



# **Mission Based Analysis in the Systems Engineering Process**

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# What is Mission Based Analysis?

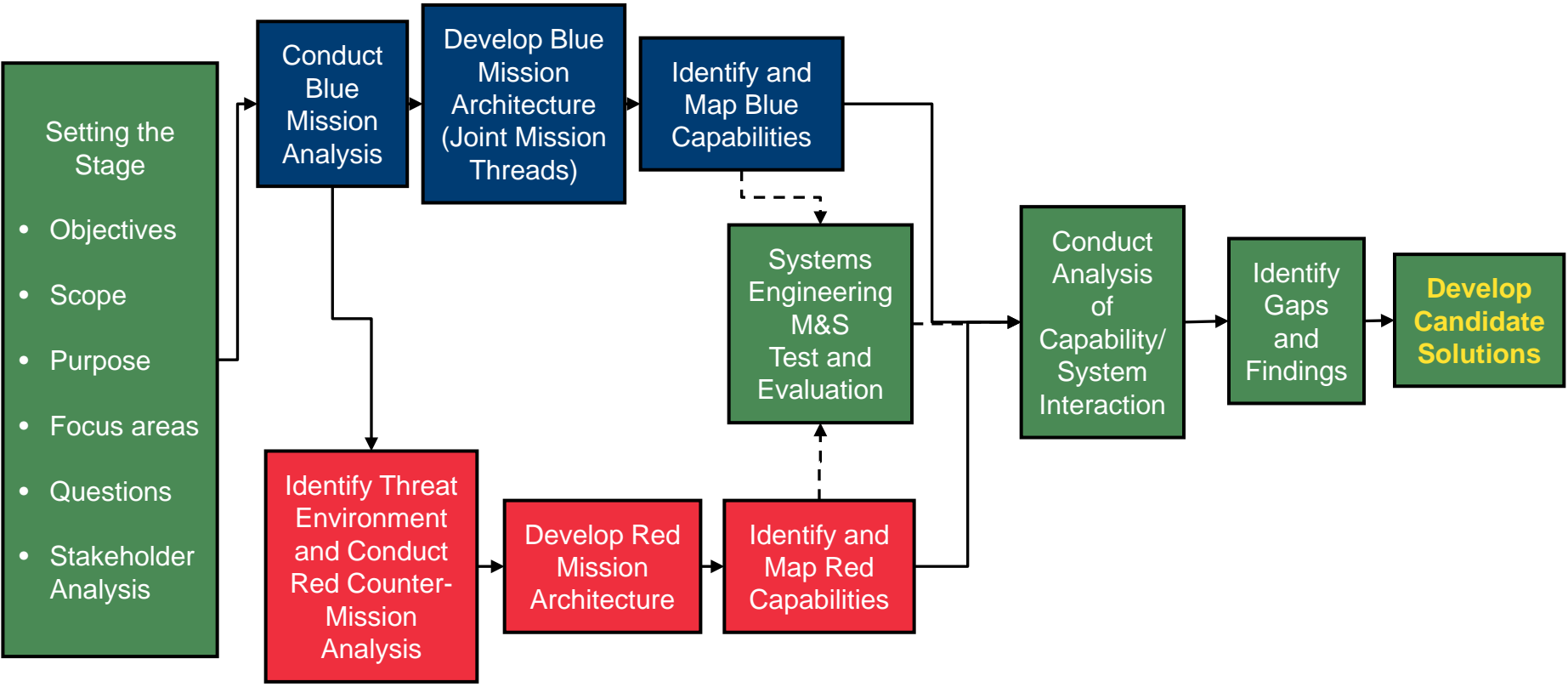


- **A repeatable means to improve end-to-end warfighter mission capability in an adversary environment**
  - Provides decision-quality information to understand capability, inform system engineering decisions and target areas for improvements
    - Requirements derivation
    - Systems integration
    - Measures and metrics
    - Technology insertion (P3I)
    - Basic Research priorities
    - Test and Evaluation and Model and Simulation context and scenarios

**Enhancing warfighter capability in an adversarial environment!**



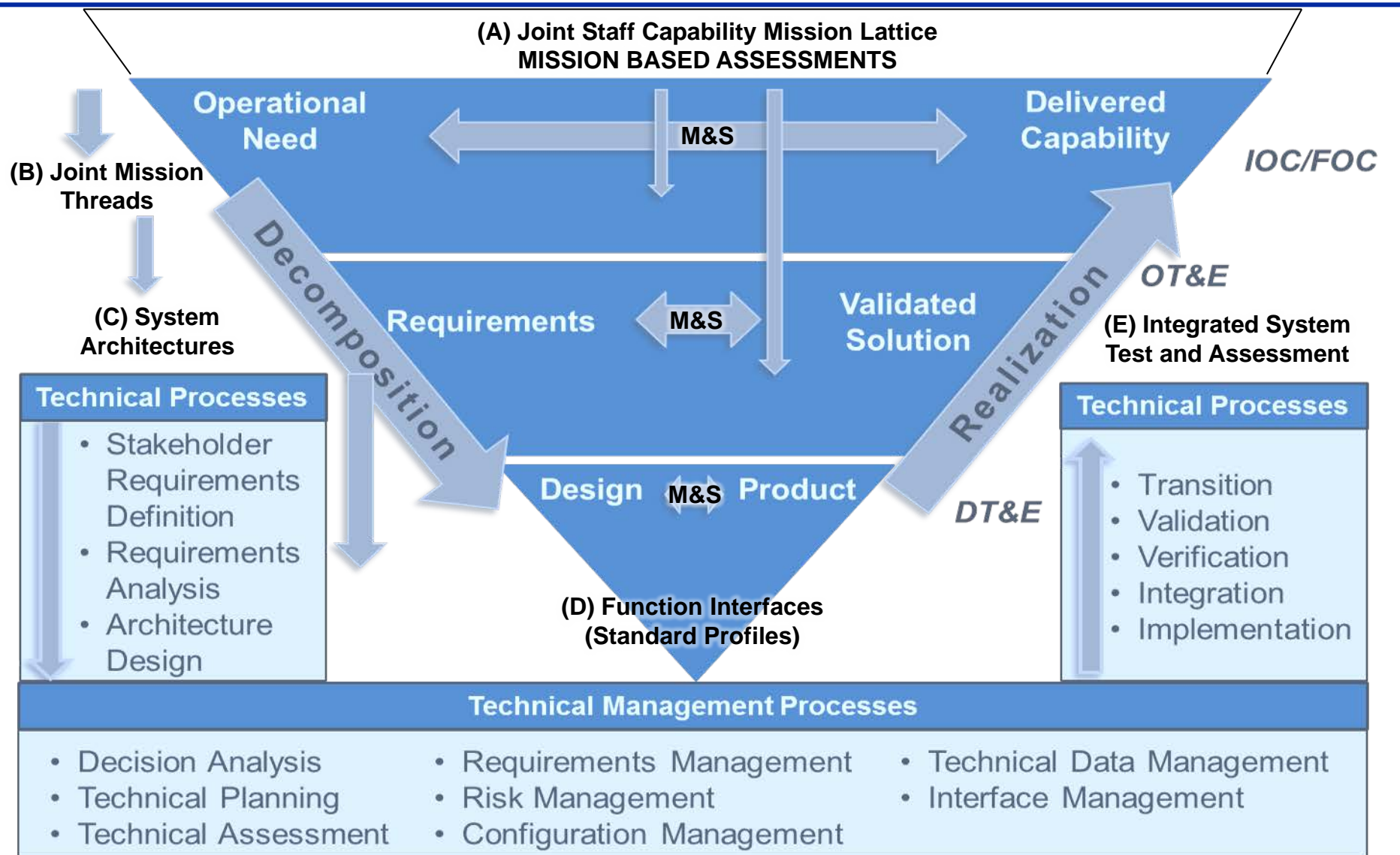
# Mission Based Analysis Process



**Joint Suppression of Enemy Air Defense Completed FY-15**



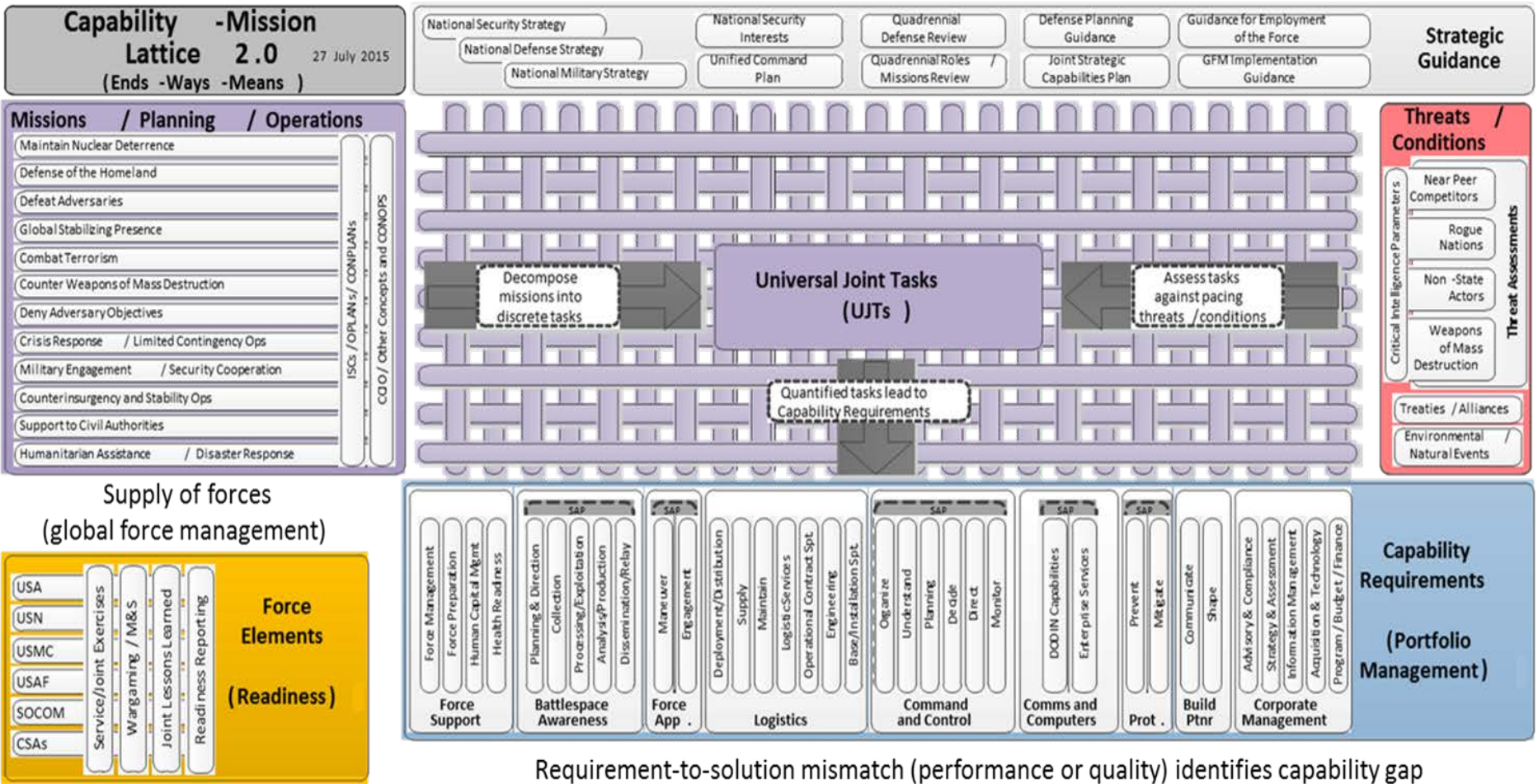
# Mission Based Systems Engineering







# (A) Capability-Mission Lattice

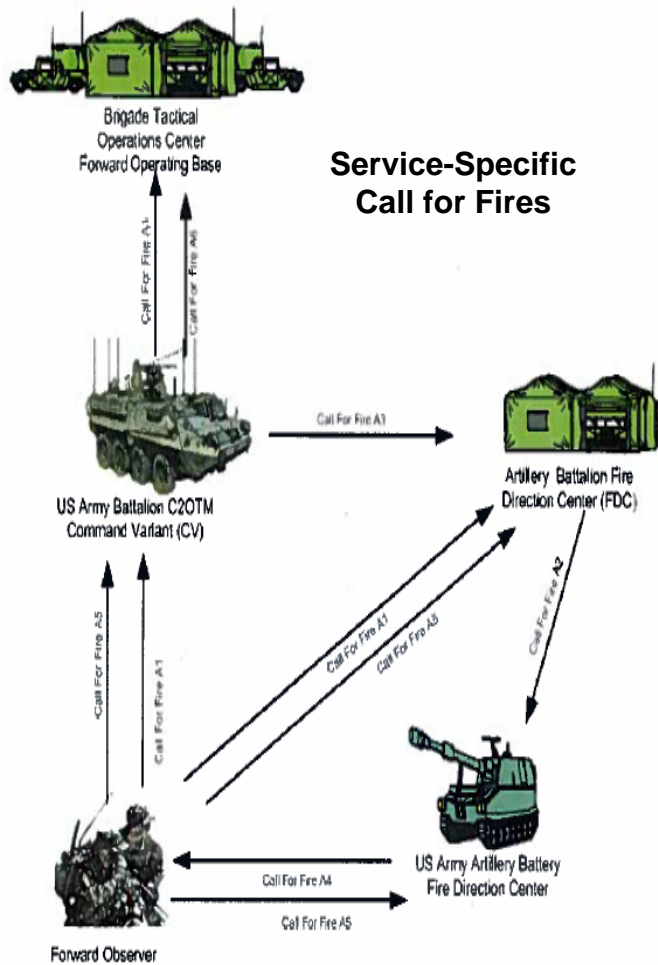


Requirement-to-solution mismatch (performance or quality) identifies capability gap

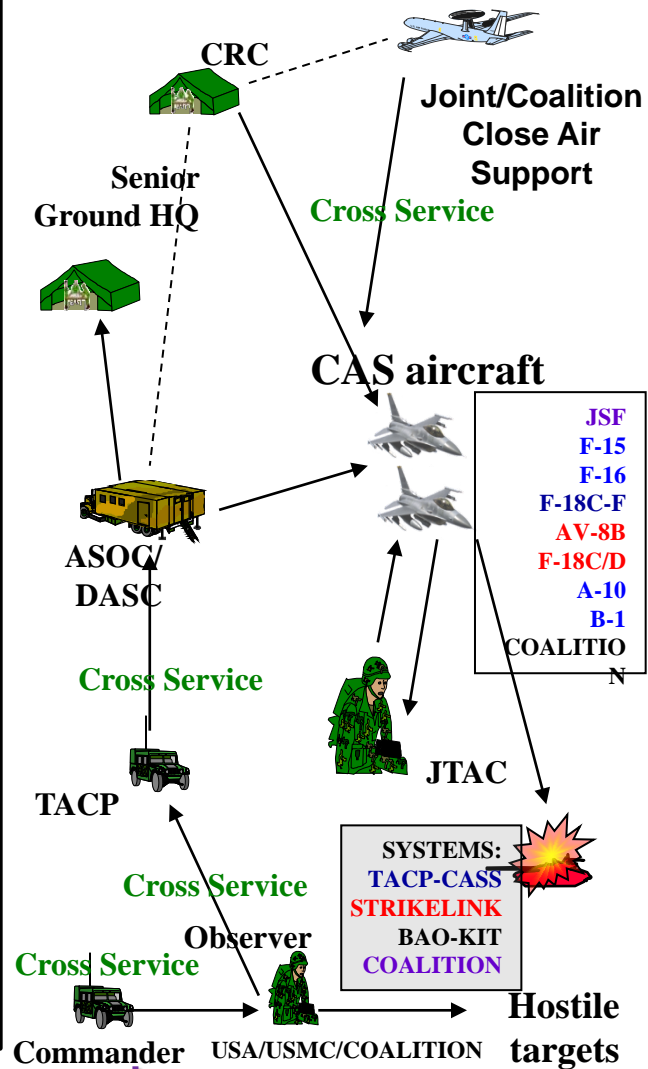
Note: each CML is a snapshot in time; can be layered for depth



# (B) Joint Mission Threads Integrated System Interfaces



Mission Event No.	Description
1	Unit detects target
2	Commander decides to request CAS
3	Unit notified TACP < 3min
4	TACP passes request to ASOC
5	ASOC coordinates with senior ground HQs which approve request
6	ASOC assigns on-call aircraft
7	CRC send aircraft to contact point (CP)
8	AWACS passes critical updates to aircraft > 95% Acrcy
9	JTAC briefs aircraft < 2 min
10	Aircraft depart initial point (IP)
11	JTAC controls CAS aircraft
12	Bombs on target > 98.9 % PK
13	Assessment



Service-centric to Enterprise-centric approach





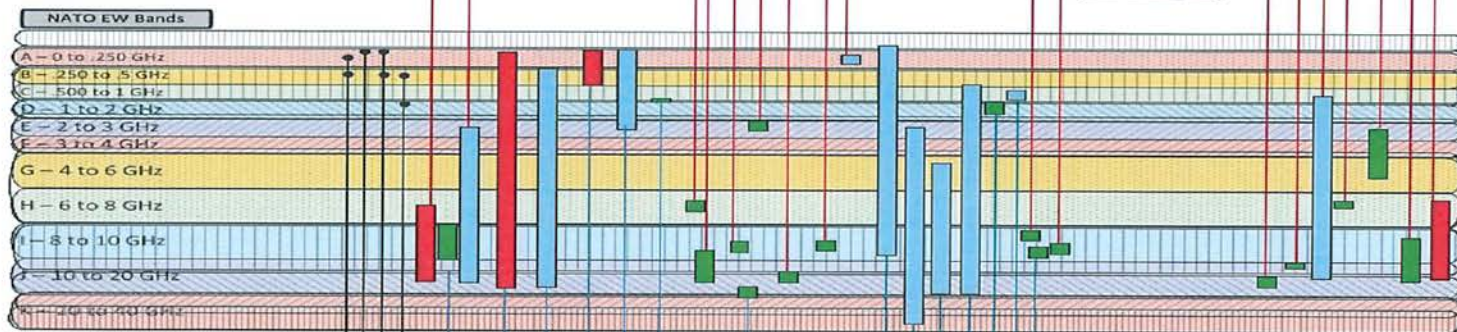
# (C) System Architectures (Example SV-1)



**KEY:**

- Radar
- Communications
- Electronic Attack (EA) Capability (e.g. Jamming)
- Electronic Surveillance (ES) / Electronic Support Measures (ESM) Capability
- Potential ES / ESM Capability
- Adversary Systems
- Friendly Systems

COMMS Bands
VHF-30 to 300 MHz
UHF - 300 to 1 GHz
L - 1 to 2 GHz
S - 2 to 4 GHz
C - 4 to 8 GHz
X - 8 to 12 GHz
Ku - 12 to 18 GHz
K - 18 to 26.5 GHz
Ka - 26.5 to 40 GHz



**Blue Platform**

- VHF/UHF Link 16
- Capability
- Capability
- Capability
- Capability

**Blue Platform**

- VHF/UHF HF Link 11
- Link 12
- Capability
- Capability

**Red Platform**

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**Red Platform**

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**Blue Platform**

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**Blue Platform**

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# (D) Function Interfaces (example)



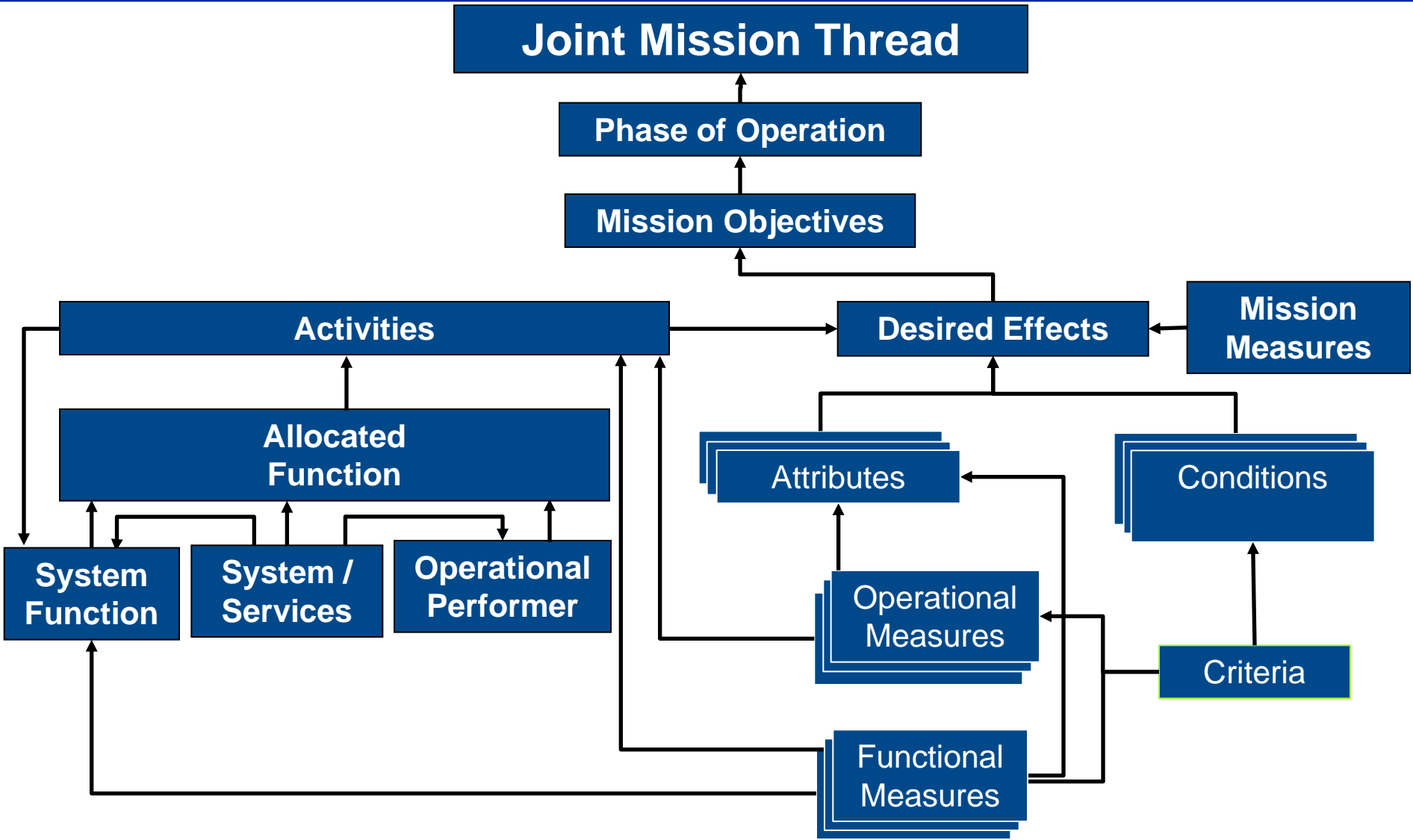
- **Variable Message Format (VMF) interoperability was broken**
  - No common digital messaging network in place or planned for Joint Tactical Air Controller, Forward Air Controller, and Strike Aircraft
  - Aircraft systems implemented different data-link standards, standards versions, and options
    - With the 47001B header there was no 'label' identifying the version of the VMF message behind it
    - Accepting computer could not recognize which version of the message was received, hence, data fields grabbed incorrectly.

**Must be able to identify problem and correct during design phase!**





# (E) Integrated Test and Assessment - Deriving Measures and Metrics -





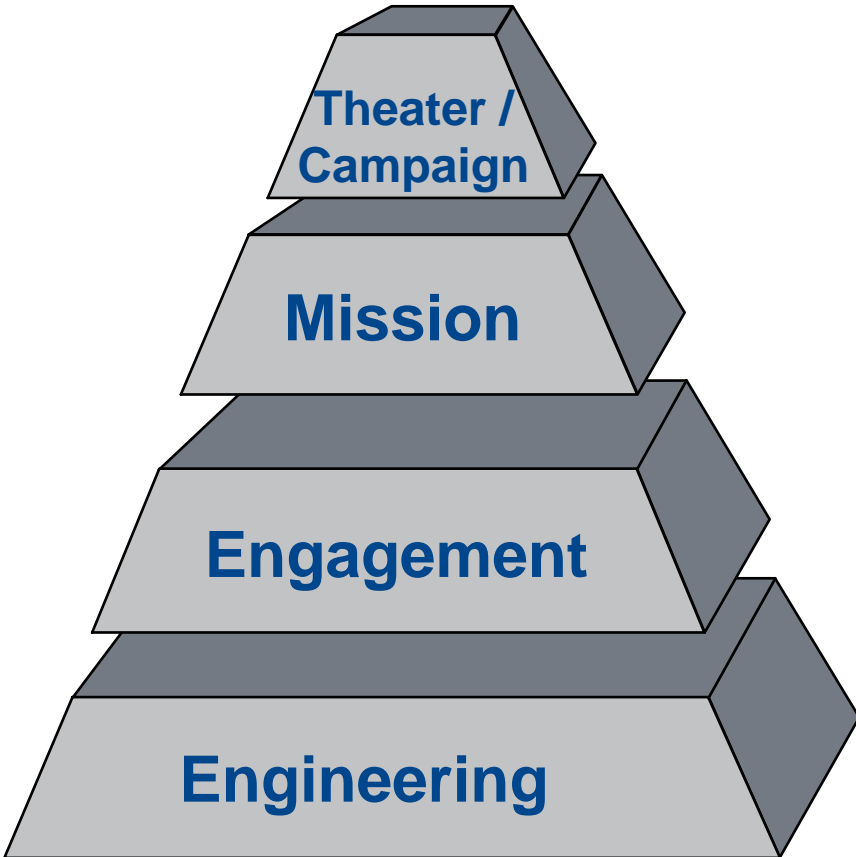
# Integrated Test and Assessment



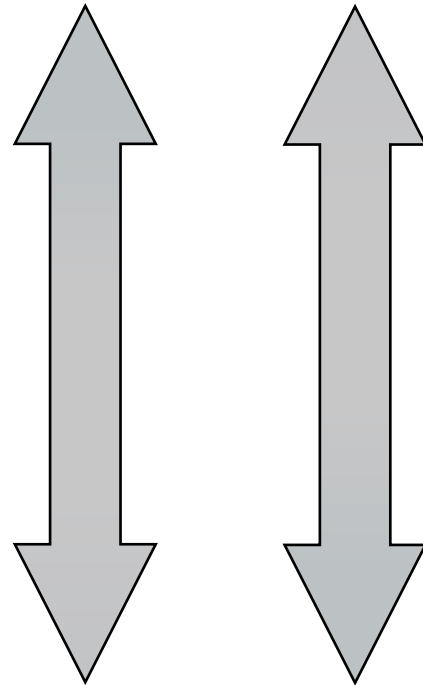
- **Bold Quest (Joint Staff)**
  - Joint and Multinational Fires Support, Personnel Recovery
- **Vigilant Hammer (OSD AT&L)**
  - Electronic Warfare
- **Network Integration Evaluation (Army)**
  - Integrated evaluations of networked systems
- **Mission-Level Test and Evaluation (Navy)**
  - Surface Warfare Integration and Interoperability



# Baselining Models and Simulations



**Degree of aggregation**



**Degree of resolution**



# Key DoD Policy

## JOINT STAFF

- **Joint Capability Integration and Development System (JCIDS) Instruction, Manual, 2015**
  - Mandating mission-based assessments and systems interoperability across DoD and components

## AT&L

- **Department of Defense Instruction (DoDI) 5000.02 Operation of the Defense Acquisition System, 2015**
  - Component Developer will prepare a Concept of Operations, Operational Mode Summary, Mission Profile to inform development plans
- **Systems Engineering Plan Annotated Outline, 2011**
  - Mission-critical external interoperability's
  - DoD Architectural Framework (Joint Mission Thread and Kill Chain Interfaces)
- **DoDI 8330.01, Interoperability of Information Technology (IT), Including National Security Systems (NSS), 2014**
  - Establishes DoD interoperability test capability, including operationally representative joint test environment
  - Joint Mission Environment Test Capability (OSD AT&L)





# Joint Mission Threat (JMT) Development



- Joint Close Air Support
- Joint Personnel Recovery
- Global Force Management
- Electronic Warfare/Electronic Attack
- Joint Fires Support
- Ballistic Missile Defense Command and Control Integration
- Counter Improvised Explosive Device
- Integrated Air and Missile Defense
- Dynamic Targeting
- Integrated Tactical Warning and Attack Assessment
- Joint Suppression of Enemy Air Defense
- Civil Information Management
- Joint Information Environment
- Future Partner Environment

- Anti-Air Warfare
- Humanitarian Assistance and Disaster Relief
- Interagency Interoperability
- CND/CAN/CNE (CYBER)

- Non-combat Evacuation
- Counter Drug
- Tactical Airlift
- Strategic Attack
- Maritime Interception

- Interdiction
- Countering Weapons of Mass Destruction
- Casualty Management
- Military Information Support Operations
- Non-lethal Capabilities
- Counter mine

- Amphibious Assault
- Mine Operations
- Defensive countermeasures
- Military Deception

Tier 1/2 (Operational and System Architectures)  
 Tier 1 Complete (Operational Architectures)  
 Tier 1/2 (Planned)

Plans underway to accelerate JMTs development



# Barriers and Challenges



- **Requirement documents consistently identifying Joint Mission Areas**
- **Decomposing system requirements and architectures from Capability Requirements and Joint Mission Areas**
- **Designing and assessing (analysis of alternatives and request for proposals, etc.) with Joint Capability in mind**
- **Cross-program communication and cooperation**
- **Early focus on Mission-Based Systems Engineering Measure and Metrics**



# Mission Based Analysis Benefits



- **Increase weapon systems exploitation to full operational and technical capability**
- **Reduce redundant capability, spending, and unnecessary workarounds**
- **Instill a culture of savings and restraint in the Defense acquisition and logistics enterprise**

**Enabling joint and multi-national warfighters to win!**



# Useful Links



- **Warfighting Mission Area Architecture Federation and Integration Portal (requires CAC)**

NIPR: <https://wmaafip.csd.disa.mil/>

- **Systems Engineering Plan**

[http://www.acq.osd.mil/se/docs/PDUSD-Approved.SEP\\_Outline-04-20-2011.docx](http://www.acq.osd.mil/se/docs/PDUSD-Approved.SEP_Outline-04-20-2011.docx)





# For More Information



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