all airborne assets, under the guise of day-to-day training operations, initiated the Task Force Normandy mission. The E-3 Sentry provided long-range radar coverage, airspace management, and communication links with multiple assets. The MH-53 Pave Lows led the AH-64 Apaches, under the cover of darkness, to their targets inside Iraqi airspace. The Pave Lows illuminated the targets and the Apaches prosecuted them. Upon mission completion, assets returned to friendly airspace and the Sentry relayed status back to the CAOC.

Alternative
Using information from an intelligence source, the CAOC notifies both the E-3 Sentry and the MC-130W Combat Spear. This enables the Sentry and the Combat Spear to provide an additional communications path between the CAOC and the helicopters. This redundancy provides a fail-safe in case the Sentry lose connectivity.
### Mission Architecture Style Guide Contents

<table>
<thead>
<tr>
<th>Mission Engineering Architecture Development</th>
<th>Results and Recommendations</th>
<th>Sources</th>
<th>Best Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Order of Battle (OOB)</td>
<td>• Mission Architecture Analysis</td>
<td>• Classification Guidance</td>
<td>• Modularity</td>
</tr>
<tr>
<td>• Mission Threads (MT)</td>
<td>• Presentations of Architecture to Leadership</td>
<td>• References</td>
<td></td>
</tr>
<tr>
<td>• Mission Engineering Threads (MET)</td>
<td></td>
<td>• Pedigree</td>
<td></td>
</tr>
<tr>
<td>• End-to-End Views (E2E)</td>
<td></td>
<td>• Confidence Levels</td>
<td></td>
</tr>
<tr>
<td>• Sequence Diagrams (SEQ)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Measures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Behaviors</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Digital mission architectures are a foundational element of advanced technology development, evaluation and transition

• Model-based mission threads support constructive modeling and simulation, mission engineering studies, and analysis

• Mission Integration leading effort across Department to integrate model-based mission architectures from authoritative sources
Resources

Training
- CLE 084 Models, Simulations, and Digital Engineering
- CLE 066 Systems Engineering for Systems of Systems
- CLE 069 Technology Transfer
- ETM 1020 Mission and Systems Thinking Fundamentals
- ETM 1030 Requirements Definition and Analysis Fundamentals
- ETM 1040 Technical Management Fundamentals
- MITRE Modular Open Systems Engineering (MOOSE)

References (Public Domain)
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