NDIA 28th Annual Test & Evaluation Conference
Mission Thread Analytic Framework

Maximo Lorenzo
Defense Information Systems Agency
Test & Evaluation, Sr. Advisor, Joint & Coalition
March 2012
This presentation builds on the products of the Joint Test and Evaluation Methodology (JTEM) Capability Test Methodology (CTM) to execute mission-based tests and assessments. A brief historical perspective will be presented from the CTM circa 2007 to the finalization of the methodology with the last major piece resulting in the Mission Thread Analytic Framework. It builds on the mission decomposition process and allows the analyst to follow through the decomposition process to the causality of system performance to mission and task outcomes.

Mission Thread Analytic Framework application for the Afghanistan Mission Network (AMN) Coalition Interoperability Assessment & Validation (CIAV) process will be discussed and will address the following: 1) agility of the process applied within 90-day assessment cycles; 2) development of objective measures at the mission, task and system levels; and 3) deployment of instrumentation and analysis tools. Finally, as the lessons learned from AMN are applied to Future Mission Network (FMN), application of the Mission Thread Analytic Framework to FMN will be explored.
Outline

• Historical Review
  – Capability Test Methodology
  – Mission Decomposition
• Mission Thread Analytic Framework
• Afghanistan Mission Network (AMN) Coalition Interoperability Assurance & Validation
• Future
Historical Review
The Mission Thread Analytic Framework is based on the CTM
- CTM was created by the Joint Test & Evaluation Methodology (JTEM) Joint Test & Evaluation (JT&E) in 2007
- The CTM was designed to describe a process for testing in a Joint Live, Virtual & Constructive distributed environment
  - CTM is a comprehensive end-to-end deliberate planning, execution and reporting process
- Afghanistan Mission Network (AMN) Battlespace Management QRT uses the AMN Coalition Interoperability Assurance & Validation (CIAV) environment
  - CIAV is an agile, short duration assurance and validation effort to support rapid assessments for Afghanistan
CTM (2007)

A Combat Support Agency

CTM PROCESS

1. DEVELOP T&E STRATEGY
   - SoS Description
   - JOC-T
   - Evaluation Strategy
   - Capability Crosswalk

2. CHARACTERIZE TEST
   - Test Concept
   - Technical Assessment
   - Refine Eval

3. PLAN TEST
   - LVC-DE Analysis
   - Test Plan
   - Design LV-DE Configuration
   - Integrate LVC-DE

4. IMPLEMENT LVC-DE
   - Analyze Data
   - Evaluate SoS Performance, Task & JMe

5. MANAGE TEST EXECUTION
   - Event Management Plan
   - Run Event

6. EVALUATE CAPABILITY
   - Event Focus

Capability Focus

Event Focus

Unclassified
The joint operational context comprises a description of forces operating jointly and details the tactics, techniques, and procedures they employ to achieve effects on the battlefield by exerting capabilities they do not possess separately.

Aspects of this joint context include mission objectives, operational and system descriptions of blue and red forces, environmental conditions, and interactions necessary to accurately and realistically test systems and system of systems, performing specific joint tasks, or portions thereof.
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. *(JCIDS Manual)*

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)*
The Measures Framework is based on systems performing tasks to accomplish a mission in a **System-of-systems**.
CTM (2010) “Pillars”

- New emphasis on the “threads” of the process and the interactions between these activities.
- Joint Operational Context for Test (JOC-T), Measures Framework and System Engineering processes combine to produce a Joint Mission Environment for testing.
A Combat Support Agency


*Lack of reusable task and mission–based measures decomposed to testable metrics*

- Major driver for Coalition Joint Mission Environment test requirements
- Gap spans
  - Joint Operational Context for Test (JOC-T)
  - Measures Framework
  - Systems Engineering
- JTEM – Transition (JTEM-T) addressed the critical gap
  - Refined JTEM Capability Test Methodology (CTM)
  - Developed mission-based T&E Assessment Guidebook
  - Provided recommendations to the JCIDS process
- Developed a Joint Coalition Mission Thread Measures SOP to decompose mission and tasks into testable measures.
SOP Overview

System functionality enables an operator to perform a task to achieve mission desired effects.

System, task and mission measures combine to provide the context for evaluating system impact on System-of-Systems.
Objective: Provide a disciplined & repeatable process for mission, task and system decomposition and analysis

- Mission Statement
- Objectives
- Desired Effects
- Nodes
- Tasks
- Sub-tasks
- Desired Effects attributes
- Task attributes
- Senior Warfighters Forum attributes
- Attribute measures for mission, tasks and system functionality
- Traceability of system attributes to task and mission desired effects

Mission Description
Task Description
Mission Task & System Measures
Traceability: System → Task → Mission
SOP Overview

Decompose Mission – Task – SoS/SUT into attributes and measures
Mission Thread Analytic Framework (MTAF)
• Expanded and refined the SOP to complete an analysis of system impact on task performance and mission effectiveness through additional causal relationships
  – System functionality impacts task performance (by relating measured system function to measured task attributes – timely, accurate, etc)
  – Task performance impacts achievement of desire effects (by relating measured task attributes to measured desired effect attributes)
  – Mission Objective accomplishment (by relating measured desired effects to mission objectives).
The Framework is based on tasks necessary to accomplish a mission in a System-of-Systems environment.
Mission Thread
Analytic Framework

A Breadcrumb trail...

Causality Diagrams

Mission Measures
Mission Attributes
Mission Desired Effects
Mission Objectives

Task Measures
Task Attributes
Tasks or Activities

System/SoS Attributes
System/SoS Measures

Traceability Matrices

Step 1
Step 2
Step 3

Matrix 1
Matrix 2
Matrix 3
Matrix 4
Matrix 5
Matrix 6
Matrix 7
Matrix 8
Matrix 9
Matrix 10
Matrix 11
Matrix 12

Desired Effect-Objective
Task-Desired Effect
System-Task

Unclassified
Causality Diagram Legend

For the task-to-mission chart, this ring contains the tasks (with attributes) within the mission description; for the system-to-task, it contains the system attributes.

These values are normalized (0-1) system or task attribute measurements.

These colors represent the result of attribute measurement vs desired effect or task standard.

The purpose of these charts is to show the impact of the outer ring (system-to-task; task-to-mission) on the inner ring.

For the task-to-mission chart, the inner ring contains mission desired effect attributes; for the system-to-task, it contains task attributes.
Afghanistan Mission Network (AMN)
Coalition Interoperability Assurance & Validation
MTAF Application in AMN Federation

• CIAV supports:
  – ISAF/Joint Command and USCENTCOM
  – AMN Secretariat, SHAPE, NATO
  – Guided by AMN Steering Group Strategic Vision and Direction

• Mission:
  – Assess systems for operational use on AMN
  – Assess mission execution given the enabling architecture

• FY 11: Battlespace Management, Counter IED, Joint Fires, Joint Intelligence, Surveillance & Reconnaissance, MedEvac threads
AMN QRT is sponsored by Defense Systems Information Agency (DISA) and endorsed by USCENTCOM
- Program managed by the Joint Program Office under the Director of Operational Test & Evaluation
- Began January 2011 and finished January 2012

Purpose is to provide a methodology that can objectively measure, test and evaluate Coalition Mission Threads and Tactics, Techniques and Procedures
- The AMN Quick Reaction Test refined the CTM to produce a responsive, effective process for the AMN environment
- Used The MedEvac Mission as the use case
Assurance & Validation Process

Assurance & Validation (A & V) Thread

A1
Identify A & V Goals & Objectives

A3
Develop Measures

A4
Identify Data Analysis Requirements

A5
Develop Scenarios & Vignettes

A2
Describe Coalition Mission Thread

System Engineering & Change Management Thread

S1
Describe & Validate CTE2 “As-Is” Design

S2
Identify CTE2 Design Changes

S3
Describe & Validate CTE2 “To-Be” Design

S4
Describe Instrumentation

S5
Implement A & V Event CTE2 Design

Planning Conference

A & V Management Thread

M1
Develop Roles & Responsibilities

M2
Coordinate A & V Support

M3
Schedule A & V Event

M4
Schedule / Deconflict CTE2 Regression

Products
- A & V Plan (A1, A5, M1, M2, M3, M4)
- Mission Decomposition (A2)
- CMT NOV-1, 6C; NSV-1, 5a/b, 10C (A2)
- Traceability Matrices (A3, A4)
- Integrated Data Requirements List (A4)

- Master Scenario Event List (A5)
- Data Analysis Plan (A4)
- Data Collection Plan/Instrumentation (S4)
- CTE2 Design (S1, S3)
Assurance & Validation Process

Assurance & Validation (A & V) Thread

A6
Execute A & V Scenario

A7
Reduce & Analyze Data

A8
Identify Significant Observations

System Engineering & Change Management Thread

S6
Feedback CTE2 Design Changes

A & V Management Thread

M5
Control & Monitor A & V Event

M6
Capture & Archive Data

M7
Report Observations & Recommendations

Products
- Time Ordered Event List (M5)
- Data (M6)
- Observations (M7)
- Causality Diagrams (A7, A8)
- CTE2 Recommendations (M7)
- Report (A8, S6, M7)
MedEvac OV-1

Point of Injury

Track

Satellite

9-line Request

TOC

Evacuate

TIC/ Salta

Evacuate

IJC

Coordinate

MTF

RC

60 Minute Circle

ECU

TLA 18

Tasking

coordinate

coordination

Evacuate

Unclassified
A Combat Support Agency

MedEvac Scenario

Patrol

MTF EVAC Unit

RC

IJC

TOC

9-line Request

Track

Track

MTF

EvAC Unit

Unclassified
MedEvac Scenario

A Combat Support Agency

Patrol
TOC
IJC
MTF
EVAC Unit
RC
SIGACT
Task
Track
Track

Unclassified
MedEvac Scenario

A Combat Support Agency

Patrol
MTF EVAC Unit
RC
IJC
Evacuate
TOC
Track
Track
Unclassified

MedEvac Scenario

A Combat Support Agency

Patrol
MTF EVAC Unit
RC
IJC
Evacuate
TOC
Track
Track
Unclassified
MedEvac Scenario

A Combat Support Agency

Evacuate

MTF

IJC

TOC

Track

RC

Track

Patrol

EvAC Unit

Unclassified
MedEvac OV-5a/b

A Combat Support Agency

MedEvac OV-5a/RC-S

Point of Injury
- SALTA
- TIC
- METHANE

Request
- Transmit 9-Line MIST

Task
- PECC assigns Msn# JChat
- PECC checks location
- PECC selects asset
- CJOC pastes location in CPOF
- PECC creates log of events
- CJOC authorizes launch
- PECC notifies MTF
- PECC opens Chat windows

Coordinate
- Pre-POI Evac
- CJOC requests T/O & ETA
- A/C Ops sends T/O & ETA
- CJOC posts POI ETA in Chat
- Post-POI Evac
- PECC confirms Evac and posts MTF ETA to Chat

Evacuate
- A/C arrives (POI)
- A/C arrives (MTF)

MedEvac OV-5b

Point of Injury

Request

Task

Coordinate

Evacuate
- (MTF)
- (Unit)
### Integrated Data Requirements List (IDRL)

<table>
<thead>
<tr>
<th>MedEvac Tracking Task</th>
<th>Attributes</th>
<th>Measure</th>
<th>Metric</th>
<th>Data Elements</th>
<th>Computation</th>
<th>Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timely</strong></td>
<td>MT2-1:</td>
<td>Time</td>
<td>Ti</td>
<td>Timely Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Mission tasking time from PECC / CJOC minus time of receipt of initial Med request if tasking was issued 2. Evac Unit arrival time minus Time mission tasking was issued</td>
</tr>
<tr>
<td></td>
<td></td>
<td>from</td>
<td>m</td>
<td>Timely Index scale factor</td>
<td>Gradient (Normal Value Range/Average Time Percentage Range)</td>
<td>1. Ttn = Ttx - Ttr 2. Tna = Tea - Ttx 3. Ti = m * F (Ttn, Tna)</td>
</tr>
<tr>
<td></td>
<td>MT2-2:</td>
<td>receipt</td>
<td>Ts</td>
<td>Count of Net Times</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>of Initial Med request at PECC / CJOC until mission tasking (transmission of JCHAT message).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ttn</td>
<td>Net Tasking Time</td>
<td>Time stamp (NTP?)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ttr</td>
<td>Receipt Time of Med request</td>
<td>Time stamp (NTP?)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ttx</td>
<td>Mission Tasking Transmit Time</td>
<td>Time stamp (NTP?)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tra</td>
<td>Net Evac Unit Mission Time</td>
<td>Time stamp (NTP?)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tea</td>
<td>Evac Unit Arrival Time</td>
<td>Time stamp (NTP?)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tti</td>
<td>Time Evac Unit Mission Issued</td>
<td>Time stamp (NTP?)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Complete</strong></td>
<td></td>
<td>CI</td>
<td>Complete Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Number of JCHAT elements at each site divided by the number of JCHAT elements generated by PECC 2. Completeness Index is a normalized value of the measures Nm (CI)</td>
</tr>
<tr>
<td></td>
<td>MT2-3:</td>
<td>All report elements generated by PECC on JCHAT are present at MTF, IJC, Evac Unit &amp; TF TOC</td>
<td>m</td>
<td>Complete Index scale factor</td>
<td>Gradient</td>
<td>1. JPe = (Nj/Njp) * 100 2. Ci = m * F (JPe)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentage</td>
<td>Nm</td>
<td>Number of Measures</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nj</td>
<td>Number of JCHAT elements displayed</td>
<td>Number</td>
<td>1. J = (J_i / J_gt) * 100 2. Ai = m * F (J)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Njp</td>
<td>Number of JCHAT elements generated by PECC</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Accurate</strong></td>
<td></td>
<td>AI</td>
<td>Accuracy Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Matching JCHAT elements divided by the total number of JCHAT elements 2. Accuracy index is a normalized value of the measures Nm</td>
</tr>
<tr>
<td></td>
<td>MT2-4:</td>
<td>JCHAT elements sent by PECC match those received by all recipients</td>
<td>m</td>
<td>Accuracy Index scale factor</td>
<td>Gradient</td>
<td>For All Tracks:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentage</td>
<td>Nm</td>
<td>Number of Measures</td>
<td>Number</td>
<td>1. J = (J_i / J_gt) * 100 2. Ai = m * F (J)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mn</td>
<td>Total number of Reports</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Jgt</td>
<td>JCHAT ground truth elements</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>J_i</td>
<td>Number of JCHAT elements that match PECC transmission</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Lawful</strong></td>
<td>National markings are not stripped off or changed during processing</td>
<td>UNLAW</td>
<td>Number of Position reports that have national markings stripped off or changed</td>
<td>Number</td>
<td>1. LAW = (UNLAW / Mn) * 100</td>
</tr>
<tr>
<td></td>
<td>MT2-5:</td>
<td>Percentage</td>
<td>Mm</td>
<td>Number of Medical reports</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Jgt</td>
<td>Number of JCHAT elements that match PECC transmission</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>J_i</td>
<td>Number of JCHAT elements that match PECC transmission</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>J_gt</td>
<td>JCHAT ground truth elements</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>J</td>
<td>JCHAT elements</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nm</td>
<td>Number of Measures</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nj</td>
<td>Number of JCHAT elements displayed</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Njp</td>
<td>Number of JCHAT elements generated by PECC</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AI</td>
<td>Accuracy Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Matching JCHAT elements divided by the total number of JCHAT elements 2. Accuracy index is a normalized value of the measures Nm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ci</td>
<td>Complete Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Number of JCHAT elements at each site divided by the number of JCHAT elements generated by PECC 2. Completeness Index is a normalized value of the measures Nm (CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hi</td>
<td>Health Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Number of JCHAT elements at each site divided by the number of JCHAT elements generated by PECC 2. Completeness Index is a normalized value of the measures Nm (CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hi</td>
<td>Health Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Number of JCHAT elements at each site divided by the number of JCHAT elements generated by PECC 2. Completeness Index is a normalized value of the measures Nm (CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mm</td>
<td>Number of Medical reports</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nj</td>
<td>Number of JCHAT elements displayed</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Njp</td>
<td>Number of JCHAT elements generated by PECC</td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AI</td>
<td>Accuracy Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Matching JCHAT elements divided by the total number of JCHAT elements 2. Accuracy index is a normalized value of the measures Nm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ci</td>
<td>Complete Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Number of JCHAT elements at each site divided by the number of JCHAT elements generated by PECC 2. Completeness Index is a normalized value of the measures Nm (CI)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hi</td>
<td>Health Index</td>
<td>Linearly regressed Normalized Value (0-1)</td>
<td>1. Number of JCHAT elements at each site divided by the number of JCHAT elements generated by PECC 2. Completeness Index is a normalized value of the measures Nm (CI)</td>
</tr>
</tbody>
</table>
### Matrix #1

<table>
<thead>
<tr>
<th>ME Mission Objectives</th>
<th>ME Mission Desired Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MedEvac Coverage</td>
</tr>
<tr>
<td>Urgent</td>
<td>X</td>
</tr>
<tr>
<td>Priority</td>
<td>X</td>
</tr>
<tr>
<td>Routine</td>
<td>X</td>
</tr>
</tbody>
</table>

### Matrix #2

<table>
<thead>
<tr>
<th>Mission Desired Effects</th>
<th>Desired Effect Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adaptable</td>
</tr>
<tr>
<td>MedEvac Coverage</td>
<td>X</td>
</tr>
<tr>
<td>Patient Sustainment</td>
<td>X</td>
</tr>
</tbody>
</table>

### Matrix #3

<table>
<thead>
<tr>
<th>Desired Effect Attributes</th>
<th>Mission Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Incidents where casualties receive care to time standard</td>
</tr>
</tbody>
</table>

### Matrix #4

<table>
<thead>
<tr>
<th>Mission Desired Effects</th>
<th>Fwd MedEvac Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Request</td>
</tr>
<tr>
<td>MedEvac Coverage</td>
<td></td>
</tr>
<tr>
<td>Patient Sustainment</td>
<td>X</td>
</tr>
</tbody>
</table>

### Matrix #5 & 6

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Measures</th>
<th>Complete</th>
<th>Accurate</th>
<th>Lawful</th>
<th>Timely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request</td>
<td></td>
<td></td>
<td>----------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>MT1-1</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT1-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT1-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT1-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td></td>
<td></td>
<td>----------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>MT2-1</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>MT2-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT2-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT2-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT2-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT2-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordinate</td>
<td></td>
<td></td>
<td>----------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>MT3-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT3-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT3-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT3-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Matrix #7

<table>
<thead>
<tr>
<th>Systems</th>
<th>Fwd MedEvac Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>JChat</td>
<td>Request</td>
</tr>
<tr>
<td>E-mail</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td></td>
</tr>
<tr>
<td>Voice</td>
<td></td>
</tr>
</tbody>
</table>

### Matrix #8 & 9

<table>
<thead>
<tr>
<th>Systems</th>
<th>Measures</th>
<th>Complete</th>
<th>Accurate</th>
<th>Timely</th>
</tr>
</thead>
<tbody>
<tr>
<td>JChat</td>
<td>MS1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>E-Mail</td>
<td>MS2</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
# Traceability Matrices

## Matrix #1

<table>
<thead>
<tr>
<th>BM Mission Objectives</th>
<th>BM Mission Desired Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce Blue-on-blue</td>
<td>Situational Awareness</td>
</tr>
<tr>
<td>Eliminate Blue-on-green</td>
<td></td>
</tr>
<tr>
<td>Maintain Operational Tempo</td>
<td></td>
</tr>
</tbody>
</table>

## Matrix #2 & 3

<table>
<thead>
<tr>
<th>Systems</th>
<th>Desired Effect - Situational Awareness - Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM Mission Objectives</td>
<td>Measures Complete Accurate Lawful</td>
</tr>
<tr>
<td>BM1-1</td>
<td>X</td>
</tr>
<tr>
<td>BM1-2</td>
<td>X</td>
</tr>
<tr>
<td>BM1-3</td>
<td>X</td>
</tr>
<tr>
<td>BM1-4</td>
<td>X</td>
</tr>
<tr>
<td>BM1-5</td>
<td>X</td>
</tr>
<tr>
<td>BM1-6</td>
<td>X</td>
</tr>
</tbody>
</table>

## Matrix #4

<table>
<thead>
<tr>
<th>BM Tasks</th>
<th>Mission Desired Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM Mission Objectives</td>
<td>Ground Tracking</td>
</tr>
<tr>
<td>BM Mission Desired Effect</td>
<td>SIGACT</td>
</tr>
</tbody>
</table>

## Matrix #5 & 6

<table>
<thead>
<tr>
<th>BM Task Attributes</th>
<th>Measures Complete Accurate Lawful Timely</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM Mission Objectives</td>
<td>BT1-1</td>
</tr>
<tr>
<td>BM Mission Desired Effect</td>
<td>BT1-2</td>
</tr>
<tr>
<td>BM Task Attributes</td>
<td>BT1-3</td>
</tr>
<tr>
<td>BM Mission Objectives</td>
<td>BT2-1</td>
</tr>
<tr>
<td>BM Mission Desired Effect</td>
<td>BT2-2</td>
</tr>
<tr>
<td>BM Task Attributes</td>
<td>BT2-3</td>
</tr>
<tr>
<td>BM Mission Objectives</td>
<td>BT2-4</td>
</tr>
<tr>
<td>BM Mission Desired Effect</td>
<td>BT2-5</td>
</tr>
<tr>
<td>BM Task Attributes</td>
<td>BT2-6</td>
</tr>
<tr>
<td>BM Mission Objectives</td>
<td>BT2-7</td>
</tr>
</tbody>
</table>

## Matrix #7 & 8

<table>
<thead>
<tr>
<th>BM Tasks</th>
<th>BM Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems</td>
<td>Ground Tracking SIGACT Timely</td>
</tr>
<tr>
<td>BFT</td>
<td>X</td>
</tr>
<tr>
<td>GCCS-J</td>
<td>X</td>
</tr>
<tr>
<td>PASS</td>
<td>X</td>
</tr>
<tr>
<td>NIRIS</td>
<td>X</td>
</tr>
<tr>
<td>GCCS-A</td>
<td>X</td>
</tr>
<tr>
<td>NORRCIS</td>
<td>X</td>
</tr>
<tr>
<td>PASS/NRTS</td>
<td>X</td>
</tr>
<tr>
<td>JADOCG-GBR</td>
<td>X</td>
</tr>
<tr>
<td>ICC</td>
<td>X</td>
</tr>
</tbody>
</table>

## Matrix #9

<table>
<thead>
<tr>
<th>BM Attributes</th>
<th>Measures Timely Complete Accurate Robust Lawful</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM Mission Objectives</td>
<td>BS1-1 X</td>
</tr>
<tr>
<td>BM Mission Desired Effect</td>
<td>BS1-2 X</td>
</tr>
<tr>
<td>BM Task Attributes</td>
<td>BS1-3 X</td>
</tr>
<tr>
<td>BM Mission Objectives</td>
<td>BS1-4 X</td>
</tr>
<tr>
<td>BM Mission Desired Effect</td>
<td>BS1-5 X</td>
</tr>
<tr>
<td>BM Task Attributes</td>
<td>BS1-6 X</td>
</tr>
<tr>
<td>BM Mission Objectives</td>
<td>BS1-7 X</td>
</tr>
<tr>
<td>BM Mission Desired Effect</td>
<td>BS1-8 X</td>
</tr>
<tr>
<td>BM Task Attributes</td>
<td>BS1-9 X</td>
</tr>
<tr>
<td>BM Mission Objectives</td>
<td>BS1-10 X</td>
</tr>
</tbody>
</table>
Measures Legend

B M 1-2
- Coalition Mission Thread
- Desired Effect/Task
- Measure Level (Mission/Task/System)
- Measure Number

Battlespace Management/Mission/Desired Effect #1/Measure #2

M T 2-3
- MedEvac/Task/Desired Effect #2/Measure #3

Unclassified
BM MEDCOP
Mission Evaluation View

Measures/Attributes

BM1-1: All position reports present (Complete)
BM1-2: All tracks displaying (Complete)
BM1-3: All track anomalies (Complete)
BM1-4: All MedEvac reports (Complete)
BM1-5: Tracks match ground truth (Accurate)
BM1-6: MedEvac reports received match entry data (Accurate)
BM1-7: All report anomalies (Accurate)
BM1-8: Security marking changes (Lawful)
BM1-9: MedEvac reports containing privacy act information (Lawful)

Task boundary

Computations

1. Number of matching JCHAT elements at recipient sites divided by the total number of JCHAT elements sent by PECC (ground truth)
2. Number of matching JCHAT elements at recipient site divided by the total number of JCHAT elements sent by PECC (ground truth)
3. Record number of security marking changes during processing and divide this by the total number of Position reports generated

Pass/Fail Criteria

PECC coordinates POI ETA

PECC coordinates MTF ETA

TBD

Unclassified
**BM Ground Track Task Evaluation View**

**Measures/Attributes**

**BT1-1:** Ground track elements are present on COP/MEDCOP (Complete)

**BT1-2:** Ground track elements match transmitted report elements (Accurate)

**BT1-3:** National markings are not stripped off or changed during processing (Lawful)

**SV-10c Event Trace Extract**

1. Number of complete ground track elements displayed divided by the total number of ground track elements transmitted (ground truth)
2. Number of ground track elements that match ground truth divided by the number of ground track elements transmitted (ground truth)
3. Record number of security marking changes during processing and divide this by the total number of Position reports generated

**Pass/Fail Criteria**

TBD
BM SIGACT Task Evaluation View

Measures/Attributes

BT2-1: Time from initial MedEvac request until SIGACT is generated (Timely)
BT2-2: Time from initial MedEvac request to display on COP/MEDCOP (Timely)
BT2-3: All SIGACT elements are present on COP/MEDCOP (Complete)
BT2-4: All updated SIGACT elements sent from CJOC to IJC are present
BT2-5: SIGACT elements on COP/MEDCOP match ground truth elements
BT2-6: SIGACT elements from CJOC to IJC match ground truth elements
BT2-7: National markings are not stripped off or changed during processing

Computations

1. Display time of COP/MEDCOP display minus time of initial Med request transmission time.
2. Time SIGACT is generated minus time initial Med request is made.
3. Complete SIGACT elements on COP / MEDCOP divided by total SIGACT elements in ground truth
4. Complete SIGACT elements received at IJC divided by total SIGACT elements sent by CJOC
5. Number of SIGACT elements matching ground truth divided by total number of SIGACT elements
6. Updated SIGACT elements sent by CJOC to IJC match ground truth elements
7. Record number of security marking changes and divide this by the total number of Position reports generated

SV-10c Event Trace Extract

Pass/Fail Criteria

SIGACT on COP/MEDCOP
TBD

SIGACT Elements Ground Truth

Task boundary
# Battlespace Management Causality Example

**Battlespace Management Mission Description**

**Mission Statement:** Manage operational environments in order to affect the behavior, capabilities, will, or perceptions of partner, competitor, or adversary leaders, military forces, and relevant populations. The ability to control or deny (destroy, remove, contaminate, or block with obstacles) significant areas, with or without force, in the operational area whose possession or control provides either side an operational advantage.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Desired Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduces blue on blue</td>
<td>Gained, Managed, and Maintained Operational Tempo</td>
</tr>
<tr>
<td>Eliminates blue on green</td>
<td>X</td>
</tr>
<tr>
<td>Maintains offensive momentum</td>
<td>X</td>
</tr>
<tr>
<td>Exchange common BM objects (for example FCCMs between core C2 applications)</td>
<td>X</td>
</tr>
<tr>
<td>Conduct operational planning using core C2 applications in order to provide SA to J1-9</td>
<td>X</td>
</tr>
<tr>
<td>Exchange common SIGACT data into core C2 applications</td>
<td>X</td>
</tr>
<tr>
<td>Exchange common TIC data into core C2 applications</td>
<td>X</td>
</tr>
<tr>
<td>Complies with International and National Laws</td>
<td>X</td>
</tr>
</tbody>
</table>

**Desired Effect:** COP (center rings)
Future Work
The Framework is based on tasks necessary to accomplish a mission in a System-of-Systems environment.

- Framework of measures that examines all levels of capability
  - Mission Effectiveness
  - Task performance
  - System attributes
MISSION
The Joint Force Commander's intent is to bring force against the opponent in a manner to overwhelm and cripple the enemy's capabilities and will to resist.

OBJECTIVES

✓ Ensure Continuous Flow of Data on Potential Targets.
✓ Provide assessed targeting info across Coalition Nation (CN) boundaries
✓ Minimize Collateral Damage
✓ Avoid Unnecessary Duplication
✓ Provide for Rapid Coordination
✓ Analyze Effectiveness
Consider the Use of all Lethal and/or Nonlethal Attack Means.
Use the Lowest Echelon Capable of Furnishing Effective Support.
Furnish the Type of Joint Fire Support Requested.
Use the Most Effective Joint Fire Support Means.
Coordinate Airspace
Provide Adequate Support.
Protect the Force.
Provide for Flexibility.

DESIRED EFFECTS
Denial/Disruption/Delay/Suppression/Neutralize/
Destruction/Influence/Synchronization/Integration

TASKS
Find/Fix/Track/Target/Engage/Assess
**Mission**: The task, together with the purpose, that clearly indicates the action to be taken and the reason therefore. (JP 1-02)

**Mission Statement**: A mission describes the organization's essential task (or tasks) and purpose — a clear statement of the action to be taken and the reason for doing so. (UJTL Manual – Aug 2008)
Short sentence or paragraph that describes the organization's essential task (or tasks) and purpose—a clear statement of the action to be taken and the reason for doing so. (JP 5-0)
Mission statement contains the elements of who, what, when, where, and why, but seldom specifies how. (JP 5-0)
Example: Conduct an integrated joint close air support with a common and standardized doctrine, organization, training, materiel and facilities that will be interoperable and effective in a joint mission environment. (JP 5-0)

**Mission Objectives**: (JP 5-0)
The mission is then further defined with objectives, that are:
The clearly defined, decisive, and attainable goal toward which every operation is directed.
The specific target of the action taken (for example, a definite terrain feature, the seizure or holding of which is essential to the commander’s plan, or an enemy force or capability without regard to terrain features).
Examples: (1) To delay, disrupt, destroy, or degrade enemy operational forces or critical tasks and facilities (including command, control, and intelligence (C2I) targets), (2) To affect the enemy's will to fight

**Mission Desired Effects**: “The Joint Operation Planning Process,” discusses the use of desired and undesired effects in joint operation planning as a way to clarify the relationship between objectives and tasks. (JP 5-0)
effects “describe system behavior in the operational environment – desired effects are the conditions related to achieving objectives;” and tasks “direct friendly action”. (CBA Guide v3)
Examples: (1) Threat forces destroyed or neutralized in JOA (2) Enemy unwillingness to fight.
**Definitions**

**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, Mar 2009)

**Capability:** The ability to achieve a desired effect under specified standards and conditions through combinations of means and ways across doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) to perform a set of tasks to execute a specified course of action. It is defined by an operational user and expressed in broad operational terms in the format of an Initial Capabilities Document (ICD) or a joint DOTMLPF Change Recommendation (DCR). In the case of materiel proposals/documents, the definition will progressively evolve to DOTMLPF performance attributes identified in the Capability Development Document (CDD) and the Capability Production Document (CPD). (CJCSI 3170.01G)

**Capability Need:** A capability defined through the Capability-Based Assessment (CBA) process, which requires performance of a task within specified conditions to a required level of performance. (CJCSI 3170.01G)

**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).
Definitions

A Combat Support Agency

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

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)

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 Manual, August 2008) NOTE: This term and its definition are to be included in JP 1-02.
From expert glossary

Mission
(1) The task, together with the purpose, which clearly indicates the action to be taken and the reason therefore. (2) In common usage, especially when applied to lower military units, a duty assigned to an individual or unit; a task. (3) Missions are statements of the objective to be accomplished for a given situation. Missions will describe the situation and will include who, what, when, where, why, and how the BMD system will perform. They contain employment direction and procedures to BMD forces for a given situation to achieve specific defense objectives. (USSPACECOM)

DoD Missile Defense Agency - Cite This Source - This Definition

Mission Area
A segment of the defense mission as established by the Secretary of Defense. Each DoD component has a mission area (i.e. Navy - sea control) for which it must equip its forces.

DoD Missile Defense Agency - Cite This Source - This Definition
Browse Related Terms: Air Force Satellite Control Network (AFSCN), ECDs, MCE, MCTE, MLCP, Tactical Control.
### Information Technology Infrastructure Library (ITIL)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission Statement</td>
<td>The Mission Statement of an Organization is a short but complete description of the overall purpose and intentions of that Organization. It states what is to be achieved, but not how this should be done.</td>
</tr>
<tr>
<td>Service</td>
<td>A means of delivering value to Customers by facilitating Outcomes Customers want to achieve without the ownership of specific Costs and Risks.</td>
</tr>
<tr>
<td>Attribute</td>
<td>A piece of information about a Configuration Item. Examples are name, location, Version number, and Cost. Attributes of CIs are recorded in the Configuration Management Database (CMDB). See Relationship.</td>
</tr>
<tr>
<td>Capability</td>
<td>The ability of an Organization, person, Process, Application, Configuration Item or IT Service to carry out an Activity. Capabilities are intangible Assets of an Organization. See Resource.</td>
</tr>
</tbody>
</table>
• Efficient and agile planning, execution and analysis methodology
  – Steps are scalable to the environment
  – Framework is organized into three threads: Evaluation, System Engineering, and Management
  – Disciplined decomposition of the mission facilitates Design Of Experiments
  – Measures Framework (system, task, mission) provides analytical rigor to answer mission concerns (the “so what” questions)
  – Traces causal connections between system, task and mission