USD(R&E)

Digital Mission Architecture

Architecture-Based Decision Making for Mission Engineering and Integration

SLIDES ONLY
NO SCRIPT PROVIDED

Jaime J. Bestard, Chief Engineer, Digital Mission Architecture
Office of the Under Secretary of Defense for Research and Engineering
Unified Architecture Framework® Summit 2024, March 20, 2024

Our Mission

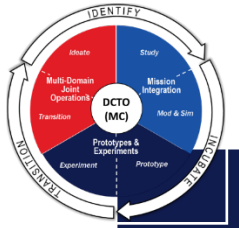
Department of Defense

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

Under Secretary of Defense for Research and Engineering

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

Assistant Secretary of Defense for Mission Capabilities



Deliver Joint Warfighting Concepts to Prototype Capabilities. Transition the Valley of Death.

Organization

Mr. Joseph R. Biden, Jr.
President of the United States

Mr. Lloyd J. Austin, III
United States Secretary of Defense

Ms. Heidi Shyu
Under Secretary of Defense for Research and Engineering

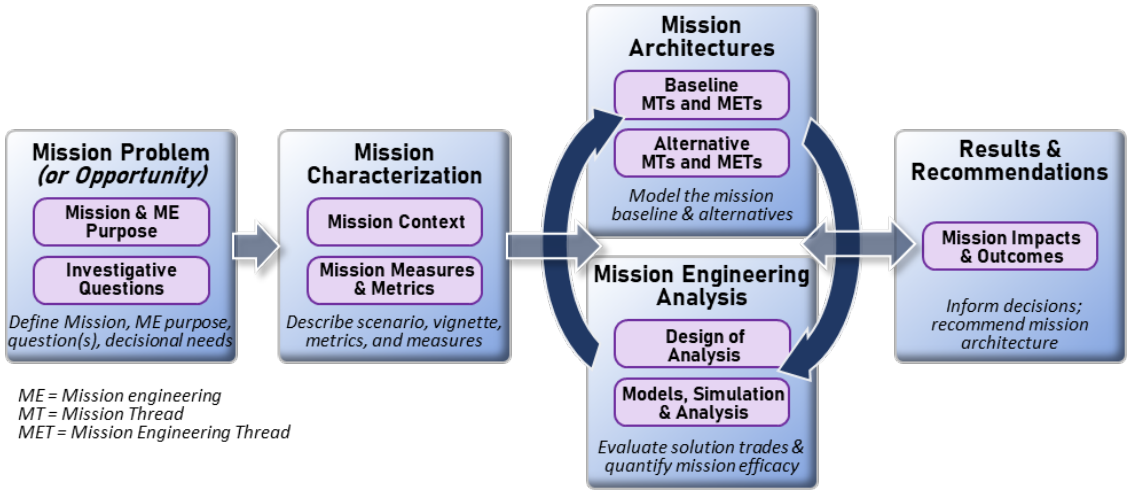
Mr. Thomas J. Browning
Performing the Duties of the Assistant Secretary of Defense for Mission Capabilities

Mr. Elmer L. Roman
Deputy Assistant Secretary of Defense for Mission Integration

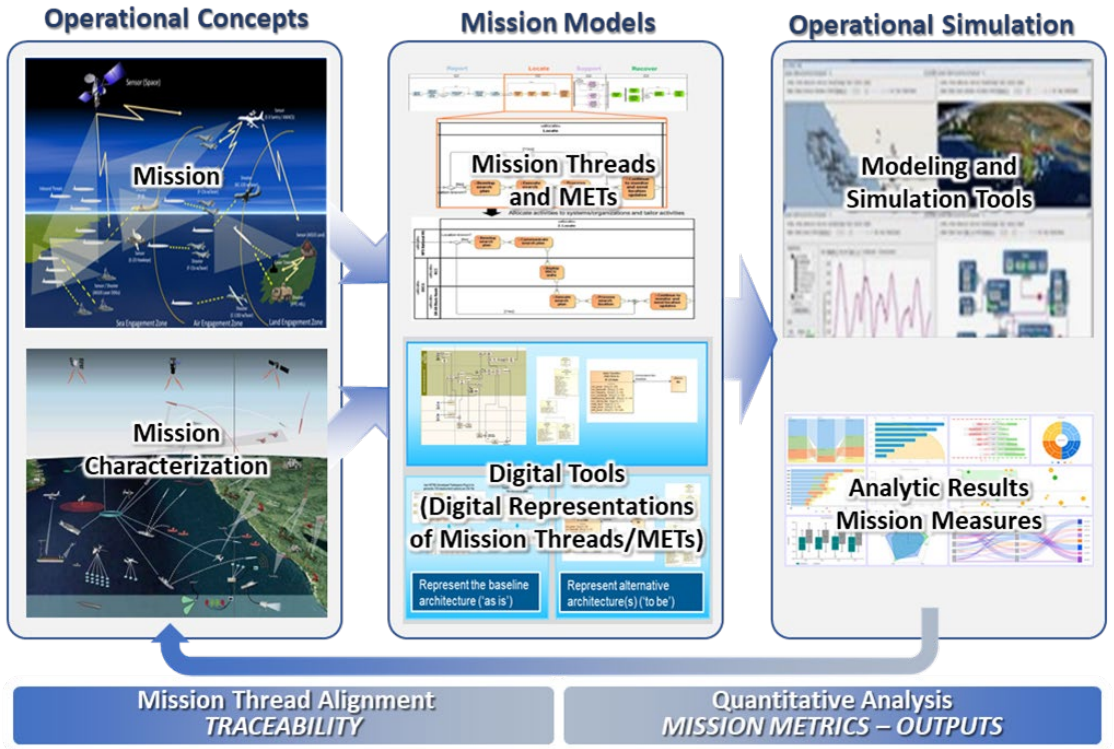
Mr. Jaime J. Bestard
Chief Engineer for Digital Mission Architecture

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

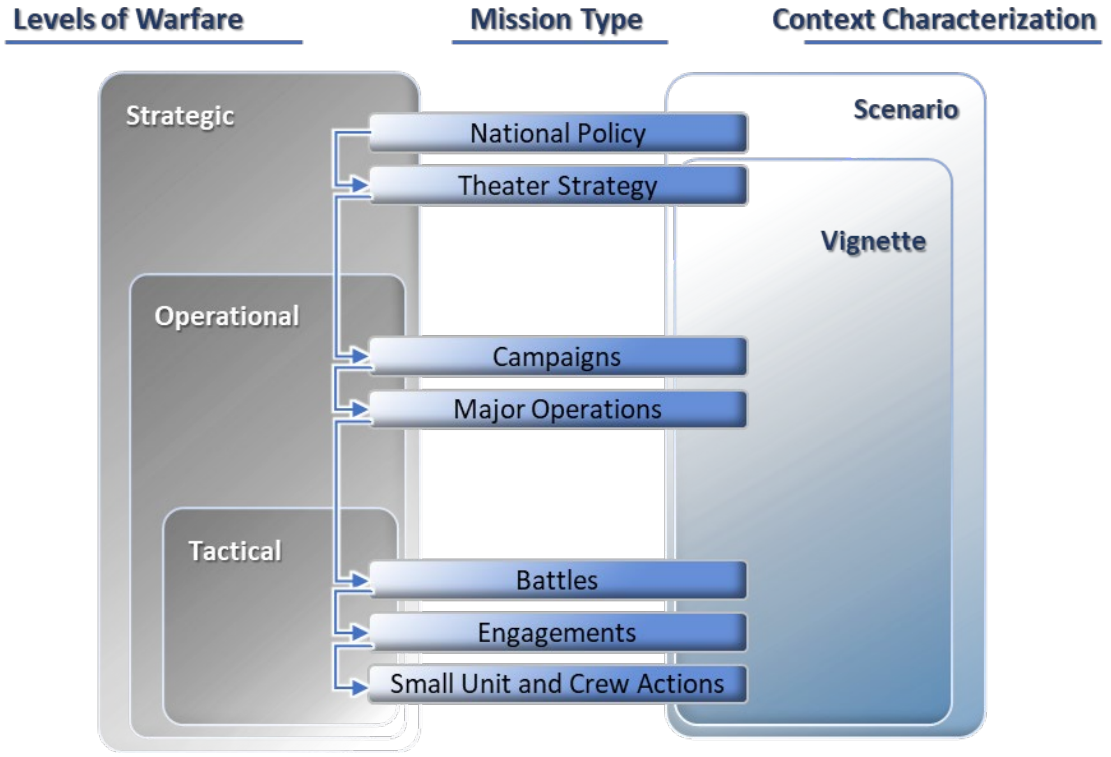
Systematic understanding of model pedigree, information gaps, and related confidence levels

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:**
  - Standardizes future theater threat laydown and conflict for DoD planning
  - Provides top-level MOSs
  - Common starting point for mission engineering activities and leadership decisions

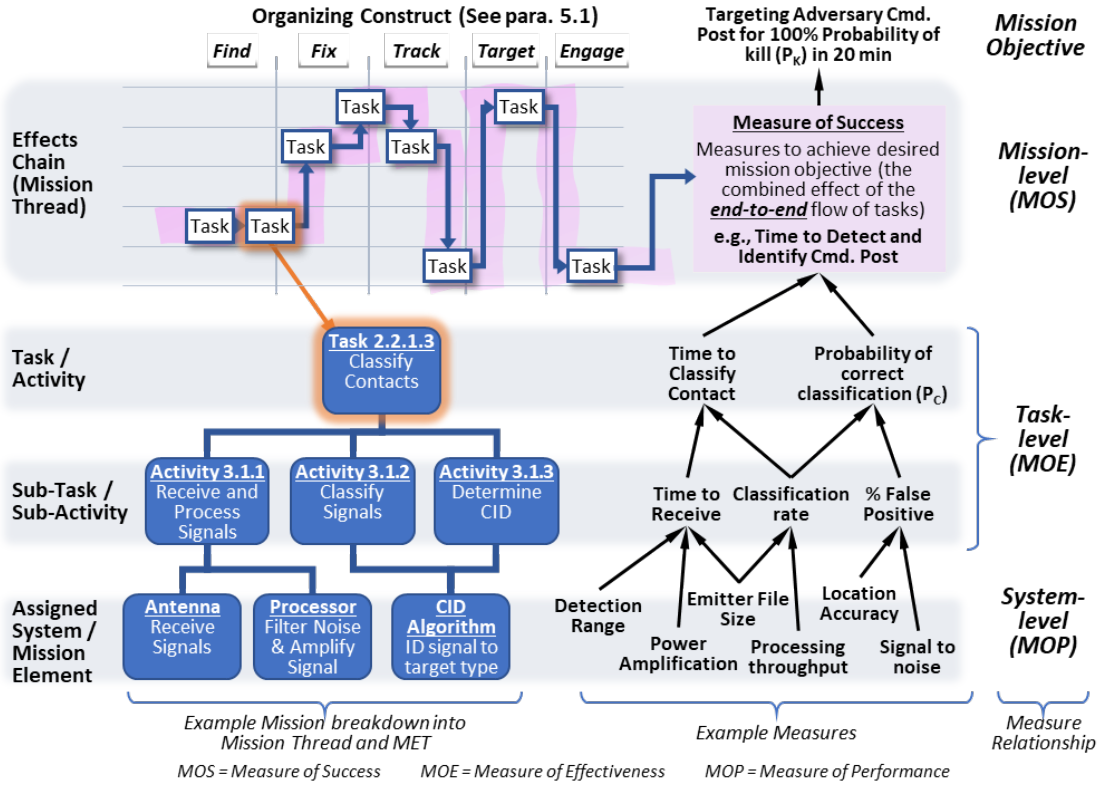
Vignette: Subset of a scenario to focus the scope, details, and tactical objectives to address the needs of the mission problem or opportunity

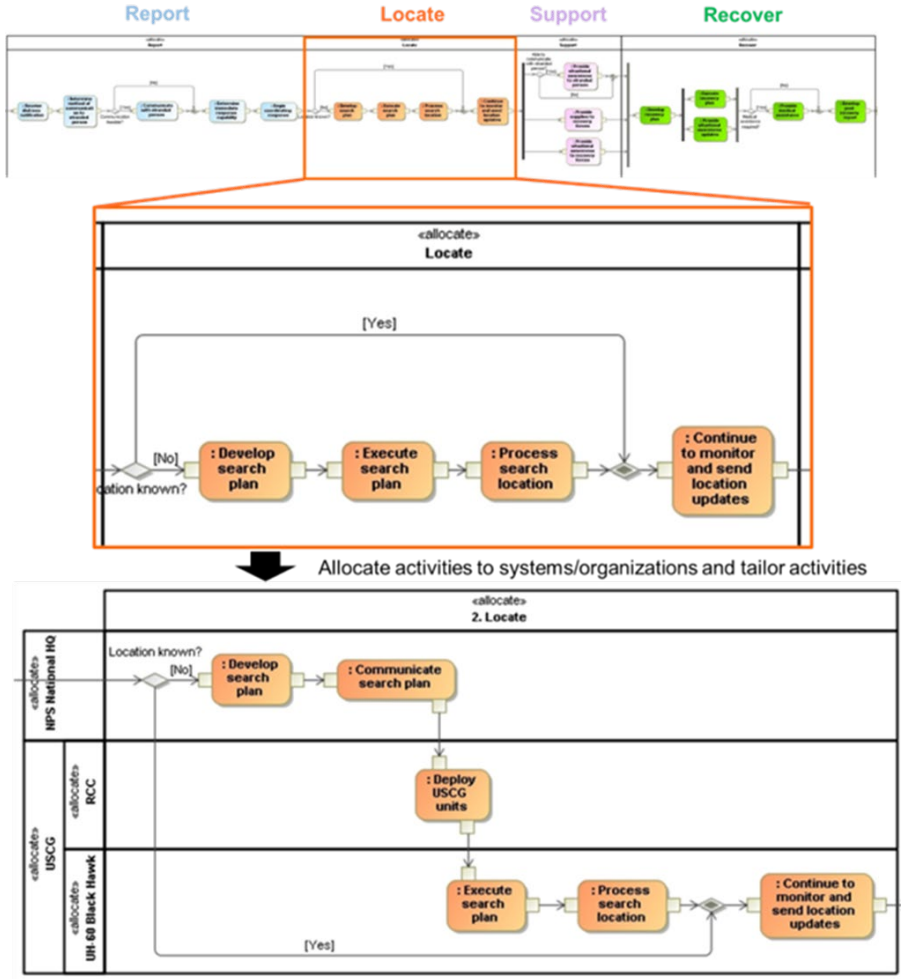
- Setting, objective(s), commander's intent
- Baseline forces, threats / intel, and order of battle
- Details of blue, green, and red CONOPS; Rules of engagement and operational tasks
- Clutter (e.g., neutral forces), contested, etc.
- Vignette measures (i.e., MOEs)
- Refining assumptions and conditions

Many vignettes can be derived from a single scenario

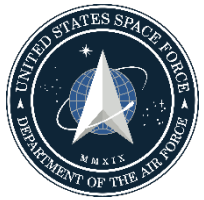
MOS = Measure of Success MOE = Measure of Effectiveness CONOPS= Concept of Operations

Mission Architecture Development



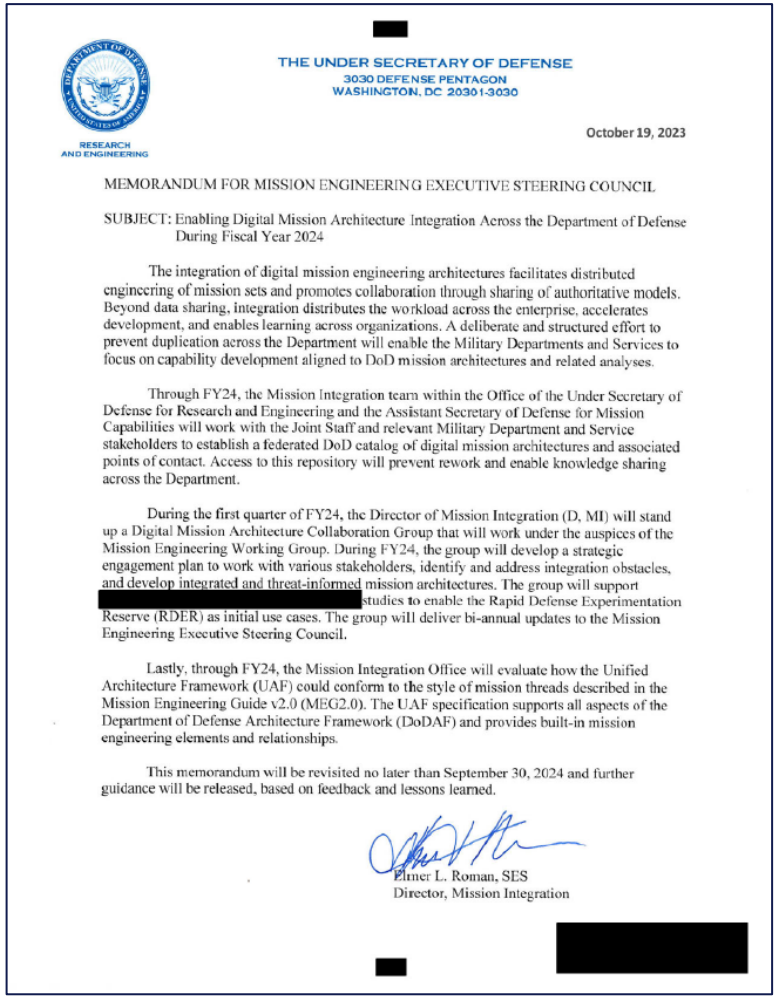


Mission Integration Across the Defense Enterprise



Fiscal Year 2024 Digital Mission Architecture Integration Guidance

- 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)



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THE UNDER SECRETARY OF DEFENSE
3030 DEFENSE PENTAGON
WASHINGTON, DC 20301-3030

RESEARCH AND ENGINEERING

October 19, 2023

MEMORANDUM FOR MISSION ENGINEERING EXECUTIVE STEERING COUNCIL

SUBJECT: Enabling Digital Mission Architecture Integration Across the Department of Defense During Fiscal Year 2024

The integration of digital mission engineering architectures facilitates distributed engineering of mission sets and promotes collaboration through sharing of authoritative models. Beyond data sharing, integration distributes the workload across the enterprise, accelerates development, and enables learning across organizations. A deliberate and structured effort to prevent duplication across the Department will enable the Military Departments and Services to focus on capability development aligned to DoD mission architectures and related analyses.

Through FY24, the Mission Integration team within the Office of the Under Secretary of Defense for Research and Engineering and the Assistant Secretary of Defense for Mission Capabilities will work with the Joint Staff and relevant Military Department and Service stakeholders to establish a federated DoD catalog of digital mission architectures and associated points of contact. Access to this repository will prevent rework and enable knowledge sharing across the Department.

During the first quarter of FY24, the Director of Mission Integration (D, MI) will stand up a Digital Mission Architecture Collaboration Group that will work under the auspices of the Mission Engineering Working Group. During FY24, the group will develop a strategic engagement plan to work with various stakeholders, identify and address integration obstacles, and develop integrated and threat-informed mission architectures. The group will support [redacted] studies to enable the Rapid Defense Experimentation Reserve (RDER) as initial use cases. The group will deliver bi-annual updates to the Mission Engineering Executive Steering Council.

Lastly, through FY24, the Mission Integration Office will evaluate how the Unified Architecture Framework (UAF) could conform to the style of mission threads described in the Mission Engineering Guide v2.0 (MEG2.0). The UAF specification supports all aspects of the Department of Defense Architecture Framework (DoDAF) and provides built-in mission engineering elements and relationships.

This memorandum will be revisited no later than September 30, 2024 and further guidance will be released, based on feedback and lessons learned.

Elmer L. Roman, SES
Director, Mission Integration

[redacted]

Mission Architecture Style Guide

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

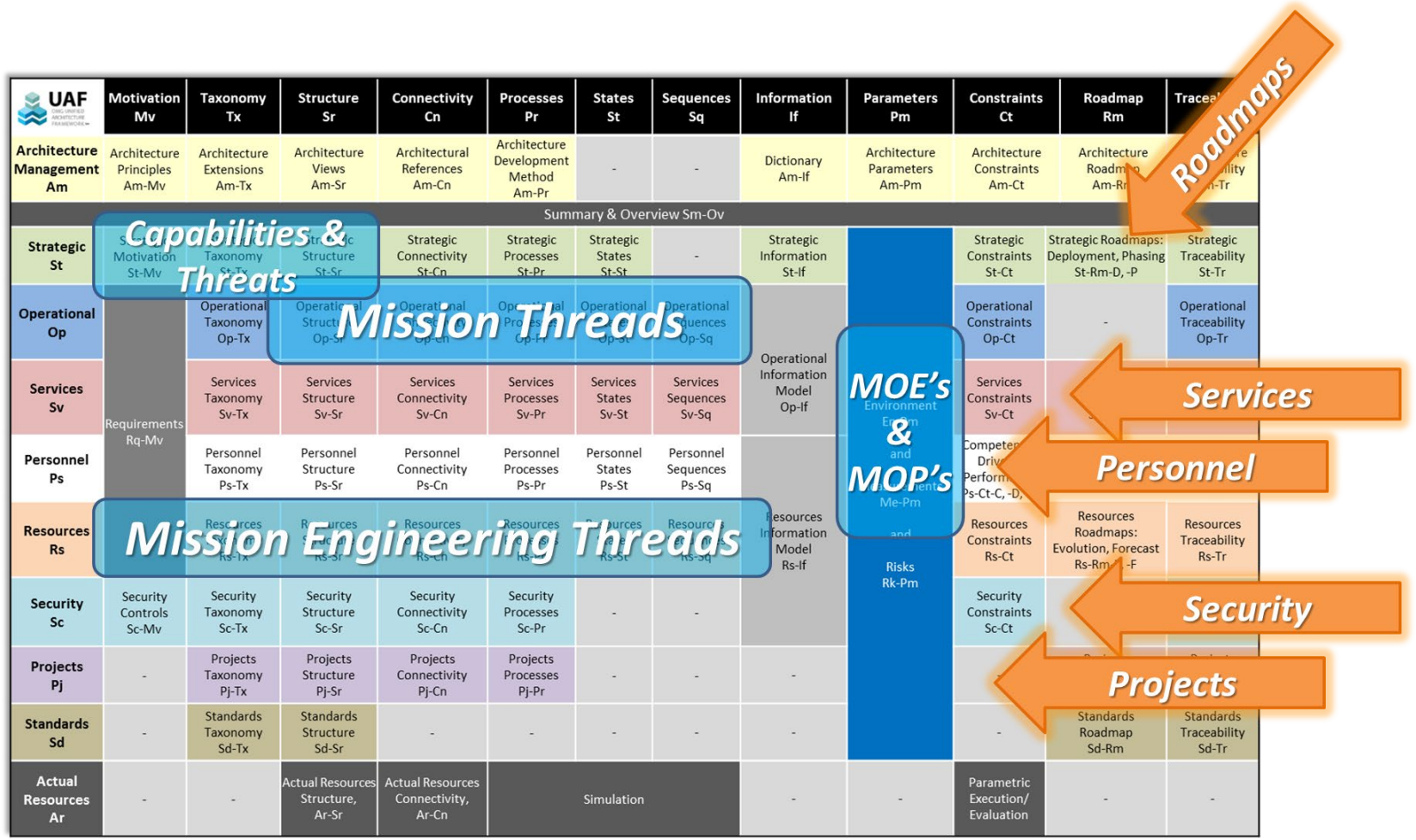
Document recommendations to facilitate model and data exchange between stakeholders

Continue development to capture measures, represent behaviors

Coordinate draft guidance across Department

Publish the Mission Architecture Style Guide

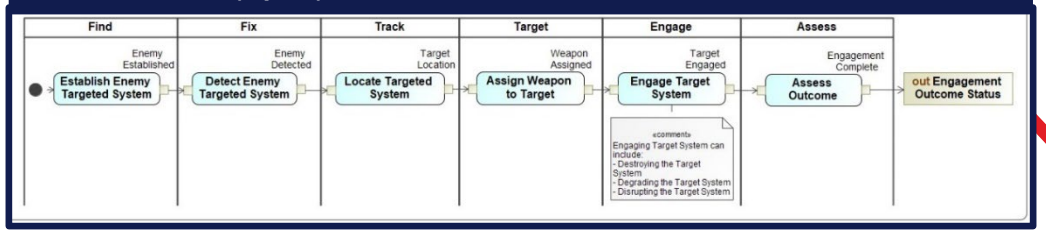
Mission Architectures in the Unified Architecture Framework®



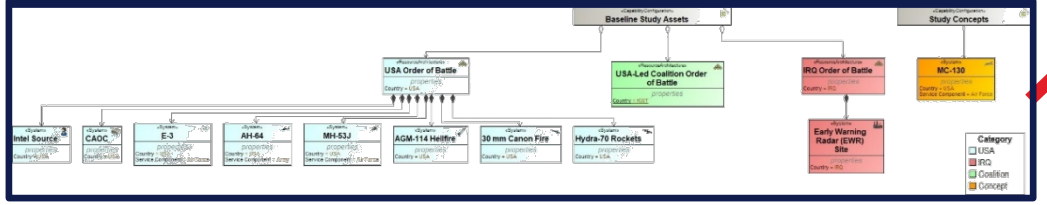
UAF	Motivation Mv	Taxonomy Tx	Structure Sr	Connectivity Cn	Processes Pr	States St	Sequences Sq	Information If	Parameters Pm	Constraints Ct	Roadmap Rm	Traceability Tr
Architecture Management Am	Architecture Principles Am-Mv	Architecture Extensions Am-Tx	Architecture Views Am-Sr	Architectural References Am-Cn	Architecture Development Method Am-Pr	-	-	Dictionary Am-If	Architecture Parameters Am-Pm	Architecture Constraints Am-Ct	Architecture Roadmap Am-Rm	Architecture Traceability Am-Tr
Summary & Overview Sm-Ov												
Strategic St	Strategic Motivation St-Mv	Strategic Taxonomy St-Tx	Strategic Structure St-Sr	Strategic Connectivity St-Cn	Strategic Processes St-Pr	Strategic States St-St	-	Strategic Information St-If		Strategic Constraints St-Ct	Strategic Roadmaps: Deployment, Phasing St-Rm-D, -P	Strategic Traceability St-Tr
Operational Op		Operational Taxonomy Op-Tx	Operational Structure Op-Sr	Operational Connectivity Op-Cn	Operational Processes Op-Pr	Operational States Op-St	Operational Sequences Op-Sq	Operational Information Model Op-If		Operational Constraints Op-Ct	-	Operational Traceability Op-Tr
Services Sv	Requirements Rq-Mv	Services Taxonomy Sv-Tx	Services Structure Sv-Sr	Services Connectivity Sv-Cn	Services Processes Sv-Pr	Services States Sv-St	Services Sequences Sv-Sq			Services Constraints Sv-Ct		
Personnel Ps		Personnel Taxonomy Ps-Tx	Personnel Structure Ps-Sr	Personnel Connectivity Ps-Cn	Personnel Processes Ps-Pr	Personnel States Ps-St	Personnel Sequences Ps-Sq			Competency and Performance Ps-Ct-C, -D,		
Resources Rs		Resources Rs-Tx	Resources Rs-Sr	Resources Rs-Cn	Resources Rs-Pr	Resources Rs-St	Resources Rs-Sq	Resources Information Model Rs-If		Resources Constraints Rs-Ct	Resources Roadmaps: Evolution, Forecast Rs-Rm-E, -F	Resources Traceability Rs-Tr
Security Sc	Security Controls Sc-Mv	Security Taxonomy Sc-Tx	Security Structure Sc-Sr	Security Connectivity Sc-Cn	Security Processes Sc-Pr	-	-		Risks Rk-Pm	Security Constraints Sc-Ct		
Projects Pj	-	Projects Taxonomy Pj-Tx	Projects Structure Pj-Sr	Projects Connectivity Pj-Cn	Projects Processes Pj-Pr	-	-	-				
Standards Sd	-	Standards Taxonomy Sd-Tx	Standards Structure Sd-Sr	-	-	-	-	-		-	Standards Roadmap Sd-Rm	Standards Traceability Sd-Tr
Actual Resources Ar	-	-	Actual Resources Structure, Ar-Sr	Actual Resources Connectivity, Ar-Cn	Simulation			-	-	Parametric Execution/ Evaluation	-	-

Operation Desert Storm Historical Example

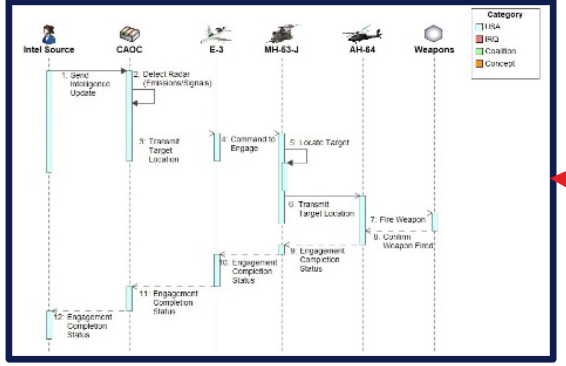
Mission Thread (Op-Pr)



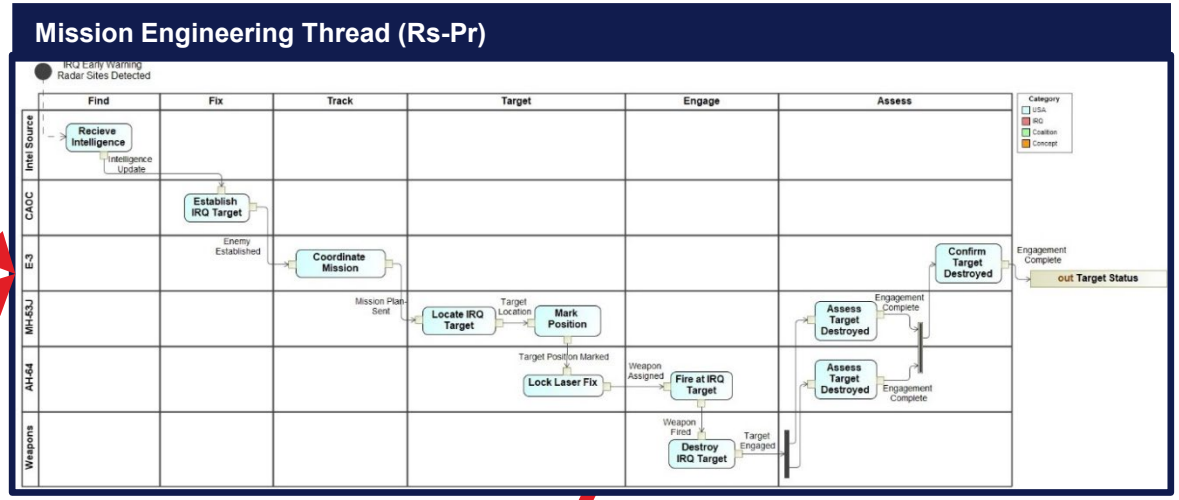
Order of Battle (Rs-Sr)



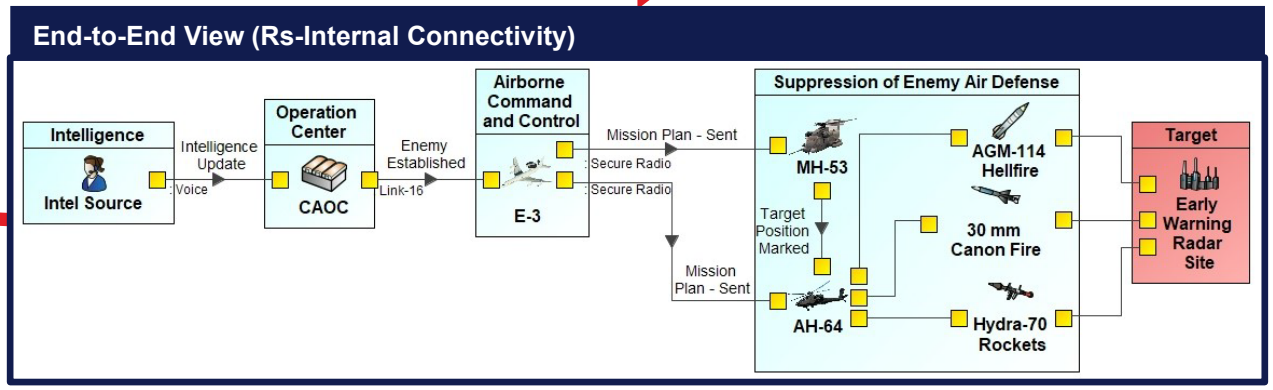
Sequence Diagram (Rs-Sq)



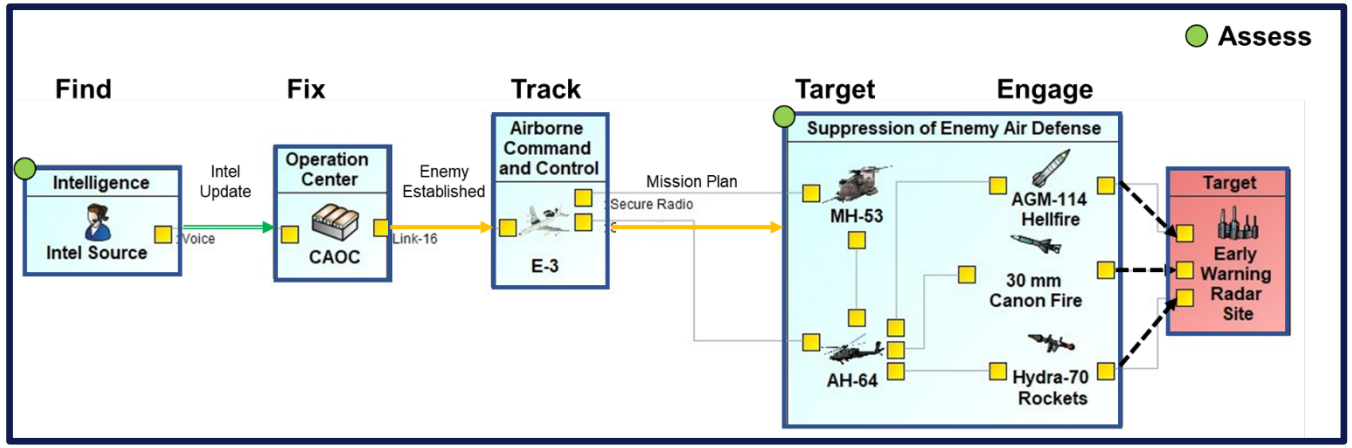
Mission Engineering Thread (Rs-Pr)



End-to-End View (Rs-Internal Connectivity)

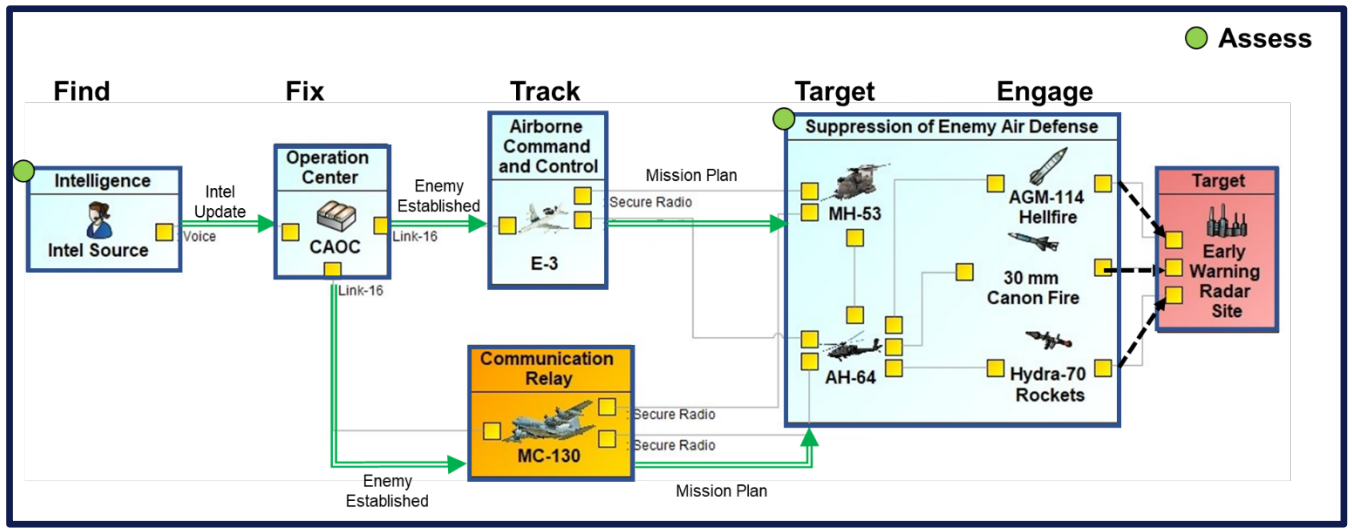


Baseline vs. Alternative Mission Engineering Threads



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.

Resilient Path
Vulnerable Path
Kinetic Engagement

Mission Architecture Style Guide Contents

Mission Engineering Architecture Development	Results and Recommendations	Sources	Best Practices

• Order of Battle (OOB)
• Mission Threads (MT)
• Mission Engineering Threads (MET)
• End-to-End Views (E2E)
• Sequence Diagrams (SEQ)
• *Measures*
• *Conditions*
• *Behaviors*
	• *Mission Architecture Analysis*
	• Presentations of Architecture to Leadership
		• Classification Guidance
		• References
		  • Pedigree
		  • Confidence Levels
			• Modularity

Summary

- 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)

- Mission Engineering Overview: https://ac.cto.mil/mission-engineering/
- Mission Engineering Guide: https://ac.cto.mil/wp-content/uploads/2023/11/MEG_2_Oct2023.pdf

Contact

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