# The Four-Element Framework:
# An Integrated Test and Evaluation Strategy

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*Our Army . . .Our Soldiers . . .Our Equipment*

ARMY TEST AND EVALUATION COMMAND

# *Agenda*

- Background

- Introduction

- Overview

- Element/Interface Development

- Application

- Weaknesses/Strengths

- Conclusions

**ARMY TEST AND EVALUATION COMMAND**
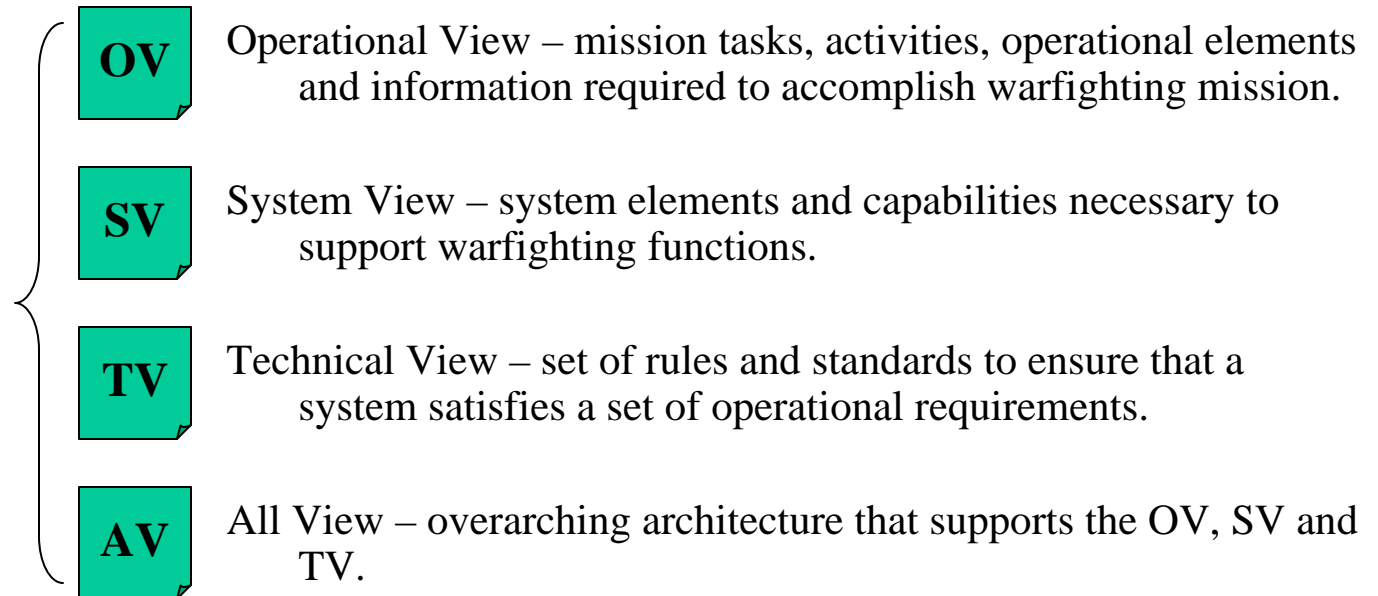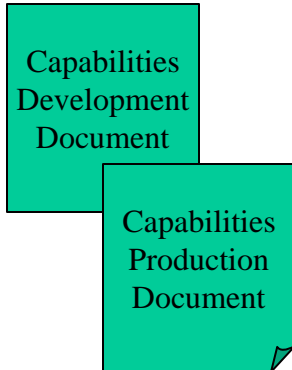
# *Background*

**DoD 5000.1**

DOD 5000.1 – "The primary objective of Defense acquisition is to acquire quality products that **satisfy user needs with measurable improvements to mission capability**…"

**JCIDS**

Joint Capabilities Integration and Development System
- War Fighting Capability Gaps
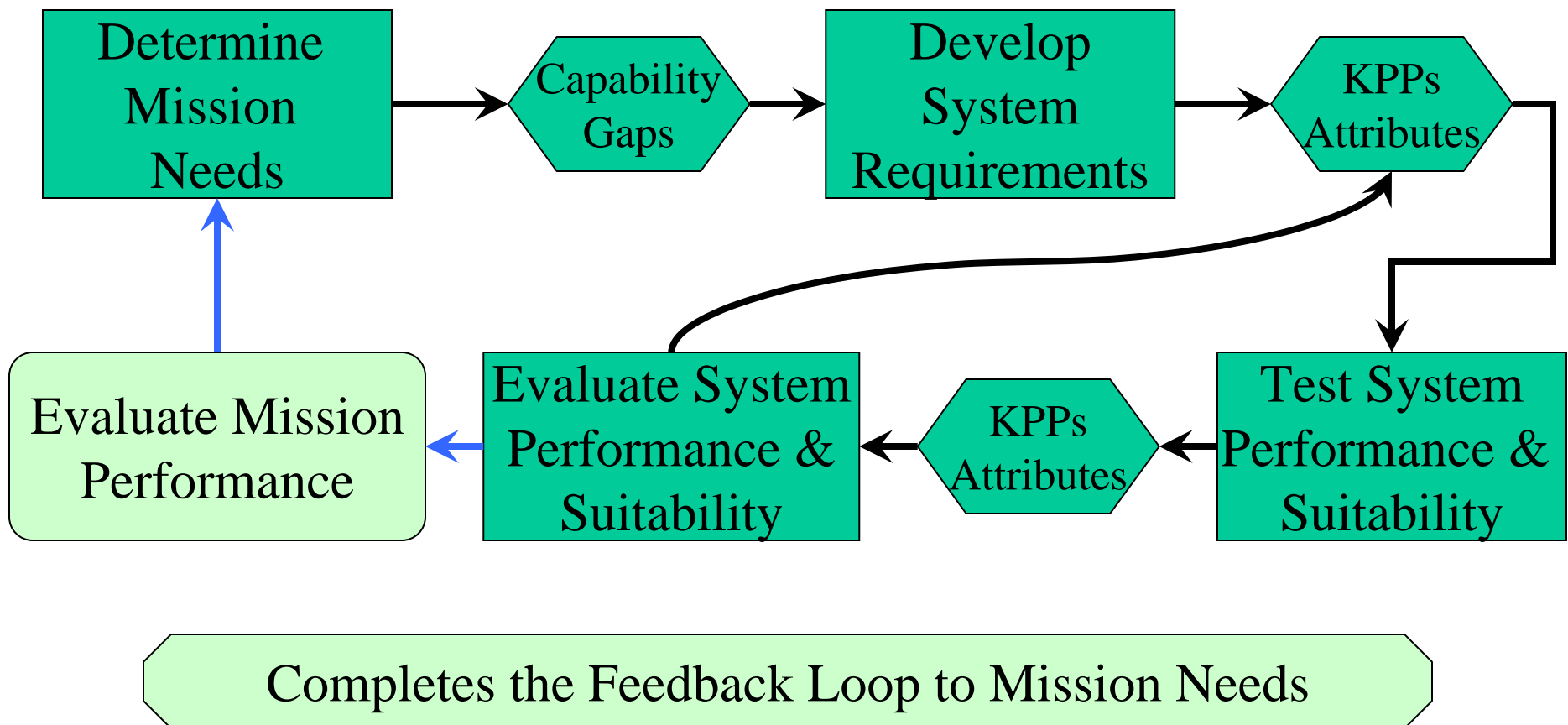- Material/Non-material Solutions

Materiel System
Performance Attributes
Key Performance Parameters

Capabilities Development Document

Capabilities Production Document

**OV** — Operational View – mission tasks, activities, operational elements and information required to accomplish warfighting mission.

**SV** — System View – system elements and capabilities necessary to support warfighting functions.

**TV** — Technical View – set of rules and standards to ensure that a system satisfies a set of operational requirements.

**AV** — All View – overarching architecture that supports the OV, SV and TV.

# *Introduction*

T&E Process Paradigms: ▭ Traditional; ▭ Proposed

```
Determine
Mission    →  Capability  →  Develop          →  KPPs
Needs         Gaps           System              Attributes
                             Requirements
```

```
Evaluate Mission  ←  Evaluate System  ←  KPPs        ←  Test System
Performance          Performance &       Attributes      Performance &
                     Suitability                         Suitability
```

Completes the Feedback Loop to Mission Needs

# *Overview*
# *The Four Elements*

Purpose
(What)

**MISSION ELEMENT**
Mission Tasks and Sub-tasks

Means
(How)

**SYSTEM ELEMENT**
System and Sub-system Functions

Purpose
(What)

**EVALUATION ELEMENT**
Mission Ability and System Capability Measures

**TEST ELEMENT**
Data Products and Data Sources

Means
(How)

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**ARMY TEST AND EVALUATION COMMAND**

# *Overview*
## *Elements, Interfaces and Traces*

Elements

- Mission, System, Evaluation, and Test

Interfaces

- Mission to System
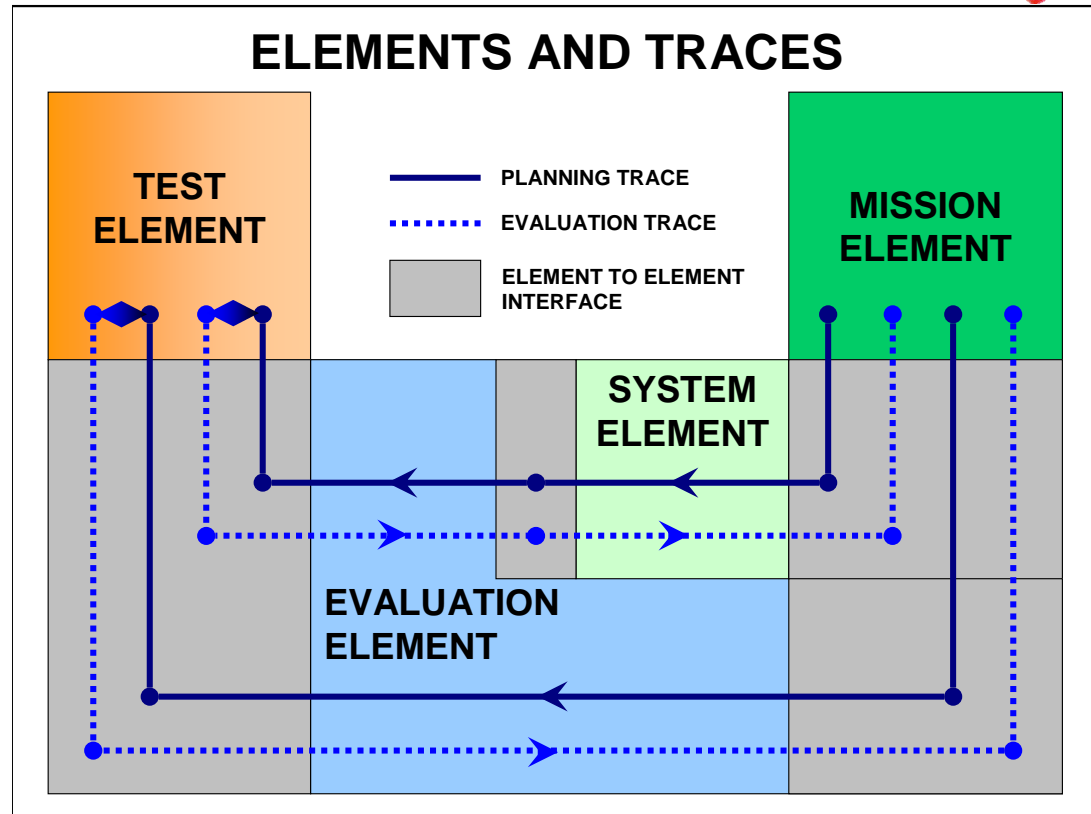- Mission to Evaluation
- System to Evaluation
- Evaluation to Test

Traces

Planning = Mission to Test

Evaluation = Test to Mission

Two Types:

- Type 1 links Mission, System, Evaluation and Test Elements.
    - Plans and evaluates mission task ability through system function capability.
- Type 2 links Mission, Evaluation and Test Elements.
    - Plans and evaluates mission task ability directly.

**ELEMENTS AND TRACES**

TEST ELEMENT

MISSION ELEMENT

SYSTEM ELEMENT

EVALUATION ELEMENT

PLANNING TRACE
EVALUATION TRACE
ELEMENT TO ELEMENT INTERFACE

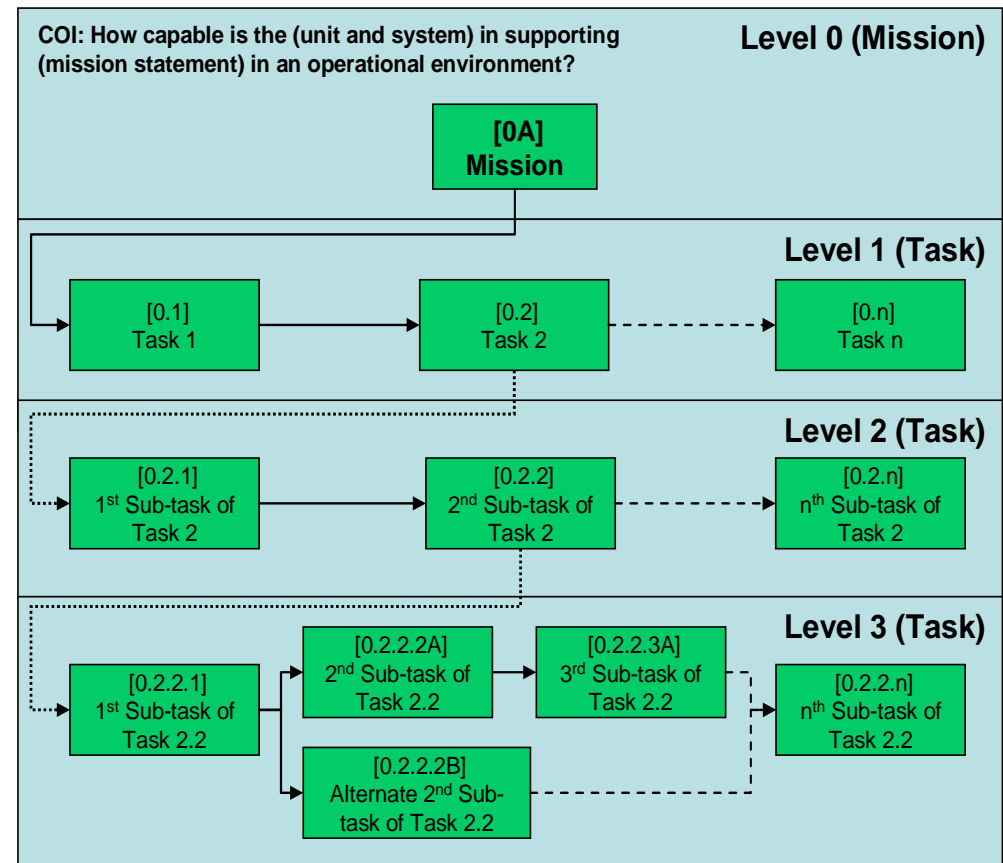# Element/Interface Development Mission Element

## Purpose

● To describe unit mission and tasks.
-- A task is defined as a discrete action that the unit (system and its operators) must perform in order to accomplish its mission.

## Components

● Critical Operational Objective: Mission based – "How capable is the (unit and system) in supporting (mission statement) in an operational environment."

● Task Levels: Orderly breakdown of the mission into tasks and sub-tasks.

● Alternate Mission Tasks: Optional mission tasks used to accomplish part(s) of the mission. Alternate task options define different "mission threads."
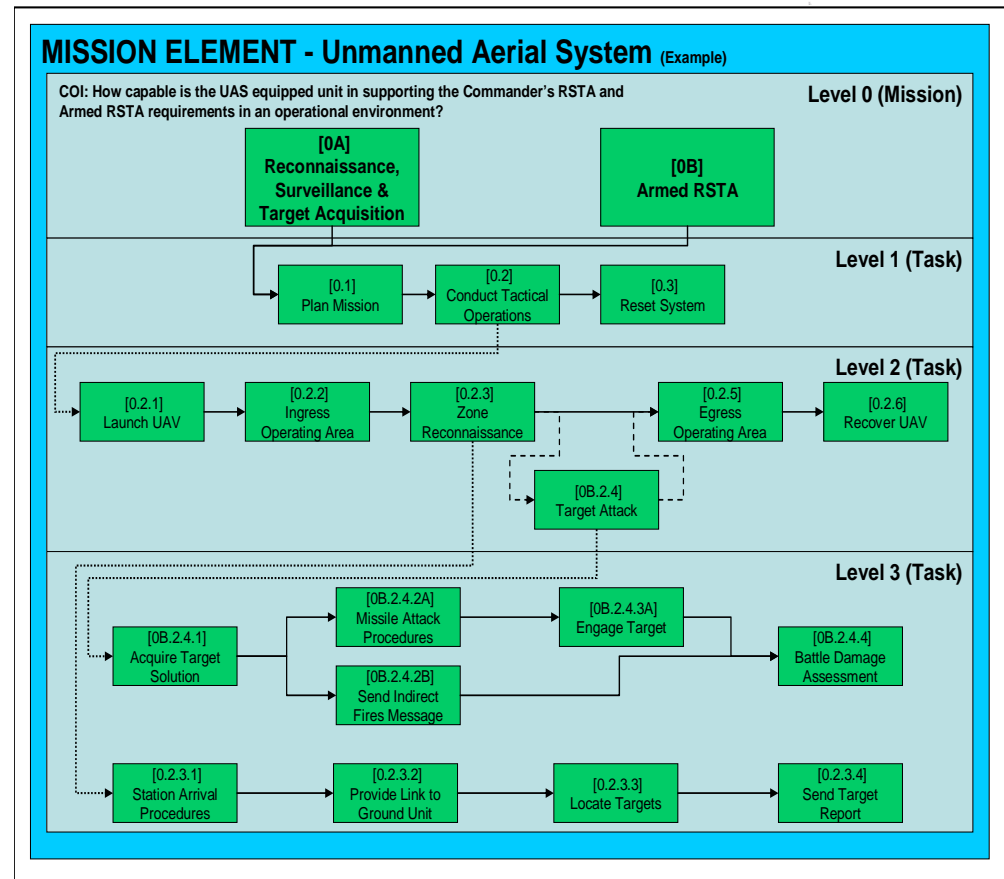
COI: How capable is the (unit and system) in supporting (mission statement) in an operational environment?

**Level 0 (Mission)**

[0A]
Mission

**Level 1 (Task)**

| [0.1] Task 1 | [0.2] Task 2 | [0.n] Task n |

**Level 2 (Task)**

| [0.2.1] 1st Sub-task of Task 2 | [0.2.2] 2nd Sub-task of Task 2 | [0.2.n] nth Sub-task of Task 2 |

**Level 3 (Task)**

[0.2.2.1] 1st Sub-task of Task 2.2

[0.2.2.2A] 2nd Sub-task of Task 2.2

[0.2.2.3A] 3rd Sub-task of Task 2.2

[0.2.2.n] nth Sub-task of Task 2.2

[0.2.2.2B] Alternate 2nd Sub-task of Task 2.2

# Element/Interface Development Mission Element – Example

## Development Keys

- Temporal Format.
    - Temporal format provides a block diagram of mission to mission tasks in order of their occurrence.
    - Supports development of mission threads.

- Lowest Level of Mission Tasks.
    - Lowest level mission tasks must be measurable.
    - Evaluated directly or indirectly via evaluation of system function capability.

- Support Documents.
    - Mission Need Statement, Initial Capabilities Document, Operational and Organizational Plan, Universal Task Lists, Capabilities Development/Production Documents (CDD/CPD).
    - Integrated architecture products in CDD/CPD uniquely support mission element.
        - OV-1: Who, How, Where, When, Why of the system and its mission.
        - OV-5: Operational activities (mission tasks).
        - OV-6c: Association of capabilities with sequences of operational activities (mission tasks).

**MISSION ELEMENT - Unmanned Aerial System** (Example)

COI: How capable is the UAS equipped unit in supporting the Commander's RSTA and Armed RSTA requirements in an operational environment?

Level 0 (Mission)

[0A] Reconnaissance, Surveillance & Target Acquisition

[0B] Armed RSTA

Level 1 (Task)

[0.1] Plan Mission → [0.2] Conduct Tactical Operations → [0.3] Reset System

Level 2 (Task)

[0.2.1] Launch UAV → [0.2.2] Ingress Operating Area → [0.2.3] Zone Reconnaissance → [0.2.5] Egress Operating Area → [0.2.6] Recover UAV

[0B.2.4] Target Attack

Level 3 (Task)

[0B.2.4.1] Acquire Target Solution → [0B.2.4.2A] Missile Attack Procedures → [0B.2.4.3A] Engage Target → [0B.2.4.4] Battle Damage Assessment

[0B.2.4.2B] Send Indirect Fires Message

[0.2.3.1] Station Arrival Procedures → [0.2.3.2] Provide Link to Ground Unit → [0.2.3.3] Locate Targets → [0.2.3.4] Send Target Report

# Element/Interface Development
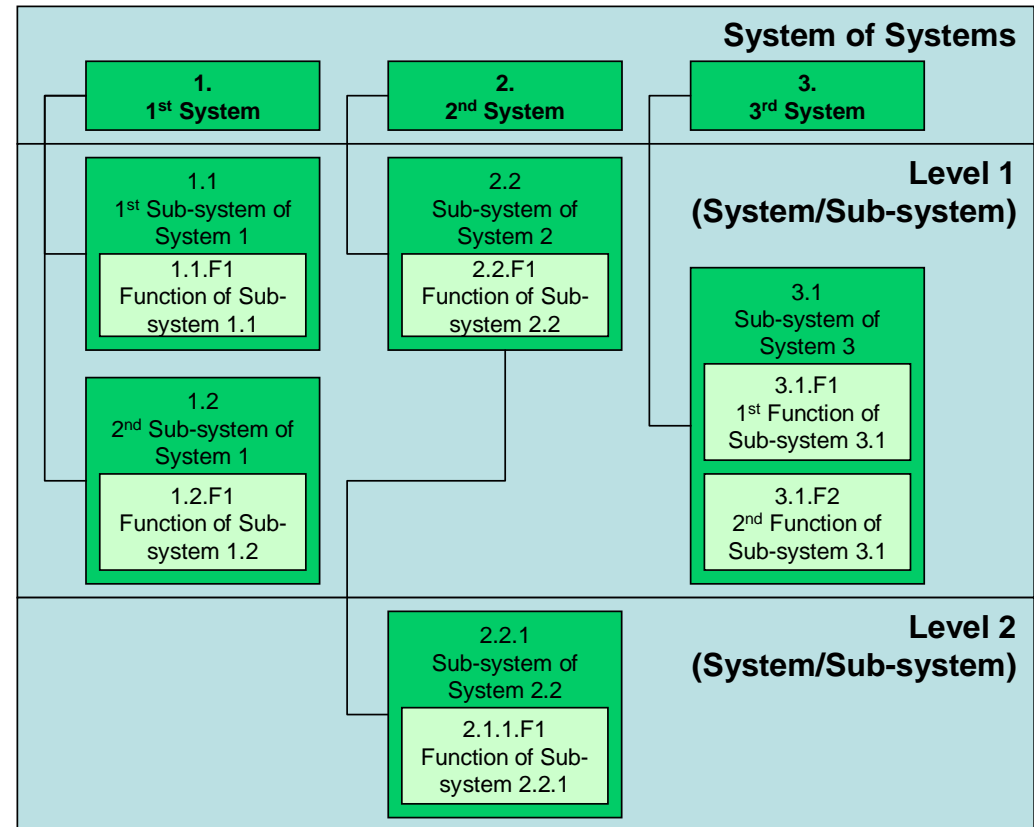# System Element

Purpose

- To describe the system and the system functions.

Components

- System Items: Makeup of the system and sub-systems.

- System Functions: Description of the function an item must perform in support of the mission.

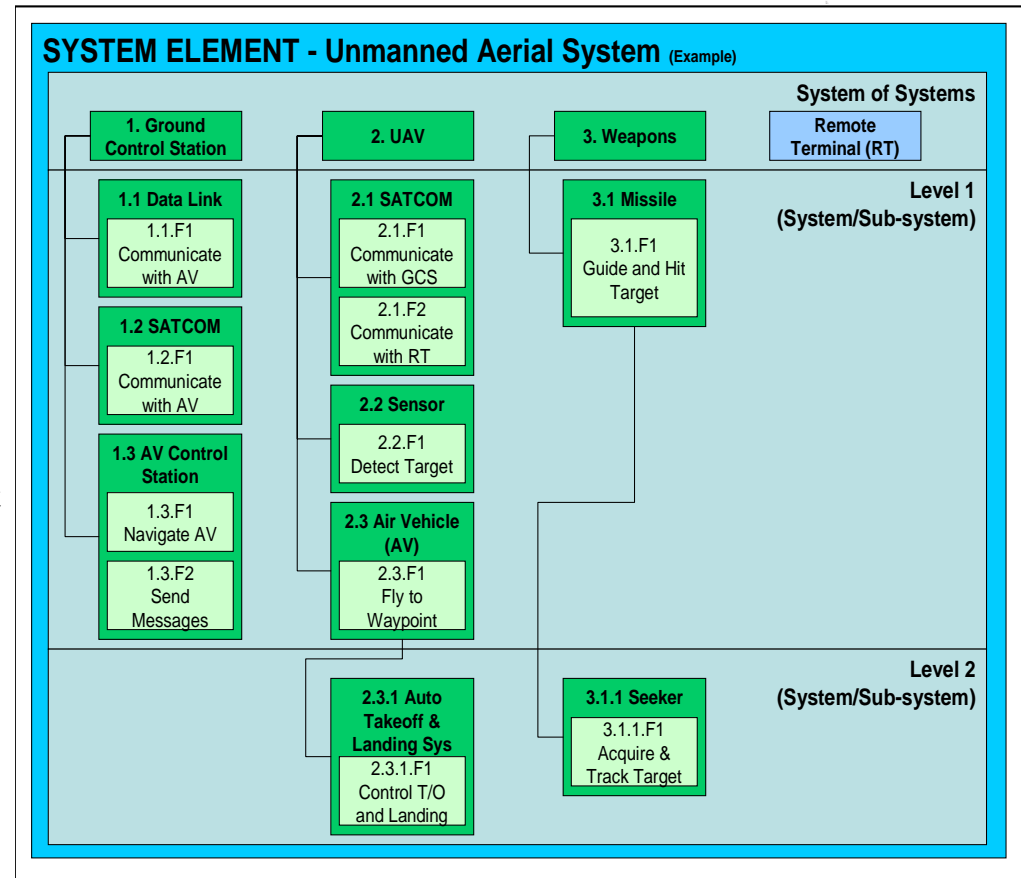- System Level: Level of systems, sub-system, and components from the system-of-systems perspective.

**System of Systems**

| 1. 1st System | 2. 2nd System | 3. 3rd System |

**Level 1 (System/Sub-system)**

| 1.1 1st Sub-system of System 1 | 2.2 Sub-system of System 2 |
| 1.1.F1 Function of Sub-system 1.1 | 2.2.F1 Function of Sub-system 2.2 |

3.1 Sub-system of System 3

3.1.F1 1st Function of Sub-system 3.1

| 1.2 2nd Sub-system of System 1 |
| 1.2.F1 Function of Sub-system 1.2 |

3.1.F2 2nd Function of Sub-system 3.1

**Level 2 (System/Sub-system)**

2.2.1 Sub-system of System 2.2

2.1.1.F1 Function of Sub-system 2.2.1

# *Element/Interface Development System Element – Example*

## Development Keys

- Item to Function Link.
    - Objective is to define the system functions.
    - System item is the sub-system responsible for providing the function.
- System-of-Systems.
    - Include systems that are not part of the system being developed and evaluated if they are required to support the mission.
- Lowest Level of System Function.
    - Should be associated with the accomplishment of a mission task.
    - Measurable by T&E.
- Risk Areas
    - Items and functions can be based on a specific area of developmental risk.
- Support Documents.
    - System Work Breakdown Structure
    - Integrated architecture products in CDD/CPD uniquely support mission element.
        - SV-1: Systems required to support the mission and the interfaces between them.
        - SV-4: System functions required to support the operational activities (mission tasks).

**SYSTEM ELEMENT - Unmanned Aerial System** (Example)

System of Systems

| 1. Ground Control Station | 2. UAV | 3. Weapons | Remote Terminal (RT) |
|---|---|---|---|

Level 1 (System/Sub-system)

**1.1 Data Link**
1.1.F1 Communicate with AV

**1.2 SATCOM**
1.2.F1 Communicate with AV

**1.3 AV Control Station**
1.3.F1 Navigate AV
1.3.F2 Send Messages

**2.1 SATCOM**
2.1.F1 Communicate with GCS
2.1.F2 Communicate with RT

**2.2 Sensor**
2.2.F1 Detect Target

**2.3 Air Vehicle (AV)**
2.3.F1 Fly to Waypoint

**3.1 Missile**
3.1.F1 Guide and Hit Target

Level 2 (System/Sub-system)

**2.3.1 Auto Takeoff & Landing Sys**
2.3.1.F1 Control T/O and Landing

**3.1.1 Seeker**
3.1.1.F1 Acquire & Track Target

# *Element/Interface Development Mission to System Interface*

## Purpose

- To describe how the mission tasks relate to the system functions.

## Components

- Mission Tasks: Taken from the mission element.

- System and System Functions: Taken from the system element.

- Input Rule: Description of how the system and its functions relate to the mission task. Uses logical input rules, such as AND and OR to describe links to more than one system or function.

- Conditions: Description of the physical, military, and civil variations that effect performance of a task. For example; weather conditions, countermeasures, urban environment, etc.

| | [0.1] Task 1 | [0.2.1] 1st Sub-task of Task 2 | [0.2.2.1] 1st Sub-task of Task 2.2 | [0.n] Task n |
|---|---|---|---|---|
| System 1 | Input Rule (AND/OR) | Input Rule (AND/OR) | Input Rule (AND/OR) | |
| 1.1.F1 Function of Sub-system 1.1 | Input Rule (AND/OR)<br>Conditions | | Input Rule (AND/OR)<br>Conditions | |
| 1.2.F1 Function of Sub-system 1.2 | | Input Rule (AND/OR)<br>Conditions | | |
| System 2 | | Input Rule (AND/OR) | Input Rule (AND/OR) | |
| 2.2.F1 Function of Sub-system 2.2 | | Input Rule (AND/OR)<br>Conditions | | |
| 2.1.1.F1 Function of Sub-system 2.2.1 | | | Input Rule (AND/OR)<br>Conditions | |
| System 3 | | | | Input Rule (AND/OR) |
| 3.1.F1 1st Function of Sub-system 3.1 | | | | Input Rule (AND/OR)<br>Conditions |

# Element/Interface Development Mission to System – Example

## Development Keys

- Input Rule.
  - Link every function required to support the mission task.
  - Link alternate system functions that support the mission task.
  - Top row for every system defines if the system supports the mission task with a function. (Used later to link system suitability to the task.)
  - Linkages are important since they will be used to evaluate mission tasks based on the evaluation of system functions/suitability.

- Conditions.
  - Consider the conditions based on the ability to support the mission task, but…
  - The specific function may drive the choice of applicable conditions. For example; terrain may effect the communication functions of line-of-sight systems but not effect satellite systems.

- Support Documents.
  - Initial Capabilities Document and System Threat Assessment Report to determine conditions.
  - Factors of METT-TC to determine conditions.
  - Integrated architecture products in CDD/CPD uniquely support mission element.
    - SV-5: Maps operational activities (mission tasks) from the OV-5 to the system functions from the SV-4. **12**



**MISSION TO SYSTEM LINKS - Unmanned Aerial System (Example)**

KEY — MISSION TASK; SYSTEM and SYSTEM FUNCTION — LINKS / CONDITIONS

| SYSTEM / FUNCTION | | | 0.2 Conduct Tactical Operations | 0.2.1 Launch UAV | 0.2.2 Ingress OA | .. | 0.2.5 Egress OA | 0.2.6 Recover UAV | .. | 0B.2.4.3A Engage Target |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 Ground Control Station | 1.1 Data Link | 1.1.F1 Communicate with AV | All Functions OR 1.2.F1 / 1. Terrain 2. AV Altitude 3. EW Jamming | All Functions OR 1.2.F1 AND 2.3.1.F1 / 0.2 | All Functions OR 1.2.F1 AND 1.3.F1, 2.3.F1 / 0.2 | | All Func. 0.2.2 | All Func. 0.2.1 | | All Functions OR 1.2.F1 AND 3.1.F1 / 0.2 |
| | 1.2 SATCOM | 1.2.F1 Communicate with AV | OR 1.1.F1 / 1. EW Jamming | OR 1.1.F1 AND 2.3.1.F1 / 0.2 | OR 1.1.F1 AND 1.3.F1, 2.3.F1 / 0.2 | | 0.2.2 / 0.2 | 0.2.1 / 0.2 | | OR 1.1.F1 AND 3.1.F1 / 0.2 |
| | 1.3 AV Control Station | 1.3.F1 Navigate AV | | | AND 2.3, (1.1 OR 1.2) / 1. Flight Profile 2. Weather (Icing) 3. EW Jamming 4. Terrain | | 0.2.2 / 0.2.2 | | | |
| 2.0 UAV | 2.3 Air Vehicle | 2.3.F1 Fly to Waypoint | | All Functions | All Functions AND 1.3, (1.1 OR 1.2) / 1. Winds 2. Flight Profile 3. Day/Night 4. Weather (Icing) | | All Func. 0.2.2 / 0.2.2 | All Func. | | |
| | 2.3.1 ATLS | 2.3.1.F1 Control Takeoff and Landing | | AND (1.1 OR 1.2) / 1. Winds 2. Runway Length 3. Density Altitude | | | | 0.2.1 / 0.2.1 | | |
| 3.0 Weapon | 3.1 Missile | 3.1.F1 Guide and Hit Target | | | | | | | | All Functions AND(1.1OR1.2) / 1. Target Type 2. Weather 3. Slant Range |

ARMY TEST AND EVALUATION COMMAND

# Element/Interface Development Evaluation Element

### Purpose

- To describe the evaluation measures and how they relate to mission tasks, system functions, and system suitability.

### Components

- Conditions: Conditions are assigned to tasks that are linked directly to a MOE in the evaluation element.

- Measure of Effectiveness (MOE): Parameter used to evaluate the system function or mission task.

- Measure of Suitability (MOS): Parameter used to evaluate the suitability of a system.

- Standard: Acceptable performance of the system function or mission task in terms of the MOE or MOS.

- System-focused COI: COI focused on system or sub-system performance. Typically stated, "Does the (system) perform (a specific required capability)?"

- Link to System-focused COI: Column in the evaluation element that identifies which MOE/Ss are used to evaluate the system-focused COI.

- Measure of Performance (MOP): Quantitative or qualitative measure of system performance under specified conditions.

COI: Does the (system) perform (system capability)?

| MOP | Standard | MOE/MOS | System/Function | [0.1] Task 1 | [0.2.1] Sub-task of Task 2 | [0.n] Task n |
|---|---|---|---|---|---|---|
| S1.S1.P1 MOP for MOS S2.S1 | Standard for MOS S1.S1 | S1.S1 MOS for System 1 | System 1.0 | Input Rule (AND/OR) | Input Rule (AND/OR) | |
| 1.1.F1.E1.P1 MOP for MOE 1.1.F1.E1 | Standard for MOE 1.1.F1.E1 | 1.1.F1.E1 1st MOE for Function 1.1.F1 | 1.1.F1 Function of Sub-system 1.1 | Input Rule (AND/OR) | | |
| 1.1.F1.E2.P1 MOP for MOE 1.1.F1.E2 | Standard for MOE 1.1.F1.E2 | 1.1.F1.E2 2nd MOE for Function 1.1.F1 | | Conditions | | |
| 1.2.F1.E1.P1 MOP for MOE 1.1.F1.E1 | Standard for MOE 1.2.F1.E1 | 1.2.F1.E1 MOE for Function 1.2.F1 | 1.2.F1 Function of Sub-system 1.2 | | Input Rule (AND/OR) | |
| | | | | | Conditions | |
| S2.S1.P1 MOP for MOS S2.S1 | Standard for MOS S2.S1 | S2.S1 MOS for System 2 | System 2.0 | | Input Rule (AND/OR) | |
| 2.2.F1.E1.P1 1st MOP for MOE 2.2.F1.E1 / 2.2.F1.E1.P2 2nd MOP for MOE 2.2.F1.E1 | Standard for MOE 2.2.F1.E1 | 2.2.F1.E1 MOE for Function 2.2.F1 | 2.2.F1 Function of Sub-system 2.2 | | Input Rule (AND/OR) | |
| | | | | | Conditions | |
| 0.2.1.E1.P1 MOP for MOE 0.2.1.E1 | Standard for MOE 0.2.1.E1 | 0.2.1.E1 MOE for Task 01 | | | Conditions | |
| 0.n.E1.P1 MOP for MOE 0.n.E1 | Standard for MOE 0.n.E1 | 0.n.E1 MOE for Task 1.2.F1 | | | | Conditions |

# *Element/Interface Development Evaluation Element – Example*

## Development Keys

- Mission and System Elements.
  - All system functions must have at least one MOE.
  - Mission tasks linked directly to a MOE usually indicate a need for evaluation during OT&E.
- MOEs, MOSs and MOPs.
  - System functions and mission tasks may have more than one MOE.
  - MOEs may have more than one MOP.
  - Both systems and sub-systems may have one or more MOSs.
  - "Dry run" evaluation from MOP to mission task to ensure evaluation is sound.
- Standards.
  - Assign a standard to each MOE to assist in resolution of the MOE. Typically four types of standards:
    - Direct Measurement: Compare demonstrated performance to standard. For example; maximum range.
    - Pass/Fail: Demonstration of a particular feature. For example; required number of hard points.
    - Comparison: Compare performance of two systems. For example; "performance equal to or greater than…"
    - Military Judgment: No specific standard. Military utility will be determined after the evaluation.

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**EVALUATION ELEMENT - Unmanned Aerial System (Example)**

COI: Does the missile guide, fly to and impact the target in its intended operating environment?

**KEY**
- MISSION TASK
- LINKS
- SYSTEM & FUNCTION
- CONDITIONS
- EVALUATION
- CONDITIONS

COI: How capable is the UAS equipped unit in supporting the Commander's RSTA and Armed RSTA requirements in an operational environment?

| Measures of Performance | Standards | MOE/MOS | Mission Task | 0.1 Plan Mission | 0.2 Conduct Tactical Ops | 0.21 Launch UAV | 0.22 Ingress OA | 0.2.3.3 Locate Targets | 0B.2.4.3A Engage Target |
|---|---|---|---|---|---|---|---|---|---|
| S1.S1.P1 # Failures | > 100 hrs (KPP) | S1.S1 MTBMEF | | | | | | | |
| 1.1.F1.E1.P1 % of accurate sent messages. | > 90.0% (KPP) | 1.1.F1.E1 Data Accuracy | 1.1.F1 Communicate with AV (1.0 Ground Control Station) | | | | | | |
| 1.1.F1.E2.P1 % of complete messages. | < 5.0%, < 30 seconds (Attribute) | 1.1.F1.E2 Drop Out Rate | | | | | | | |
| 1.1.F1.E2.P3 Time of drop out. | | | | | | | | | |
| 1.3.F1.E1.P1 % via direct route. | Military Judgment | 1.3.F1.E1% of Successful Course Changes | 1.3.F1 Navigate AV | | | | | | |
| 1.3.F1.E1.P2 % via waypoints. | | | | | | | | | |
| S1.S1.P1 # Failures | > 100 hrs (KPP) | S2.S1 MTBMEF | | | | | | | |
| 2.2.F1.E1.P1 Stationary Targets | > xx.x % at XX km (KPP) | 2.2.F1.E1 % of Targets Detected | 2.2.F1 Detect Target (2.0 UAV) | | | | | | |
| 2.3.F1.E1.P1 Difference between estimated and actual time of arrival. | < 10 sec from estimated time of arrival (AA) | 2.3.F1.E1 Waypoint Arrival On-Time % | 2.3.F1 Fly to Waypoint | | | | | | |
| 2.3.1.F1.E1.P1 % of Successful T/O | Must Control YES/NO (AA) | 2.3.1.F1.E1 % of Successful T/O | 2.3.1.F1 Control Takeoff and Landing | | | | | | |
| 2.3.1.F1.E2.P1 % of Successful Landings | Must Control YES/NO (AA) | 2.3.1.F1.E2 % of Successful Landings | | | | | | | |
| S1.S1.P1 % Failed Missiles | > 100 hrs (KPP) | S3.S1 In-flight Rel. | | | | | | | |
| 3.1.F1.E1.P1 % targets hit. | Performance similar to AGM-xxx | 3.1.F1.E1 Probability of Single Shot Hit | 3.1.F1 Guide and Hit Target (3.0 Weapon) | | | | | | |
| 0.1.E1.P1 Time to plan. | Military Judgment | 0.1.E1 % of Successful Mission Planning Sessions | | | | | | | |
| 0.1.E1.P2 % successful loads. | | | | | | | | | |
| 0.2.3.3.E1.P1 % operational targets detected. | > xx.x % at XX km (KPP) | 0.2.3.3.E1 % of Targets Detected | | | | | | | |

# Element/Interface Development Test Element

## Purpose

- To describe the data products, the sources of the data products, and how they relate to the evaluation element's MOPs.

## Components

- Link to MOPs: Description of which data products support which MOPs.

- Data Products: Specific data packet obtained though a data source satisfying a MOP data requirement.

- Data Sources: The specific source of a data product.

DATA SOURCE →

MOPs

| Operational Test Event #2 | | Operational Test Event #1 | | | Modeling and Simulation | Developmental Test | | | Contractor Test | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data Product #1 | Data Product #2 | Data Product #1 | Data Product #2 | Data Product #3 | Data Product | Data Product #1 | Data Product #2 | Data Product #3 | Data Product #1 | Data Product #2 | MOPs |
| | | | | | | | | X | | X | MOP S1.S1.P1 |
| X | | X | | | X | | | | X | | MOP 1.1.F1.E1.P1 |
| | | | | | | | X | | | | MOP 1.2.F1.E1.P1 |
| | | | | | X | X | | | | | MOP S2.S1.P1 |
| | | | | | | | | X | | | MOP 2.2.F1.E1.P2 |
| | X | X | | X | | | | | | | MOP 0.2.1.E1.P1 |
| | X | X | | X | | | | | | | MOP 0.n.E1.P1 |

## Development Keys

- **Data Products.**
  - Data requirements for each MOP are translated into the data products.
  - Requirements should be of sufficient detail to provide the scope of the effort that will generate the data product.
  - Each MOP must have at least one data product.
  - More than one MOP can be supported by a data product.

- **Data Sources.**
  - Data sources can include: contractor tests, developmental test, operational tests, field exercises, and modeling and simulations.

- **Evaluation Strategy.**
  - The test element describes an integrated test program.
  - The test element also provides a method to view the acceptability of the entire evaluation strategy.
    - Are the data products sufficient to evaluate the MOE/MOS standard?
    - Which functions/tasks are demonstrated solely in DT?
    - Are there any functions/tasks that are not demonstrated prior to OT?  Is this acceptable?

**TEST ELEMENT - Unmanned Aerial System** (Example)

KEY: TEST ELEMENT / EVALUATION ELEMENT

Test groups (columns): Initial Operational Test (GCS Video, Crew Log, AV Telemetry, Crew Questionnaires); Limited User Test (GCS Video, Crew Log, Crew Questionnaires); DT Missile Shots (AV Telemetry, Missile TM, Target TM, Target Damage Reports); DT Flight Tests (AV Telemetry, GCS Video, Airstrip Video, Crew Log, Message Traffic Reports); Simulation (AV Simulation, Missile Simulation, Link Status Reports); Contractor Tests (Airstrip Video, Message Traffic Reports); System Integration Lab Test (Message Traffic Reports)

| Measures of Performance | Standards | MOE/MOS |
|---|---|---|
| S1.S1.P1 # Failures | > 100 hrs (KPP) | S1.S1 MTBMEF |
| 1.1.F1.E1.P1 % of accurate sent messages. | > 90.0% (KPP) | 1.1.F1.E1 Data Accuracy |
| 1.1.F1.E2.P1 % of complete messages. | < 5.0%, < 30 seconds (Attribute) | 1.1.F1.E2 Drop Out Rate |
| 1.1.F1.E2.P3 Time of drop out. | | |
| 1.3.F1.E1.P1 % via direct route. | Military Judgment | 1.3.F1.E1% of Successful Course Changes |
| 1.3.F1.E1.P2 % via waypoints. | | |
| S1.S1.P1 # Failures | >100 hrs (KPP) | S2.S1 MTBMEF |
| 2.2.F1.E1.P1 Stationary Targets | > xx.x % at XX km (KPP) | 2.2.F1.E1 % of Targets Detected |
| 2.3.F1.E1.P1 Difference between estimated and actual time of arrival. | < 10 sec from estimated time of arrival (AA) | 2.3.F1.E1 Waypoint Arrival On-Time % |
| 2.3.1.F1.E1.P1 % of Successful T/O | Must Control YES/NO (AA) | 2.3.1.F1.E1 % of Successful T/O |
| 2.3.1.F1.E2.P1 % of Successful Landings | Must Control YES/NO (AA) | 2.3.1.F1.E2 % of Successful Landings |
| S1.S1.P1 % Failed Missiles | > 100 hrs (KPP) | S3.S1 In-flight Rel. |
| 3.1.F1.E1.P1 % targets hit. | Performance similar to AGM-xxx | 3.1.F1.E1 Probability of Single Shot Hit |
| 0.1.E1.P1 Time to plan. | Military Judgment | 0.1.E1 % of Successful Mission Planning Sessions |
| 0.1.E1.P2 % successful loads. | | |
| 0.2.3.3.E1.P1 % operational targets detected. | > xx.x % at XX km (KPP) | 0.2.3.3.E1 % of Targets Detected |

# *Element/Interface Development Mission Test & Evaluation Plan*

- Documents the four elements and the interfaces between them.
- Two main body chapters: mission evaluation and data sources.

**MISSION EVALUATION CHAPTER**

**Mission**
Description of the overall mission.
 - **Mission Task**
   Description of the mission task.
   System functions input rule.
   Conditions.
   - Measure of Effectiveness
     Description of the MOE.
     Evaluation Design and Procedure.
     Standard.
    - Measure of Performance
      Description of the MOP.
      Method of Analysis.
      - Data Product (s)
        Listing of required data product (s).
 - **System**
   - MOS; MOP; Data Product (s).
   - System Function
     - MOE; MOP; Data Product (s).

**DATA SOURCES CHAPTER**

**Data Sources**
Summary description of all data sources.
Summary data product schedule for all data sources.
 - Data Source
   Purpose and description of the data source.
   Scope and schedule of the data source.
   - Data Products
     Description of the data product.
     Listing of the MOPs requiring the data product.

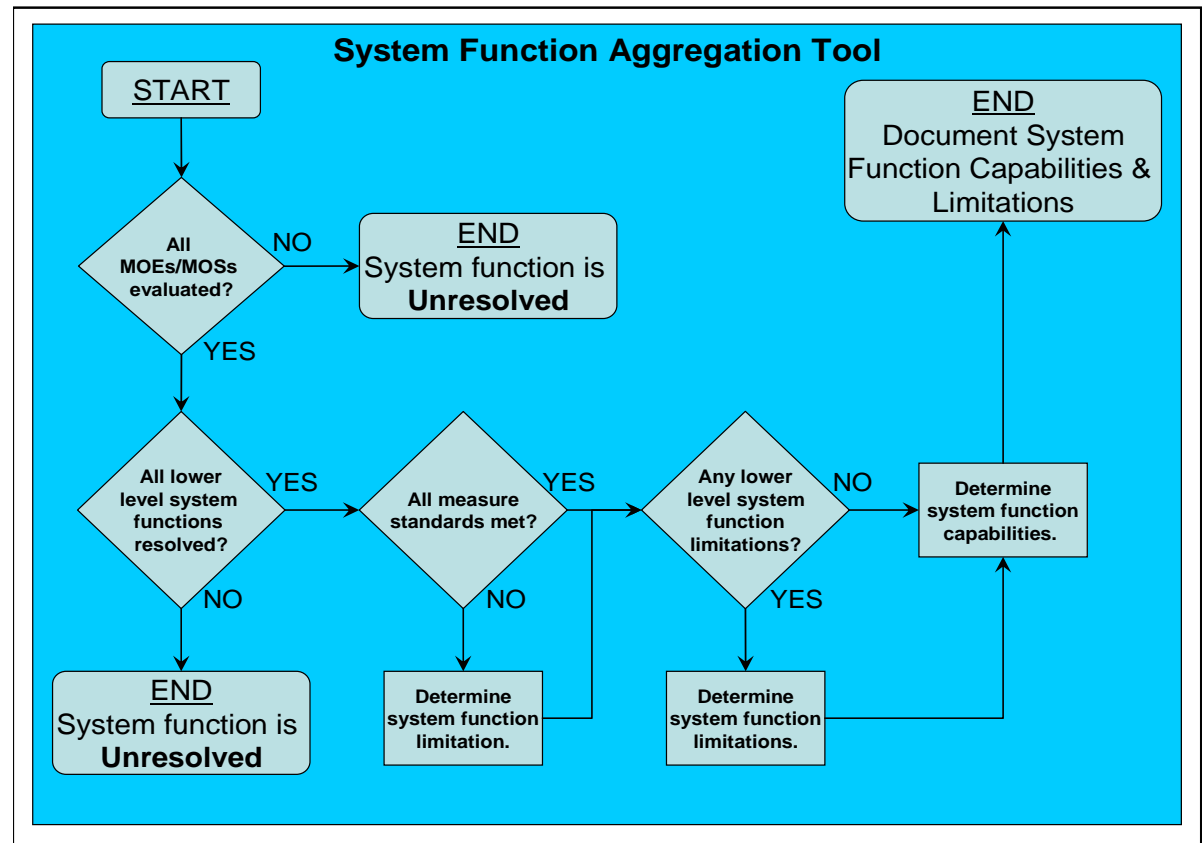# *Application*
# *Test and Evaluation Elements*

- Test Element:
  - ◆ Data is collected from the data sources.
  - ◆ Data is then authenticated in terms of quantity, quality and applicability.
  - ◆ Authentication body (Data Authentication Group) includes representatives from the test events, other data sources, the evaluator and materiel developer.

- Evaluation Element:
  - ◆ Data is then organized and analyzed.
  - ◆ Each MOE/S is rated as **met** or **not met** based on the standard.

# *Application System Element*

- System function **capabilities and limitations** are determined at the System Element.
  - Capability: "The (system) has the capability to (function capability with reference to standard)."
  - Limitation: "The (system) is limited to (function capability) which is (shortcoming with reference to the standard)."

- MOE/MOS ratings are applied to the system functions to determine the system capabilities and limitations.

- Capabilities and limitations of lower level system functions are also used to evaluate higher system functions.
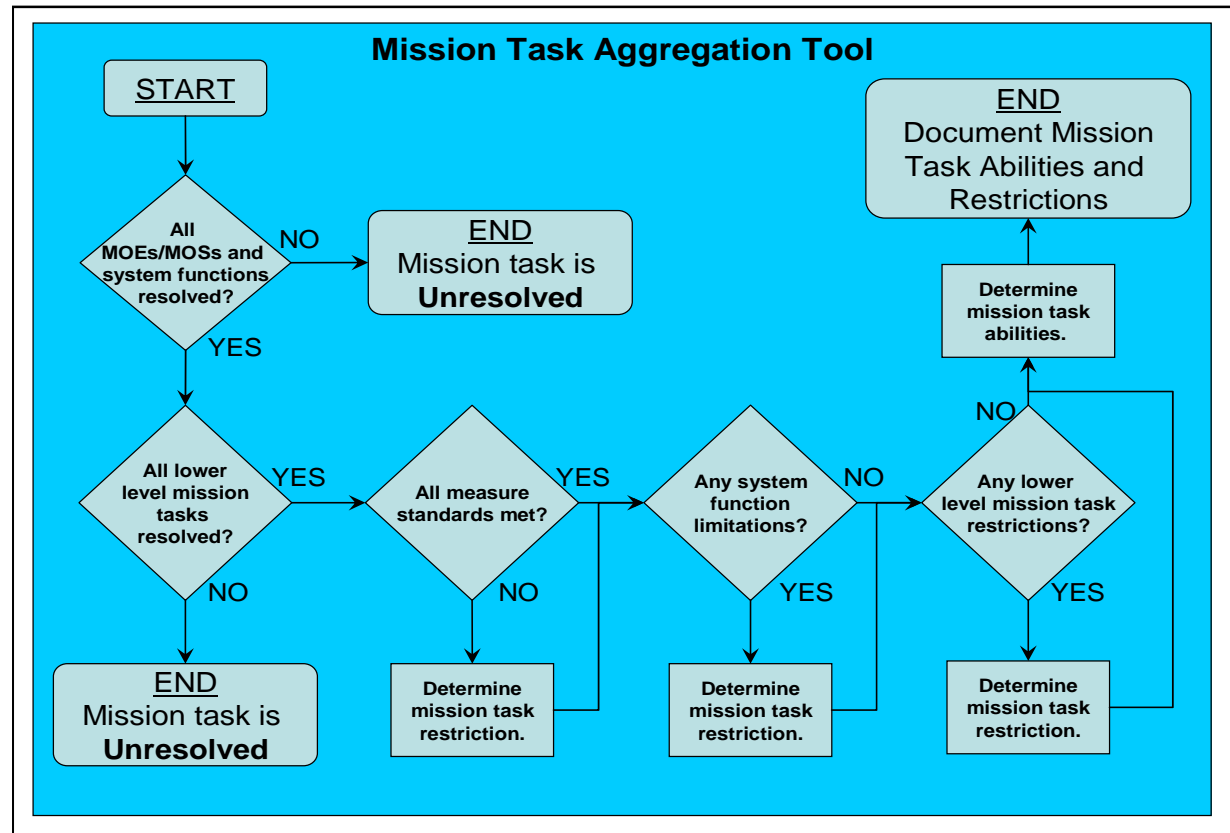
- Tool developed to resolve the system functions.

**System Function Aggregation Tool**

START

All MOEs/MOSs evaluated? — NO → END System function is **Unresolved**

YES ↓

All lower level system functions resolved? — YES → All measure standards met? — YES → Any lower level system function limitations? — NO → Determine system function capabilities.

NO ↓ (All lower level system functions resolved?)
END System function is **Unresolved**

NO ↓ (All measure standards met?)
Determine system function limitation.

YES ↓ (Any lower level system function limitations?)
Determine system function limitations.

END Document System Function Capabilities & Limitations

# *Application Mission Element*

- Mission task **abilities and restrictions** are determined at the Mission Element.
  - Ability: "The (unit) has the ability to (task ability) while (task)."
  - Restriction: "The (unit) is restricted to (task ability) while (task) which is (shortcoming to mission task requirement if available)."

- MOE/MOS ratings are applied to the mission tasks to determine the mission abilities and restrictions.

- System function capabilities and limitations are used to determine mission abilities and restrictions.

- Abilities and restrictions of lower level mission tasks are also used to evaluate higher mission tasks.

- Tool developed to resolve the mission tasks.

## Mission Task Aggregation Tool

START

All MOEs/MOSs and system functions resolved? — NO → END Mission task is **Unresolved**

YES ↓

All lower level mission tasks resolved? — NO → END Mission task is **Unresolved**

YES → All measure standards met? — NO → Determine mission task restriction.

YES → Any system function limitations? — YES → Determine mission task restriction.

NO → Any lower level mission task restrictions? — YES → Determine mission task restriction.

NO → Determine mission task abilities.

END Document Mission Task Abilities and Restrictions

# *Application*
# *Mission Evaluation Report*

- MER provides the documented results of the evaluation.
  - Mission Evaluation Results.
    - Mission Performance in terms of Mission Threads.
    - Overall Mission Abilities and Restrictions.
    - Individual Mission Task Abilities an Restrictions.
  - System Evaluation Results.
    - System Performance in terms of Attributes and KPPs.
    - System Suitability
    - Overall System Capabilities and Limitations.

## Provides the decision maker with…
a clear picture of the system capabilities and limitations allowing acquisition decisions based on the military utility gained.

## Provides the warfighter with…
a clear picture of the unit's abilities and restrictions within the context of the mission.

# *Weaknesses*

- Process is time consuming to plan and execute.
  - Requires extensive planning effort across functional boundaries (user, materiel developer, T&E).
    - "Sharing the burden" of developing the different elements with user, materiel developer and tester/evaluator can mitigate the impact. This also develops a consensus of the T&E strategy.
    - Database application software can be used as a tool to facilitate organizing elements and interfaces.
  - May require interpretation of results to determine capabilities/limitations and abilities/restrictions.
    - "Sharing the burden" again can be used. This develops a consensus of the results.
- Not all information required to develop the elements is available at early system development milestones.
  - Systems in development prior to Milestones B may still be in competition.
    - Defining system items and functions in a generic sense can be used. System design specifics would be added after contractor selection. Also, generic system functions supports evaluation of technological risks.

# *Strengths*

- Provides a mission-based form of evaluation.
  - Military utility of the system immediately apparent to the user.
  - System suitability directly linked to mission capability

- Outlines a fully integrated test and evaluation program.
  - Promotes synergistic use of data gathered from all sources: contractor test, developmental test, operational test, and modeling and simulation.
  - Promotes early identification of T&E strategy risks.

- Provides continuous evaluation of the mission throughout all system development phases.
  - Impact of development risks on the mission visible in early development.
  - Monitors progress of system development and demonstration within the context of mission abilities provided.
  - Incremental development strategies are supported by evaluating each increment's abilities in the context of the overall mission.
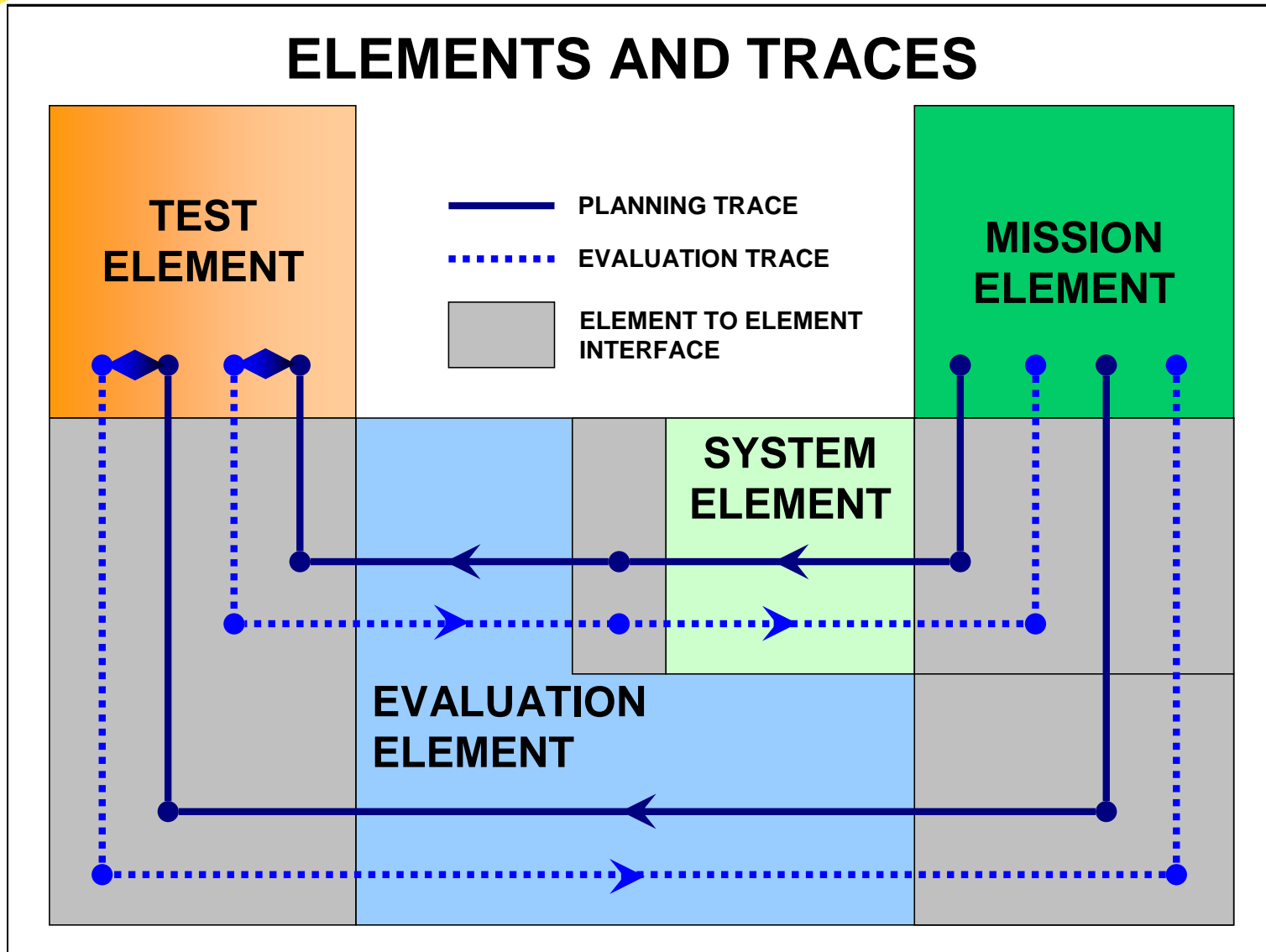
# *Summary*

- Mission-based evaluation process has been developed to support T&E planning and execution. Process is comprised of:
  - Four elements.
    - Mission Element: Comprised of the mission tasks and sub-tasks.
    - System Element: Comprised of system items and functions.
    - Evaluation Element: Comprised of the evaluation MOEs and MOPs.
    - Test Element: Comprised of the data sources and products.
  - Interfaces.
    - Links between each element have been developed to facilitate T&E planning and execution.

- Execution of the T&E effort provides:
  - the decision maker with a clear picture of the system capabilities and limitations allowing acquisition decisions based on the military utility gained.
  - the warfighter with a clear picture of the unit's abilities and restrictions within the context of the mission.

# *Element, Links & Traces*



**ELEMENTS AND TRACES**

TEST ELEMENT

MISSION ELEMENT

SYSTEM ELEMENT

EVALUATION ELEMENT

PLANNING TRACE

EVALUATION TRACE

ELEMENT TO ELEMENT INTERFACE

# Acronym Chart

| | | | | |
|---|---|---|---|---|
| AA | Additional Attribute | | MOS | Measure of Suitability |
| AV | All View (slide 4) | | OA | Operational Area |
| AV | Air Vehicle (slides 11, 13, and15) | | OT | Operational Test |
| CDD | Capabilities Development Document | | OT&E | Operational Test and Evaluation |
| COI | Critical Operational Issue | | OV | Operational View |
| CPD | Capabilities Production Document | | RSTA | Reconnaissance, Surveillance & Target Acquisition |
| DAG | Data Authentication Group | | RT | Remote Terminal |
| DoD | Department of Defense | | SATCOM | Satellite Communications |
| DT | Developmental Test | | SV | Systems View |
| GCS | Ground Control Station | | T&E | Test and Evaluation |
| JCIDS | Joint Capabilities Integration and Development System | | T/O | Takeoff |
| KPP | Key Performance Parameter | | TM | Telemetry |
| MER | Mission Evaluation Report | | TV | Technical View |
| METT-TC | Mission, Enemy, Terrain, Troops, Time and Civil | | UAS | Unmanned Aerial System |
| MOE | Measure of Effectiveness | | UAV | Unmanned Aerial Vehicle |
| MOP | Measure of Performance | | | |

**ARMY TEST AND EVALUATION COMMAND**