Joint Test & Evaluation
Methodology Transition (JTEM-T)

Measuring System Contributions to System of Systems through Joint Mission Threads

Mark Fiebrandt – Senior Operations Research Analyst

Origin of *Testing in a Joint Environment*

Transformation Planning Guidance

- Joint "concept-centric" approach for capability development
- Integrated architectures define parameters of joint capabilities
- Need to test capabilities and architectures in a realistic joint environment

Signed by SecDef, April 2003

Strategic Planning Guidance

- Need realistic T&E in a joint environment
- Directed DOT&E to develop a roadmap to identify changes necessary to ensure T&E is conducted in a joint environment to enhance fielding of joint capabilities

Signed by SecDef, March 2004

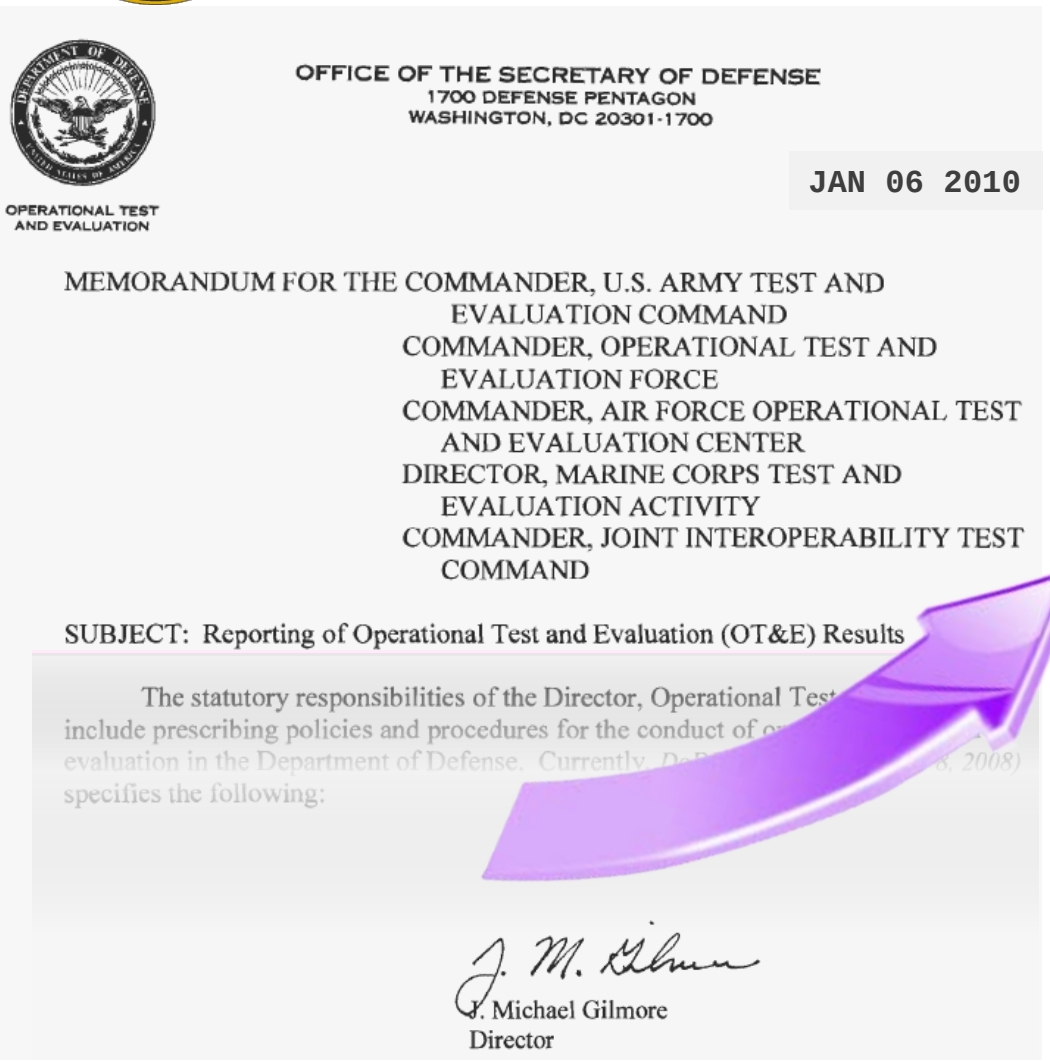
Testing in a Joint Environment Roadmap

- Required development of methods and processes to test capabilities in a Joint Mission Environment
- Required development of an infrastructure to support distributed testing
  - Network connectivity
  - Service environments
  - Program-specific
- Required evaluation of joint mission effectiveness

Signed by DepSecDef, Nov 2004

Recognized need for transformation

DOT&E Direction



OFFICE OF THE SECRETARY OF DEFENSE
1700 DEFENSE PENTAGON
WASHINGTON, DC 20301-1700

OPERATIONAL TEST AND EVALUATION

JAN 06 2010

MEMORANDUM FOR THE COMMANDER, U.S. ARMY TEST AND EVALUATION COMMAND
COMMANDER, OPERATIONAL TEST AND EVALUATION FORCE
COMMANDER, AIR FORCE OPERATIONAL TEST AND EVALUATION CENTER
DIRECTOR, MARINE CORPS TEST AND EVALUATION ACTIVITY
COMMANDER, JOINT INTEROPERABILITY TEST COMMAND

SUBJECT: Reporting of Operational Test and Evaluation (OT&E) Results

The statutory responsibilities of the Director, Operational Test
include prescribing policies and procedures for the conduct of o
evaluation in the Department of Defense. Currently, D
specifies the following:

J. M. Gilmore

J. Michael Gilmore
Director

- Operational effectiveness and suitability must be evaluated and reported on the basis of whether a system can be used by Soldiers, Sailors, Airmen, and Marines to accomplish a combat mission.
- The appropriate environment for that evaluation includes the system under test and all interrelated systems (that is, its planned or expected environment in terms of weapons, sensors, command and control, and platforms, as appropriate) needed to accomplish an end-to-end mission in combat.
- The data used for evaluation are appropriately called measures of effectiveness, because they measure the military effect (mission accomplishment) that comes from the use of the system in its expected environment.
- This statement of policy precludes measuring operational effectiveness and suitability solely on the basis of system-particular performance parameters.

Joint Mission Environment (JME)

Measures Framework, JOC-T, and System Engineering processes combine to produce a Joint Mission Environment (JME) for testing

Joint Mission Environment (JME): A subset of the joint operational environment composed of force and non-force entities; conditions, circumstances, and influences within which forces employ capabilities to execute joint tasks to meet a specific mission objective. (TSSG Jun 2008)

Joint Capability Definition

Capability: The ability to achieve a desired effect under specified standards and conditions through combinations of means and ways across DOTMLPF to perform a set of tasks to execute a specified course of action

Ref. - CJCSI 3170.01G, Mar 2009

Combinations of Means and Ways

to perform

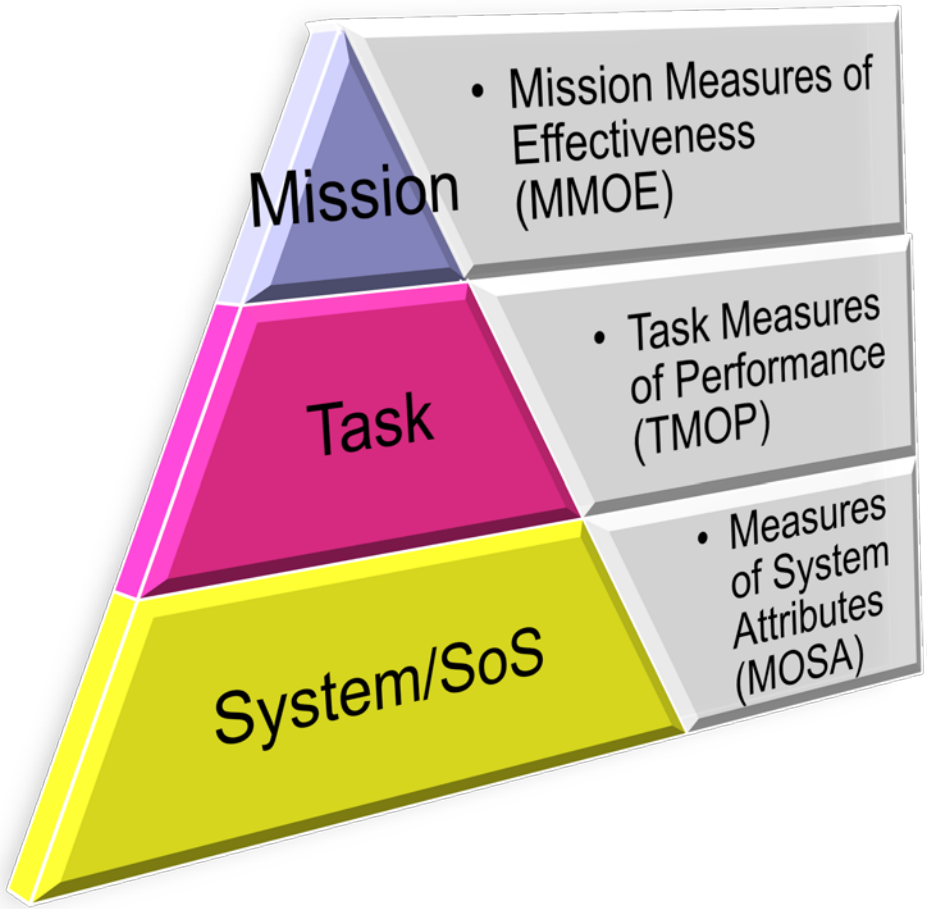
Set of Tasks

to achieve

Mission Desired Effects

Joint capabilities provide the means and ways to perform a set of tasks in order to achieve the set of desired effects that lead to mission success

Measures Framework



Capability definition (excerpts):

- **ability to achieve a desired effect**
- **to perform a set of tasks**
- **through combinations of means and ways**

The Measures Framework is based on systems performing tasks to accomplish a mission in a System-of-systems

Joint Mission Thread (JMT) Products

A **joint mission thread (JMT)** is an operational and technical description of the end to end set of activities and systems that accomplish the execution of a joint mission. (CJCSI 6212.01E)

Tier 1:
JMT: AV-1(High Level), OV-1, OV-2, OV-4, OV-5a, SV-1, Measures, High-Level Executable Architecture (EA) & IV

JMT generic data description – totally reusable architecture-based info sets

Tier 2:

JMT "Strands": (Additional) AV-1 (Specific), OV-2, OV-3, OV-4, OV-5b, OV-6c, SV-1, SV-3, SV-5s, SV-6, SV-10c, SvcV-3, SvcV-5, Baseline EA, or documents that show:

- Node/System Pairing
- Message Order
- Distributions
- Timings
- Decision processes
- System attributes
- System Functionality (IAW JCSFL)
- Information Exchange Requirements (IERs)
- Message composition
- Interoperability Matrix
- Data Exchange Requirements (DERs)
- System Capabilities

JMT "Strand" Tier 2 information represents specific documentation required to answer a particular question or solve a problem. JMT Strands are unique JMT segments that will have specific actors for each node, might use a Service-specific set of TTPs or CONOPS, may be AOR-specific or use a unique set of systems and apps – all subset of Tier 1 information (OV-5, SV-1, etc.).

Source: JMT CONOPS (draft) dated 20 Jan 2010

Initial List of JMTs

Most JMTs map to TACTICAL level UJTs

UJTL

TA 1 Deploy/Conduct Maneuver
TA 1.1.1 Conduct Tactical Airlift
TA 1.1.2 Conduct Shipboard Deck Helicopter Landing Qualifications
TA 1.1.4 Conduct Sea and Air Deployment Operations
TA 1.2 Conduct Passage of Lines
TA 1.2.1 Conduct Air Assault Operations and Air Assault
TA 1.2.2 Conduct Airborne Operations
TA 1.2.3 Conduct Amphibious Assault Operations
TA 1.2.4 Conduct Counterdrug Operations
TA 1.2.5 Conduct Sensitive Site Exploitation
TA 1.3 Conduct Countermine Operations
TA 1.4 Conduct Mine Operations
TA 1.6 Operate from Afloat Forward Staging Base (AFSB)
TA 2 Share Intelligence
TA 2.4 Disseminate Tactical Warning Information and Attack Assessment
TA 3 Employ Firepower
TA 3.2.1 Conduct Joint Fires
TA 3.2.1.1 Engage Time Sensitive Targets
TA 3.2.2 Conduct Close Air Support
TA 3.2.3 Conduct Interdiction Operations
TA 3.2.4 Conduct Joint Suppression of Enemy Air Defenses (JSEAD)
TA 3.2.6 Conduct Attacks Using Nonlethal Means
TA 3.2.7 Conduct Air and Missile Defense Operations
TA 3.2.8 Conduct Air to Air Operations
TA 3.3 Coordinate B
Integrate with Firep

JMT

Per: JMT CONOPS (draft) , 20 Jan 2010

- **Counter IED**
- **Joint Personnel Recovery (JPR)**
- **Joint Suppression of Air Enemy Defense (JSEAD)**
- **Interdiction**
- **Joint Close Air Support (JCAS)**
- **Defensive Countermeasures**
- **EW/EA**
- **Military Deception**
- **Mine Operations**
- **CND/CNA/CNE**
- **Time Sensitive Targeting**
- **Joint Fires**
- **Counter Mine**
- **Counter Drug**
- **Amphibious Assault**
- **Tactical Airlift**
- **Medical Evacuation**
- **Air and Missile Defense**
- **CWMD**
- **PSYOP**
- **Maritime Interception**
- **Non-Lethal Attack**
- **Non Combat Evacuation**
- **AAW**

UJTL

TA 3.3.1 Coordinate Air Tasking Order
TA 3.5 Conduct Precision Engagement Counter-Countermeasure Operations
TA 3.6 Conduct Detainee Operations
TA 5.5.1 Conduct Force Link-Up
TA 5.6 Employ Tactical Information Operations
TA 5.6.1 Provide Operations Security (OPSEC)
TA 5.6.3 Execute Military Deception (MILDEC) in the Joint Operations Area (JOA)
TA 5.6.4 Employ Electronic Warfare (EW) in the Joint Operations Area (JOA)
TA 5.6.5 Conduct Computer Network Operations (CNO)
TA 5.7 Conduct Civil Administration
TA 5.8 Conduct Official Ceremonial, Musical, Public and Special Events
TA 6 Protect the Force
TA 6.1 Provide Explosives Ordnance Disposal (EOD) Support
TA 6.2 Execute Personnel Recovery Operations
TA 6.3 Conduct Rear Area Security
TA 6.4 Conduct Noncombatant Evacuation
TA 6.5 Provide for Combat Identification
TA 6.8 Conduct Defensive Countermeasure Operations
TA 6.9 Conduct Counter Improvised Explosive Device (IED) Operations
TA 7 Operate in a Chemical, Biological, Radiological, Nuclear, and High-Yield Explosives (CBRNE) Environment
OP 1.6 Conduct Patient Evacuation
OP 3.2.2.1 Employ PSYOP in the JOA
OP 7 Execute CWMD Operations in JOA
OP 1.4.4 Conduct Maritime Interception

Other potential JMTs may exist within the UJTs

Joint Mission Environment (JME)

Relation to Joint Mission Thread Development

Independent variables (test factors)	Constants	Dependent variables
• SoS configurations • System attributes • DOTMLPF • Conditions: - Environment & Threat	• Mission • Tasks • Functions	• ***Mission measures*** • ***Task measures*** • System/SoS Attribute measures
Varied across test trials	**Constant across test trials**	**Measure changes across test trials**

A **joint mission thread (JMT)** is an operational and technical description of the end to end set of activities and systems that accomplish the execution of a joint mission. (CJCSI 6212.01E)

Joint Mission Environment (JME): A subset of the joint operational environment composed of force and non-force entities; conditions, circumstances and influences within which forces employ capabilities to execute joint tasks to meet a specific mission objective. ***(TSSG)***

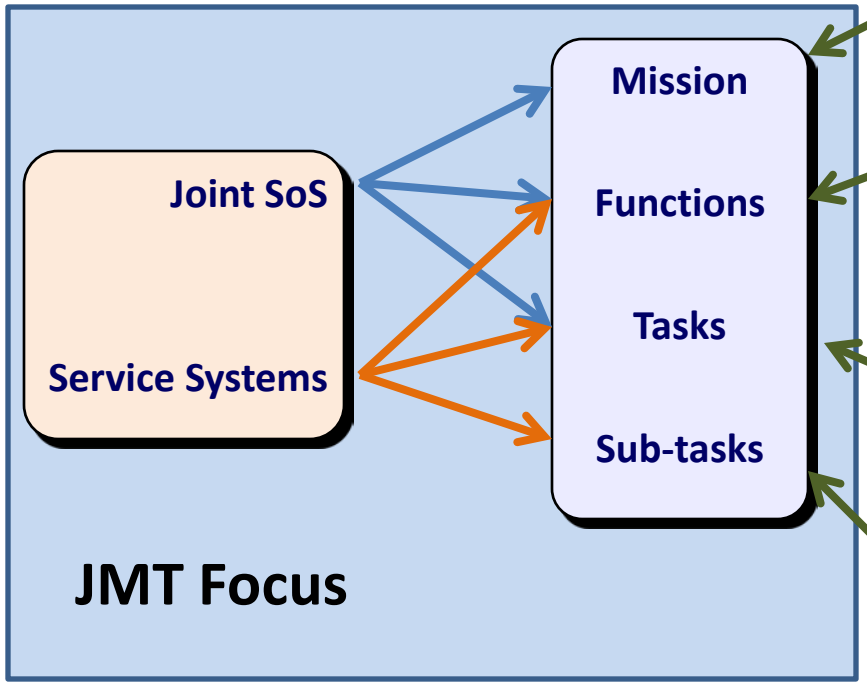
JMT Metrics Based on Requirements

Mission Measures of Effectiveness (MMOE)	Mission level measures that are stated in terms of warfighter effects to evaluate mission purpose (objectives and endstates)	**Warfighter Requirements (WR)**
Task Measures of Performance (TMOP)	Task level measures that are stated in terms of SoS/System performance to evaluate how well tasks (activities) are performed	**SoS Performance Requirements (SR)**
Measures of SoS Attributes (MOSA-1)	SoS level measures that are stated in terms of technical hardware and software requirements to evaluate net-ready characteristics (standards, protocols, system interoperability)	**Technical Requirements (TR)**
Measures of System Attributes (MOSA-2)	System level measures that are stated in terms of System/platform design requirements and documentation to evaluate suitability characteristics	**Design Decisions (DD)**

Joint Mission Thread Focus

Conceptual Decomposition

Performers ↔ DoDAF groups ↔ Activities



Definitions

Mission: The task, together with the purpose, that clearly indicates the action to be taken and the reason therefore (CJCSM 3500.04E, UJTL, 25 Aug 2008)

Function: A task, action, or activity expressed as a verb-noun combination (e.g., Brake Function: stop vehicle) to achieve a defined outcome. (IEEE 1220) The action for which a person or thing is specially designed, fitted, used or intended to accomplish or execute. (DoDAF 2.0)

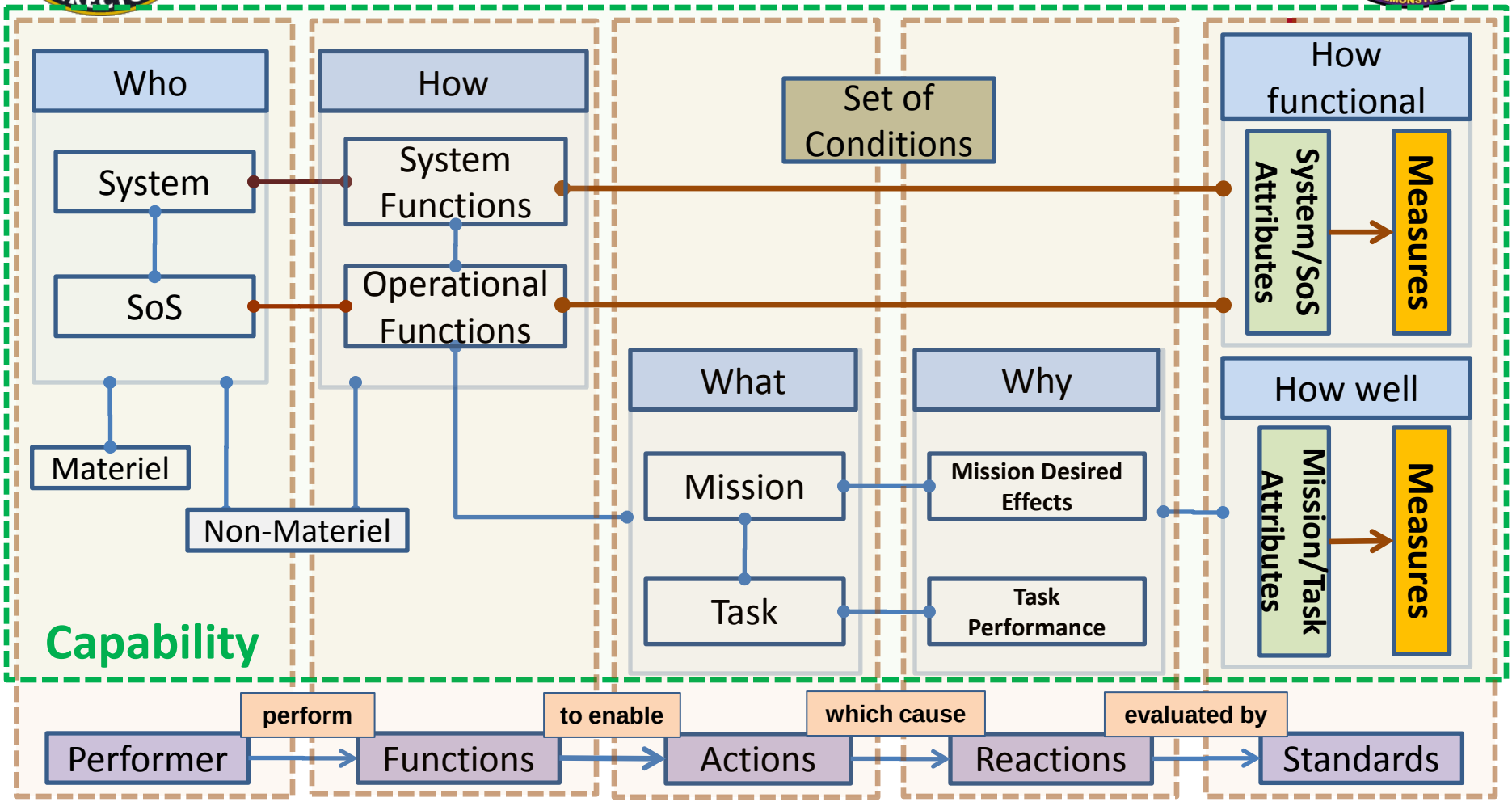
Task: An action or activity (derived from an analysis of the mission and concept of operations) assigned to an individual or organization to provide a capability (CJCSM 3500.04E, UJTL, 25 Aug 2008)

Sub-tasks: A decomposed task into specified actions.

The mission establishes the requirement to perform tasks and provides the context for each task's performance … and provides a way to understand precisely how the performance of a task contributes to mission success

Ref. - CJCSM 3500.04E, UJTL, Aug 2008, pg A-4

TIJE Measures Development Reference Model (1/21/2010)

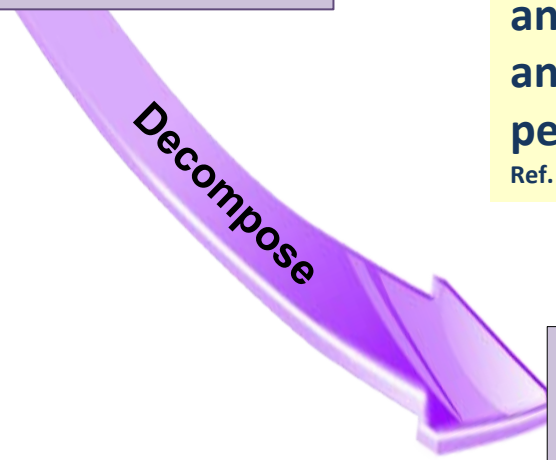


Combinations of Means & Ways → to perform → Set of Tasks → to achieve → Mission Desired Effects

Joint capabilities **provide the means and ways to perform a set of tasks to achieve mission desired effects**

JMT Decomposition Process Outline (Applying to T&E)

JMT Artifacts (OVs, SVs, SvcV)



Mission Analysis

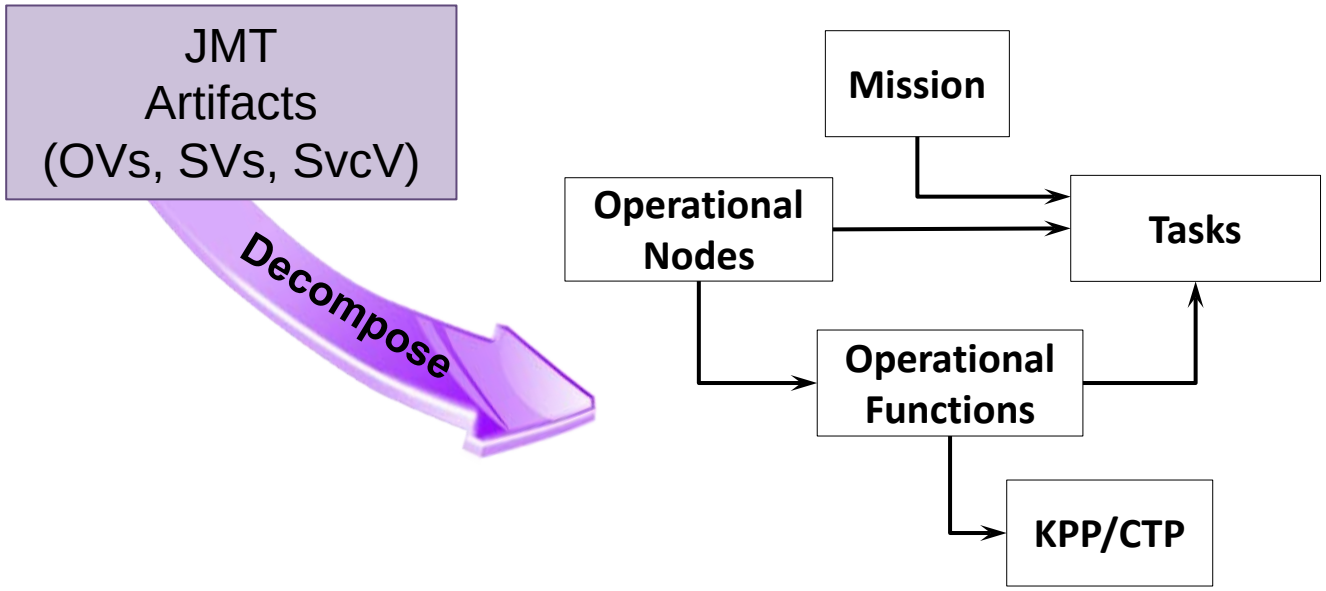
The mission establishes the requirement to perform tasks and provides the context for each task's performance … and provides a way to understand precisely how the performance of a task contributes to mission success

Ref. - CJCSM 3500.04E, UJTL, Aug 2008, pg A-4

- Mission description → Measures
- Mission → Tasks → Measures
- SoS functions → Measures

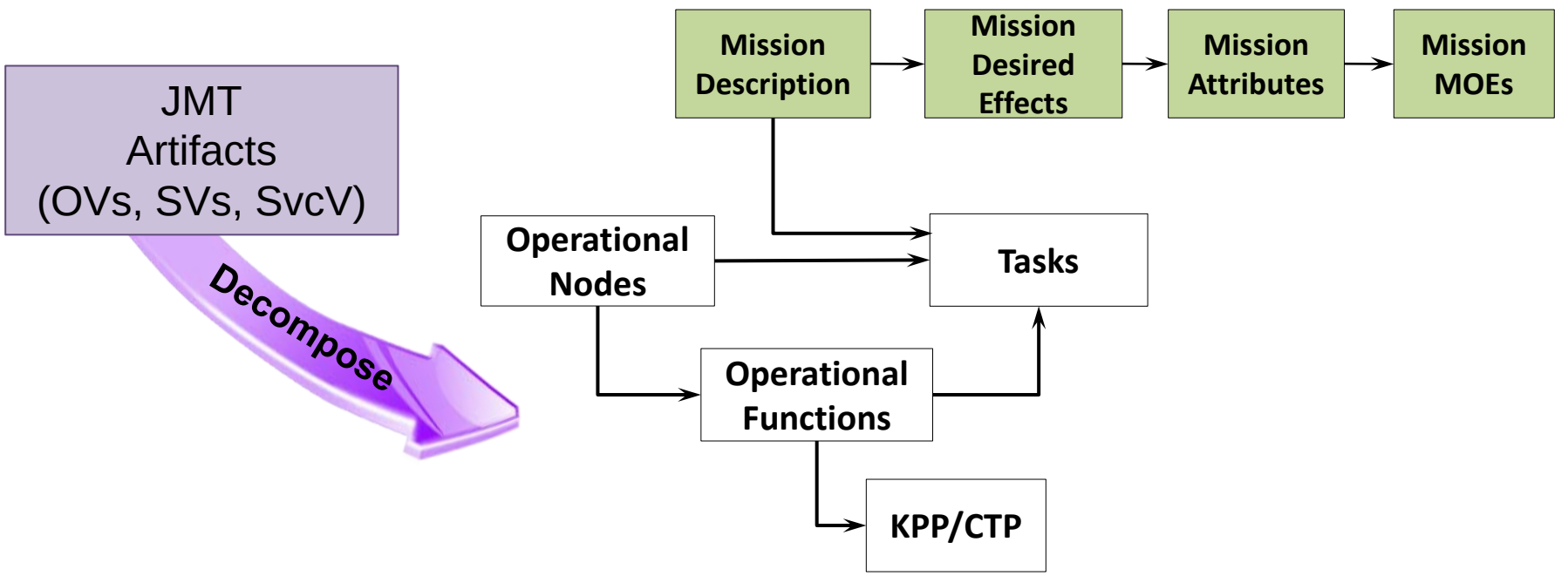
JMT can be decomposed to measures at Mission & Task levels

JMT Decomposition Process Outline (Applying to T&E)



Mission analysis identifies Operational nodes, tasks, functions, and KPPs/CTPs

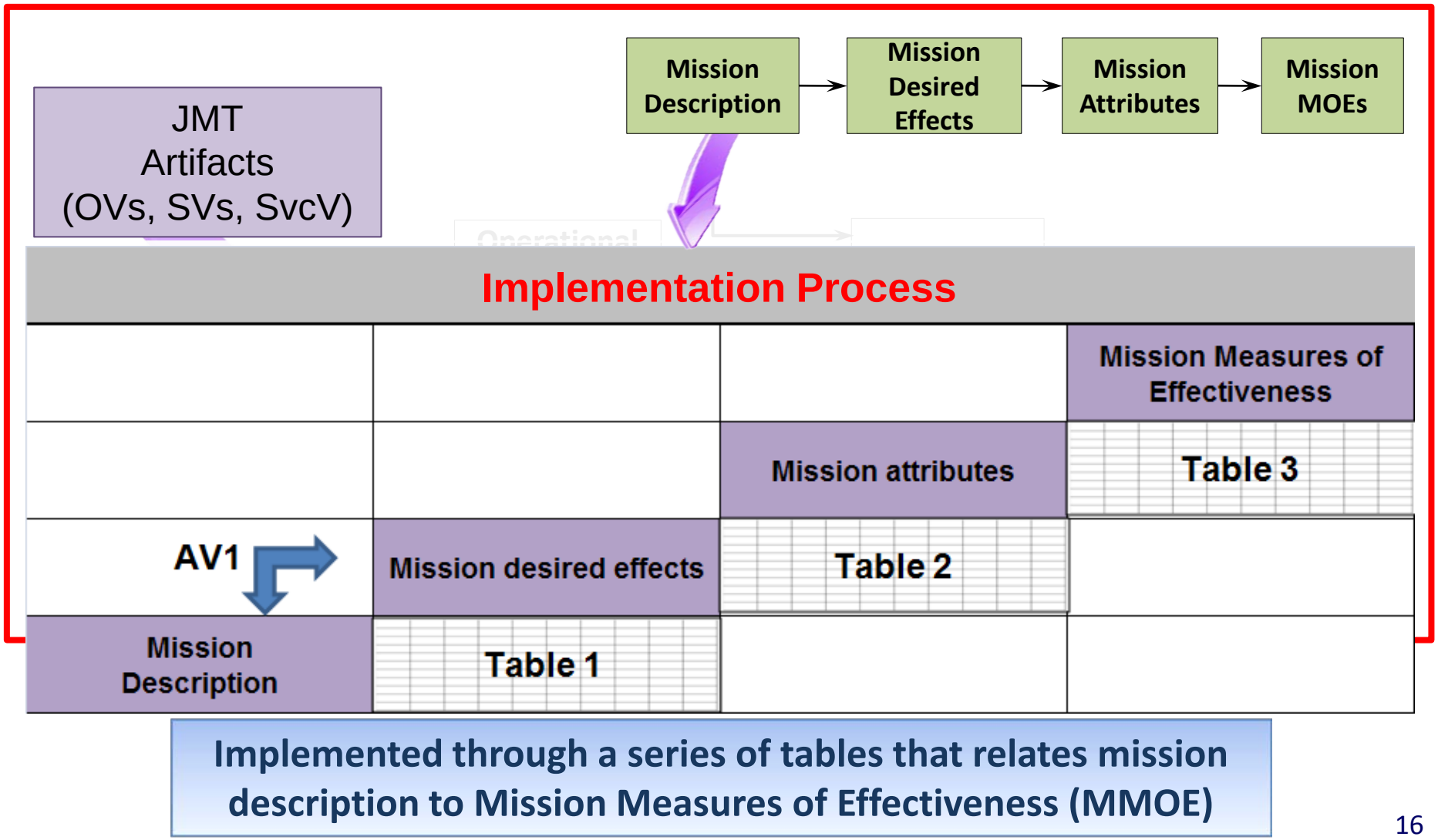
JMT Decomposition Process Outline (Applying to T&E)



STEP 1

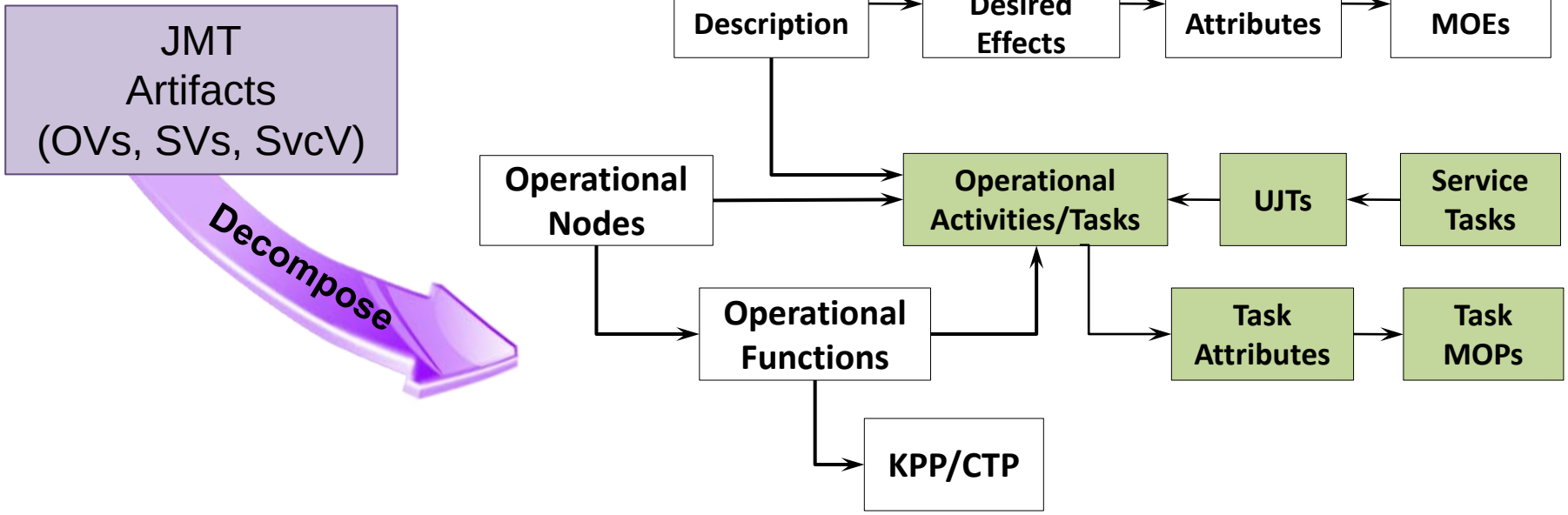
Mission effectiveness can be evaluated through mission desired effects

JMT Decomposition Process Outline (Applying to T&E)



Implemented through a series of tables that relates mission description to Mission Measures of Effectiveness (MMOE)

JMT Decomposition Process Outline (Applying to T&E)



STEP 2

Decomposing the mission into operational activities allows for evaluating task performance

JMT Decomposition Process Outline (Applying to T&E)

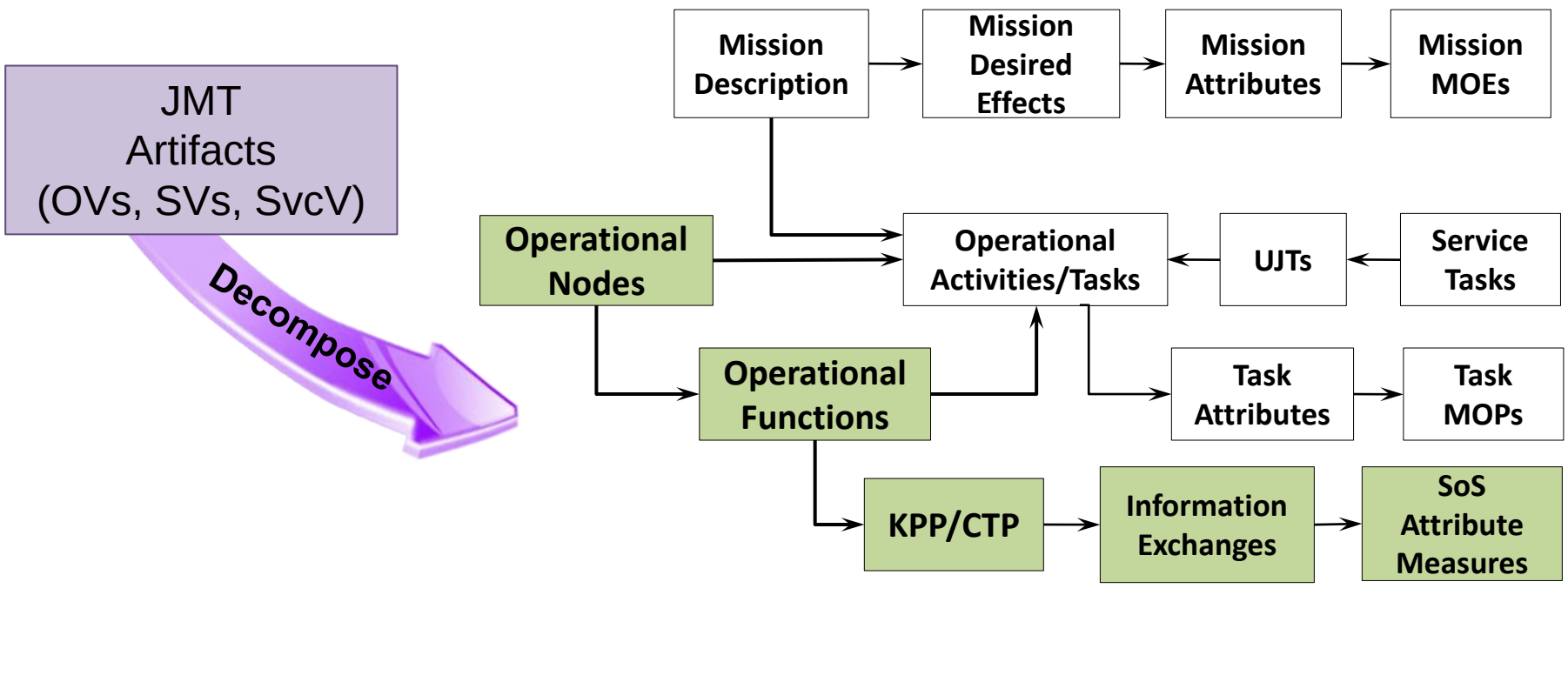
Implemented through a series of tables that relates Operational activities to Task Measures of Performance (TMOP)

JMT Artifacts (OVs, SVs, SvcV)

Implementation Process

				Potential Task Measures
			Joint/Service Tasks	Table 7
	OV2, OV5	Operational Activities/Tasks	Table 6	
	Operational Nodes	Table 5		Task MOPs
Mission Description	Table 4 (OV-1)		Task Attributes	Table 9
		Operational Activities/Tasks	Table 8	

JMT Decomposition Process Outline (Applying to T&E)



STEP 3

Decomposing the operational nodes into functions allows for evaluating SoS attributes

JMT Decomposition Process Outline (Applying to T&E)

Implemented through a series of tables that relates Operational functions to Measures of SoS Attributes (MOSA)

JMT Artifacts (OVs, SVs, SvcV)

Decompose

Operational Nodes

Operational Functions

KPP/CTP

Information Exchanges

SoS Attribute Measures

Operational Activities/Tasks

UJTs

Service Tasks

Task Attributes

Task MOPs

Implementation Process

	SV5a →	Operational Activities/Tasks			Net Enabled Measures
SV4 →	Operational Functions	Table 10	SV2 →	Net Ready KPP	Table 14
Operational Nodes	Table 11	SV1 →	Information Exchange	Table 13	
		Operational Nodes	Table 12		

JMT Decomposition Implementation (Mission Analysis)

			Mission Measures of Effectiveness			
		Mission attributes	Table 3			
AV1	Mission desired effects	Table 2		Potential Task Measures		
Mission Description	Table 1		Joint/Service Tasks	Table 7		
	OV2, OV5	Operational Activities/Tasks	Table 6		Task MOPs	
	Operational Nodes	Table 5		Task Attributes	Table 9	
Mission Description	Table 4 (OV-1)	SV5a	Operational Activities/Tasks	Table 8		Net Enabled Measures
	SV4	Operational Functions	Table 10	SV2	Net Ready KPP	Table 14
	Operational Nodes	Table 11	SV1	Information Exchange	Table 13	
			Operational Nodes	Table 12		

Mission analysis provides a repeatable process for developing Joint Mission Thread measures

Summary

- Operational effectiveness and suitability should evaluate mission effectiveness and task performance in a realistic joint mission environment
- A joint mission thread (JMT) provides an operational and technical description of the end to end set of activities and systems that accomplish the execution of a joint mission
- Joint Mission Threads (JMT) requires a decomposition of mission, tasks, functions, and performers (systems) to develop measures
- An Evaluation strategy can be developed from a JMT that will support System test and evaluation

Questions

Mark Fiebrandt
Lead Operations Research Analyst
Scientific Research Corporation
757.638.6055
mark.fiebrandt.ctr@jte.osd.mil

Serving the testing, acquisition, and warfighting communities

Back-up Charts

Abstract

- One of the foundations of the future military force is for Systems to be “born joint”. This requires testing Systems as a part of a System of Systems (SoS) and the evaluation of System impacts on joint mission effectiveness. There are complexity and cost challenges with including SoS in the test environment and test design. The presentation addresses methods for overcoming those challenges that will provide processes for measuring effectiveness of SoS and System contributions to a SoS in a Joint Mission Environment. The results are based on the findings from the three-year Joint Test & Evaluation Methodology (JTEM), which developed a measures framework to help align Service developmental and operational testing with joint capability based planning, improve System interoperability, and support fielding of Systems as a part of SoS. Additional material will be presented on the development of Joint Mission Threads (JMT) that will document reusable and repeatable functions, tasks, and measures for SoS/System test and evaluation of joint mission effectiveness.

Terms of Reference

- **Activity**: An Activity is work, specific to a single organization, weapon system, or individual, that transforms inputs into outputs or changes their state. (DoDAF 2.0)
- **Attribute**: A quantitative or qualitative characteristic of an element or its actions. (CJCSI 3170.01G)
- **Capability:** The ability to achieve a desired effect under specified standards and conditions through combinations of means and ways across DOTMLPF to perform a set of tasks to execute a specified course of action (CJCSI 3170.01G, Mar 2009)
- **Condition**:
  - (1) Those variables of an operational environment or situation in which a unit, system, or individual is expected to operate and may affect performance. (UJTL Manual),
  - (2) The sample of adversaries and operating conditions – the scenario (Capability-Based Assessment User's Guide v3 dated Mar 2009)
- **Criterion**: The minimum acceptable level of performance associated with a particular measure of [task] performance. It is often expressed as hours, days, percent, occurrences, minutes, miles, or some other command-stated measure. (UJTL Manual – Aug 2008)
- **Effect [Mission Desired]**: (JP 1-02)
  - (1) The physical or behavioral state of a system that results from an action, a set of actions, or another effect,
  - (2) The result, outcome, or consequence of an action,
  - (3) A change to a condition, behavior, or degree of freedom

Terms of Reference

- **Function [System/Operational]** : The action for which a person or thing is specially designed, fitted, used or intended to accomplish or execute. (DoDAF 2.0)
- **Joint Mission Environment** : A subset of the joint operational environment composed of force and non-force entities; conditions, circumstances and influences within which forces employ capabilities to execute joint tasks to meet a specific mission objective. (TSSG)
- **Joint Mission Thread**: An operational and technical description of the end to end set of activities and systems that accomplish the execution of a joint mission. (CJCSI 6212.01E)
- **KPP/KSA/CTP**: Attributes/parameters of a system that are considered critical (JCIDS)
- **Means**:
  - (1) Forces, units, equipment, and resources (TOR for JCA reassessment),
  - (2) Solutions represent means, or resources that can be employed (Capability-Based Assessment User's Guide v3 dated Mar 2009),
  - (3) Means are based on DOTMLPF organization, materiel, personnel, & facility resources
- **Measure**: A parameter that provides the basis for describing varying levels of accomplishment. (UJTL Manual Aug 2008)
- **Measure of Effectiveness [Mission]**: A criterion used to assess changes in system behavior, capability, or operational environment that is tied to measuring the attainment of an end state, achievement of an objective, or creation of an effect (JP 1-02)

Terms of Reference

- **Measure of Performance [Task]**: A criterion used to assess friendly actions that is tied to measuring task accomplishment. (JP 1-02)
- **Measure of System/SoS Attribute**: A parameter that describes varying levels of attributes. (CTM)
- **Mission**: The task, together with the purpose, that clearly indicates the action to be taken and the reason therefore. (JP 1-02)
- **Node**: An element of a system that represents a person, place, or physical thing. (JP 1-02)
- **Task**: An action or activity (derived from an analysis of the mission and concept of operations) assigned to an individual or organization to provide a capability. (UJTL Manual – Aug 2008)
  Note: This term and its definition to be included in JP 1-02
- **Standard**: A standard provides a way of expressing the acceptable proficiency that a joint organization or force must perform under a specified set of conditions. A standard consists of one or more measures for a task and a criterion for each measure. (UJTL Manual – Aug 2008)
- **System**: A functionally, physically, and/or behaviorally related group of regularly interacting or interdependent elements; that group of elements forming a unified whole. (JP 1-02)
- **Ways**:
  - (1) Doctrine, tactics, techniques, and procedures, competencies, and concepts (TOR for JCA reassessment),
  - (2) Functions [are] considered ways (Capability-Based Assessment User's Guide v3 dated Mar 2009),
  - (3) Ways are based on DOTMLPF doctrine, training, and leadership,

Contact Info

Mark Fiebrandt
Lead Operations Research Analyst
Scientific Research Corporation
757.638.6055
mark.fiebrandt.ctr@jte.osd.mil

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