



An Enhanced Analysis of Alternatives (AoA)

A Mission-Oriented, Evaluation-Based Framework for Defense Test & Evaluation

*Highlighting
Emerging Roles for Systems Engineering
in
Defense Decision Making
Abstract # 8813*



Emerging Needs for an Enhanced AoA

Scenario - Mission Need- -System Design- System Performance - Suitability - Mission Effectiveness & Cost

Aligning and Informing Defense Decision Making

- **CJCSI 3170.01G , JCIDS, 1 March 2009** “All **JROC Interest programs** with approved CDDs and CPDs **must return to the JROC if they experience a cost growth** of 10 percent over their current baseline or 25 percent over their original baseline as defined in the Acquisition Program Baseline. Information system programs must return to the JROC if they experience a cost growth of 15 percent or more over their approved baseline. **The JROC will assess whether the cost growth is a result of the validated KPPs and if so whether or not an adjustment to the KPPs is appropriate to mitigate the cost growth.**”

- **Capstone Concept for Joint Operations (CCJO) 15 January 2009** : “Adopting this concept has significant implications for the way the Services organize, man, train, and equip the units that compose the joint force.” “The common theme to all these implications is creating greater adaptability and versatility across the force to cope with the uncertainty, complexity, unforeseeable change, and persistent conflict that will characterize the future operating environment.” ...**the growing importance of understanding:**

- (1) **limitations to flexible use of a system**, and
- (2) the “**complementarity factors that enable multiple services to perform (or not) the supporting tasks that enable a system to do its mission** and consequently affect flexibility and limitations in joint force effectiveness”.

- **Acquisition:**
 - Early and More Frequent Program Reviews Beginning Pre-milestone A
 - Mission Oriented, Evaluation-Based Test Programs

- **T&E:**
 - Early Engagements by T&E with JCIDS and ACQUISITION
 - Integrated DT / OT Planning (DT/OE)Test in Joint Environments

- **Joint Commander: Informed on System:**
 - Effectiveness and Suitability
 - Flexibility and Limitations in Use
 - Flexibility and Limitation in Support

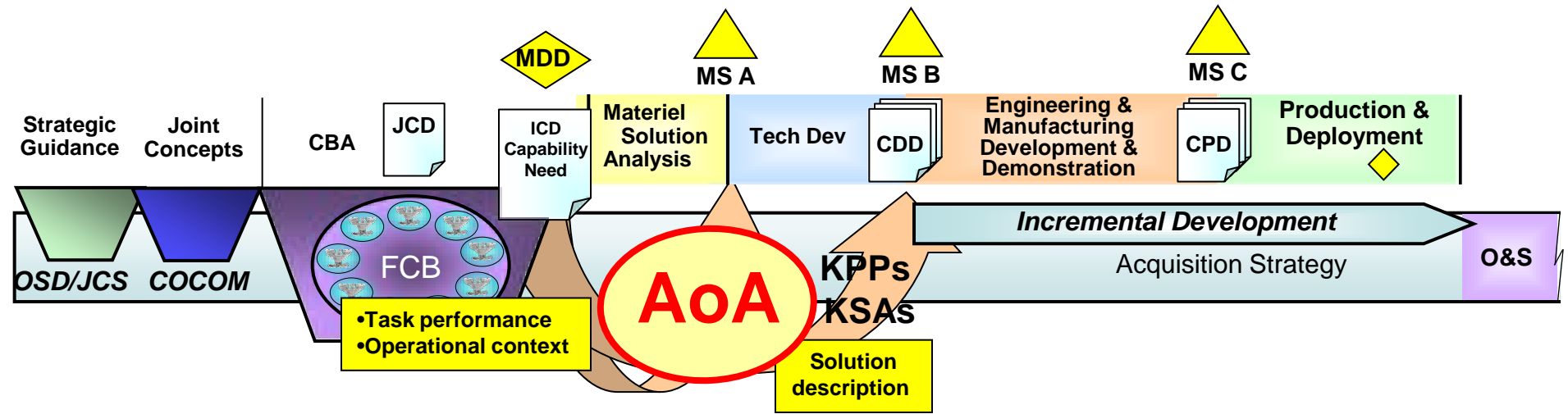
•Cost vs Capability
•Flexible Use

Observation 1.
SE informs JROC / JCIDS concerning system design and cost implications of revised capability requirements

Observation 2
SE informs commanders concerning flexible use and support of System

Role of the Analysis of Alternatives (AoA)

Analysis of Alternatives (AoA)
 Translates tasks to be performed in an operational context into a system “solution” for acquisition

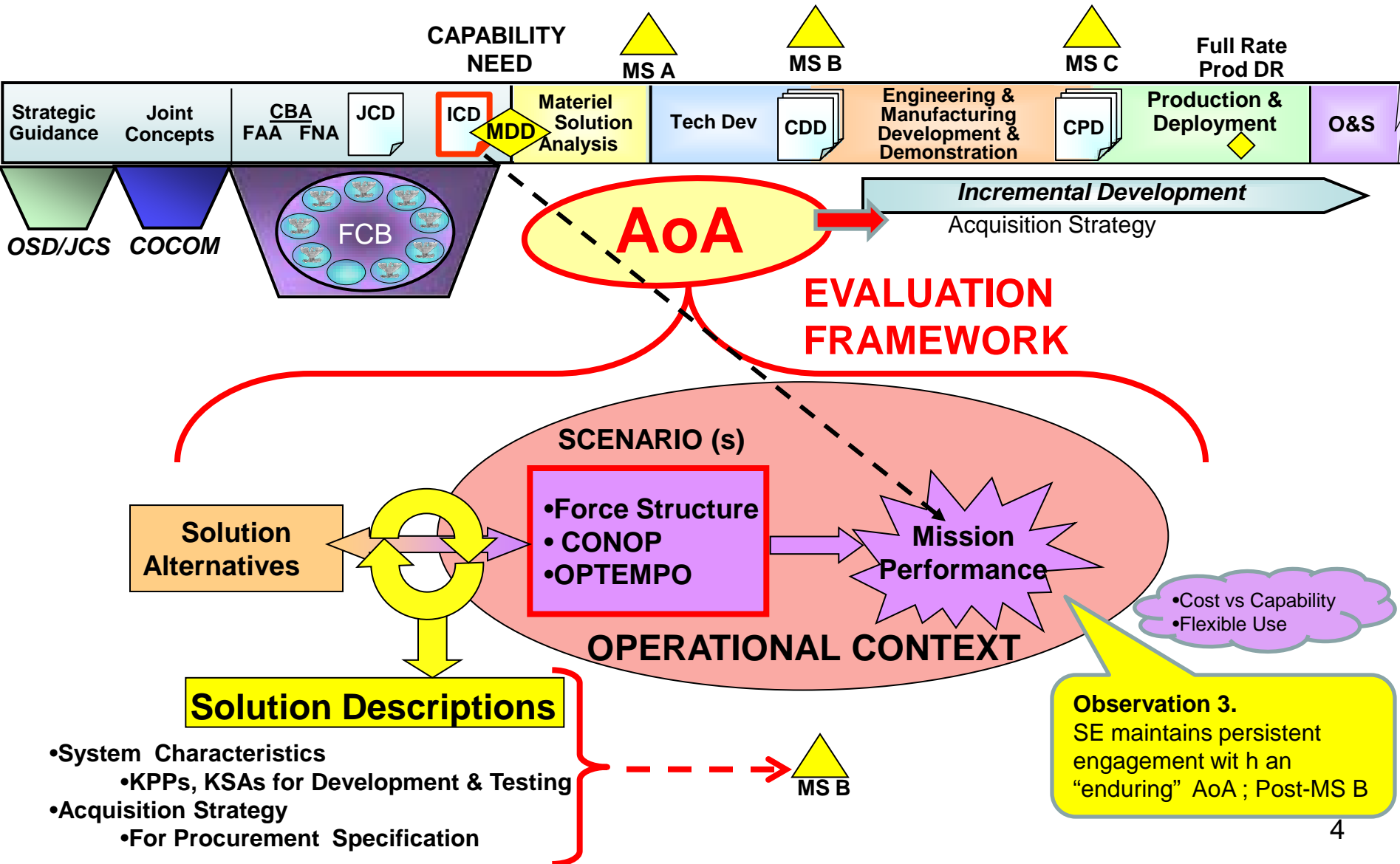


JCIDS definition of AoA:

“The **evaluation** of the performance, operational effectiveness, operational suitability, and estimated costs of alternative systems to meet a mission capability.**The AoA is one of the key inputs to defining the system capabilities in the Capability Development Document (CDD)**”

Insights Needed to Build a TEMP

AoA Methodology



A Review of AoAs

- **Reviewed AoAs**
 - AoAs Done Between 2003 and 2008 AND Done for DOT&E Oversight List Programs
- **Implications for T&E:**
 - Each Contains a Description of an **Operational Context** Potentially Useful to T&E Planning
 - Scenario, Forces, Objectives CONOPS, Climate, OPTEMPO, etc
 - Each includes a **“Sensitivity Analysis”** (SA) Relating System Performance to Mission Accomplishment

HOWEVER: SAs do NOT Generally Relate Variations in Systems’ Characteristics Performance to Mission Effectiveness

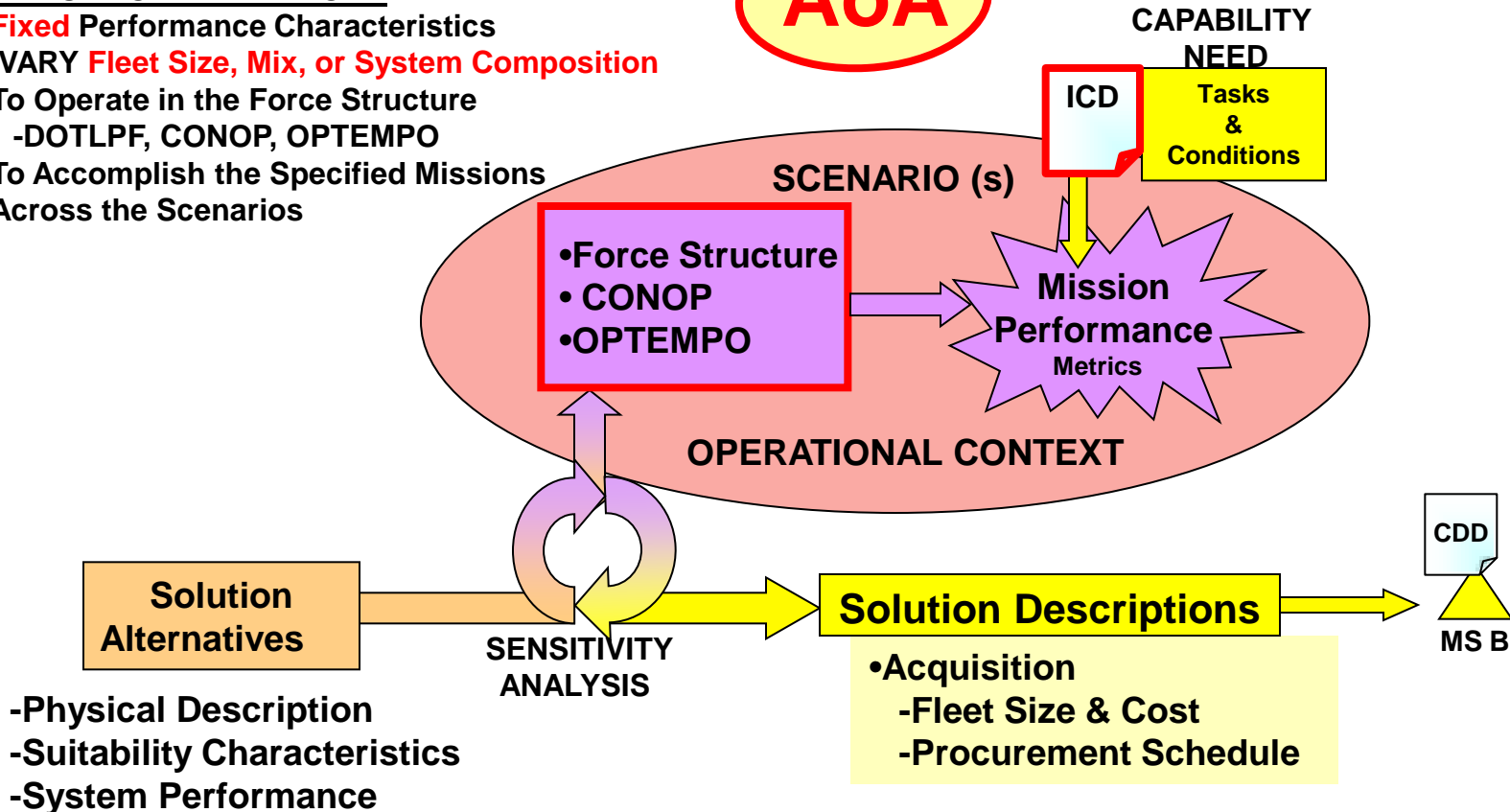
- SAs Treat Performance Characteristics as “Fixed”;
- SA used to Derive System Fleet Size or System Configurations of Fixed Components for “Mission Accomplishment” Across Varied Scenarios
 - **AoA Informs a System Acquisition Strategy**
 - » A “Packing Algorithm” Paradigm: “How Many “Systems as Defined” are Needed, by When, and at What Cost for Mission Success
 - **AoA Does NOT Recognize T&E as a Customer**
 - » T&E Examines System and Component Characteristics Performance relative to Mission Effectiveness measures
 - AoA cannot readily address revisions of Design or Performance levels
 - » SA varies the number of system, not their performance, vs the Mission.

Analysis of Alternatives (AoA) Requirements-Based

EVALUATION FRAMEWORK

- **Fixed** Performance Characteristics
- VARY **Fleet Size, Mix, or System Composition**
- To Operate in the Force Structure
 - DOTLPF, CONOP, OPTEMPO
- To Accomplish the Specified Missions
- Across the Scenarios

AoA

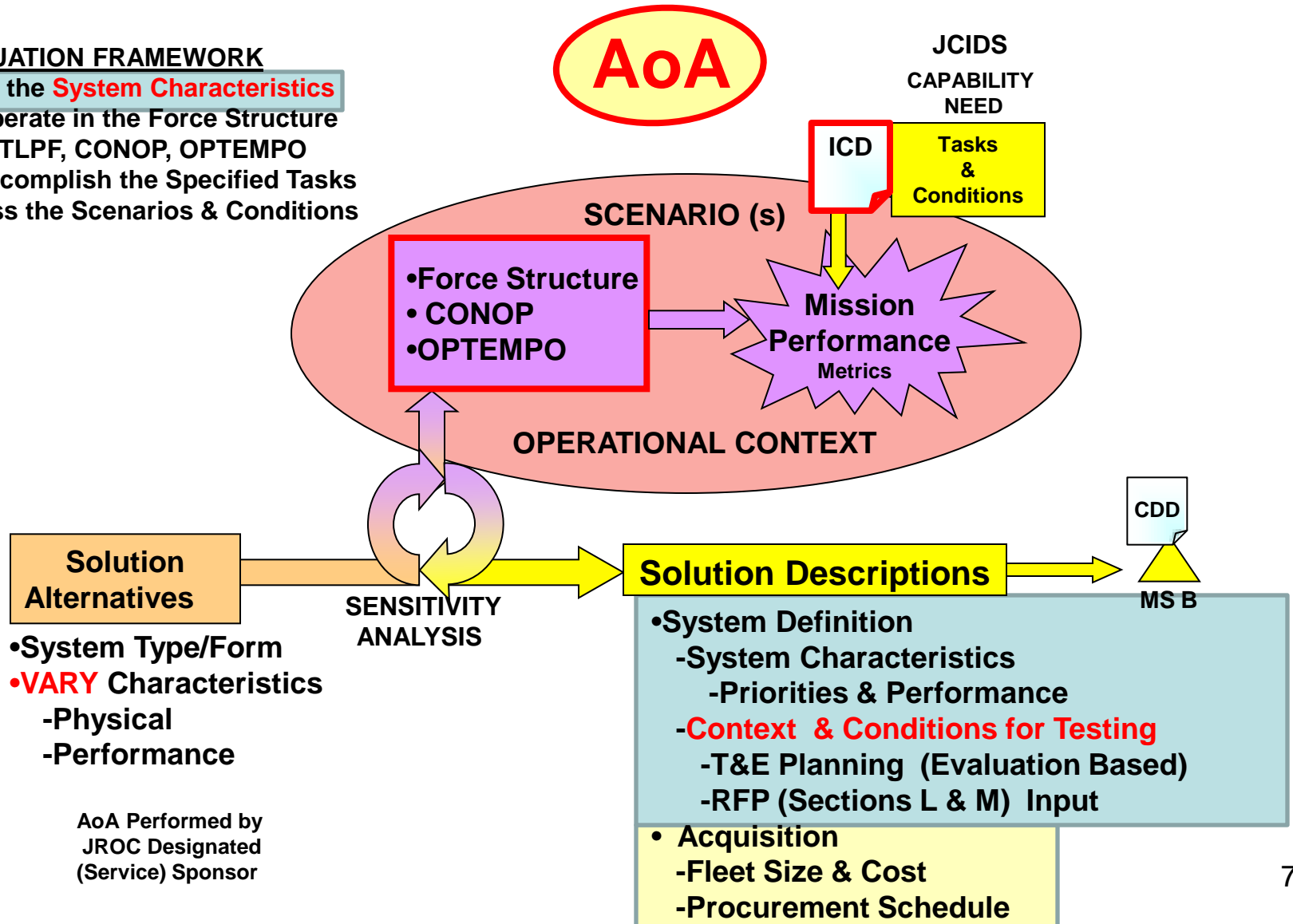


AoA Performed by
JROC Designated
(Service) Sponsor

An **Enhanced** Analysis of Alternatives (AoA) Capability-Based

EVALUATION FRAMEWORK

- **VARY** the **System Characteristics**
- To Operate in the Force Structure
 - DOTLPF, CONOP, OPTEMPO
- To Accomplish the Specified Tasks
- Across the Scenarios & Conditions

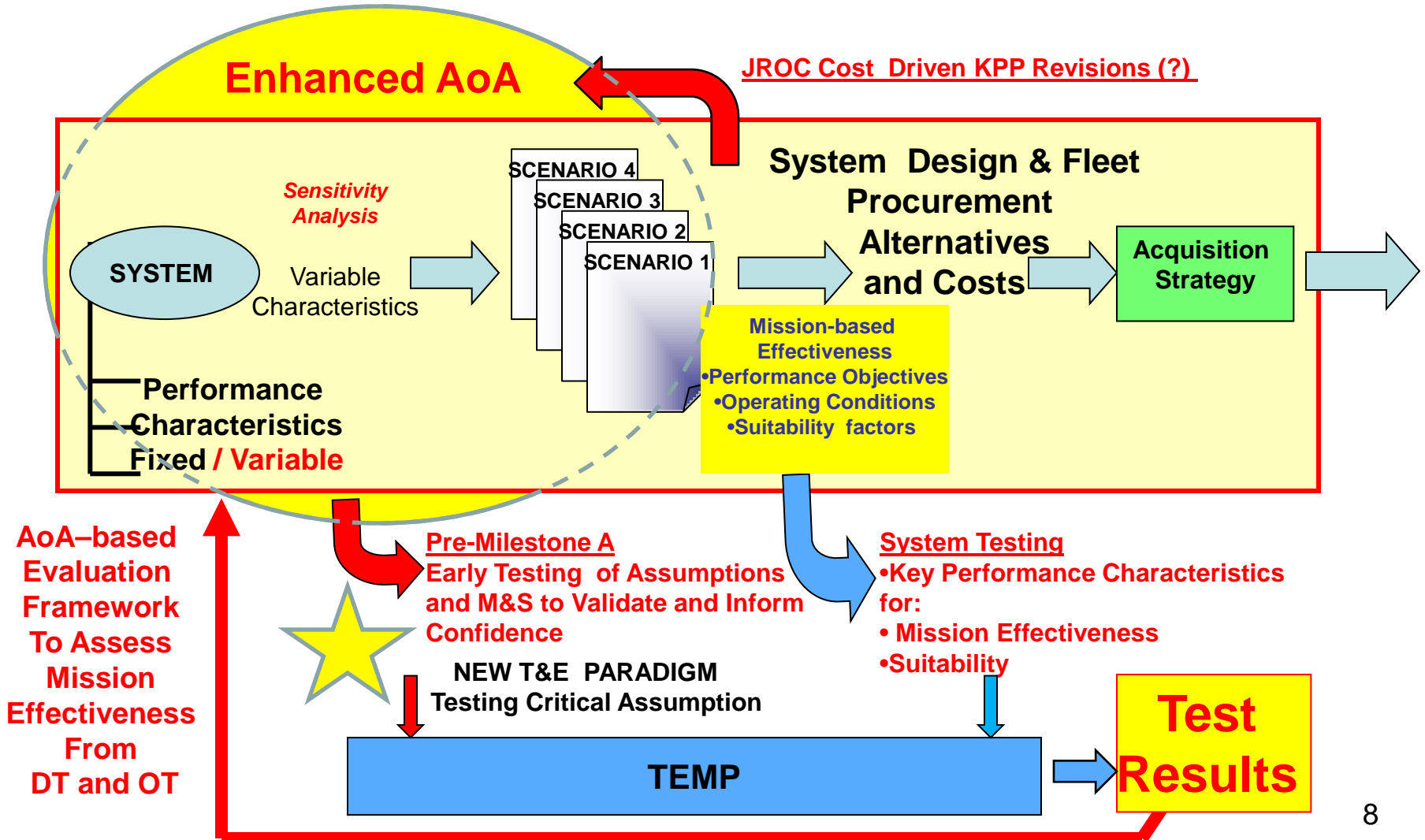


Role of the Enhanced AoA

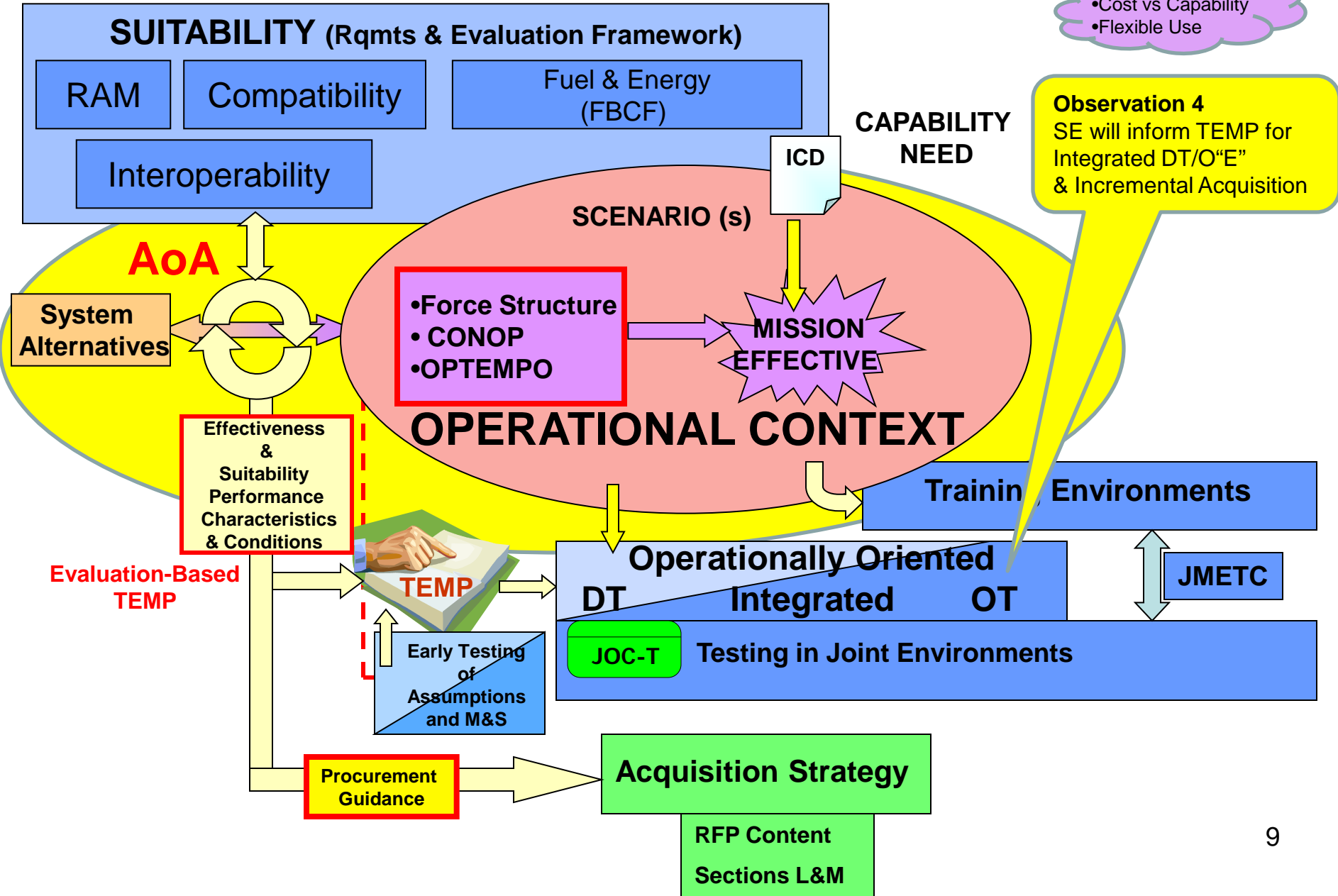
T&E Informs Confidence in Acquisition and Employment

By

Test Results Evaluated in the AoA Framework



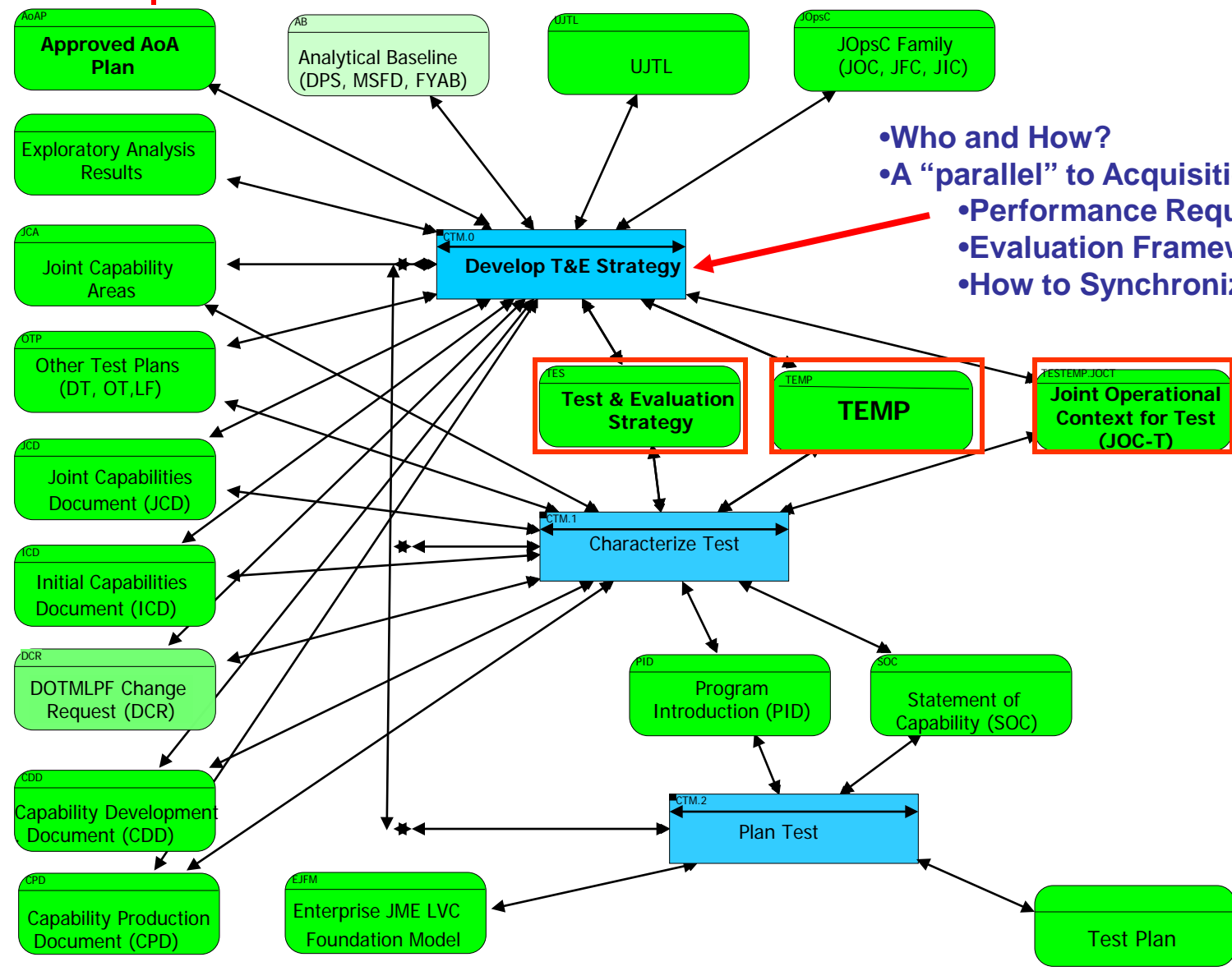
An Enhanced AoA an Integrating Process





Benefits to T&E: Capability Test Method (CTM)

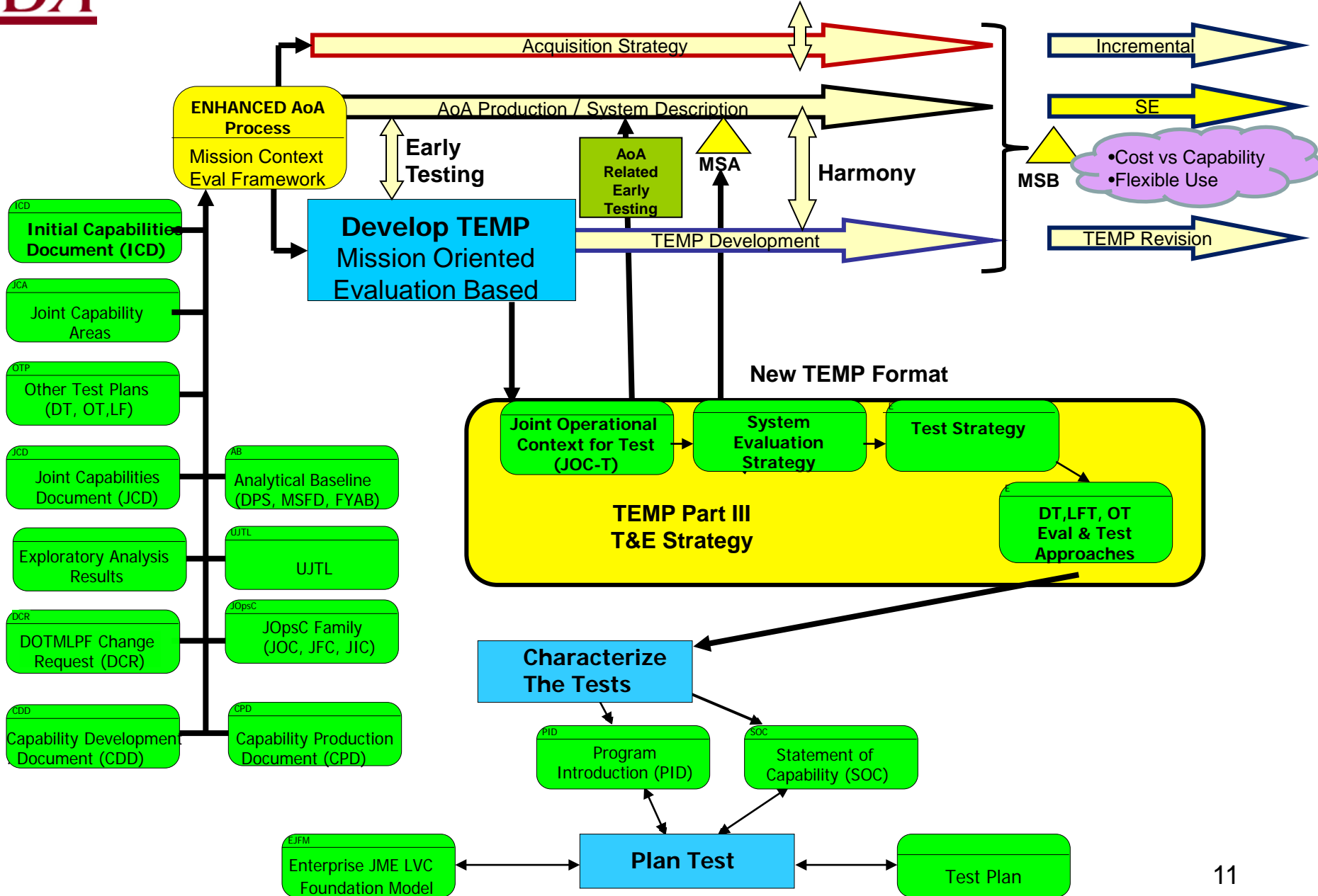
→ System Design → ACQ



- Who and How?
- A “parallel” to Acquisition Process?
- Performance Requirements?
- Evaluation Framework?
- How to Synchronize?



Benefits to T&E: Enhanced CTM





Benefits to T&E: An Emerging TEMP Format

Part I Introduction	Part II Test Program Management & Schedule	Part III Test & Evaluation Strategy	Part IV Resource Summary
<p>Brief Purpose of TEMP</p> <p>Brief Mission Description</p> <p>Brief System Description</p> <ul style="list-style-type: none"> -System Threat Assessment -Program Background -Key capabilities -Key Interfaces -Cert Rqmts -Sys Engr Rqmts 	<p>T&E Management</p> <p>Organization</p> <p>T&E Data Base Rqmts</p> <p>Deficiency Reporting</p> <p>TEMP Updates</p> <p>Integrated Test Program Schedule</p>	<p>•Evaluation Strategy Testing's Role in System/Mission Effectiveness Evaluation</p> <ul style="list-style-type: none"> •How the AoA informs the Test Planning <ul style="list-style-type: none"> -Provides Context for Performance <p>Objectives and Operational Contexts for Testing</p> <ul style="list-style-type: none"> - Provides the Evaluation framework for: <ul style="list-style-type: none"> -Mission Effectiveness Assessment -Comparison to Current Capability -Test Support to ACQ Decisions <p>•How Test Results are used in the AoA Framework ACQ and Operational Decision Making</p> <p>•Test Strategy The Approach to Supporting the Evaluation Strategy</p> <ul style="list-style-type: none"> - DT & OT Objectives from Evaluation Strategy - Joint Operational Context for Test (JOC-T) - AoA Assumptions/ M&S Validation Testing - Integrated DT & OT Planning Guidance 	<p>Introduction</p> <ul style="list-style-type: none"> -Test Articles -Test Sites & Instrumentation -Test Support Equipment -Threat Representations -Test Targets & Expendables -OPFOR Test Support -M&S and Test-beds -Joint Operational Test Environment -Special Requirements <p>Federal, state, Local Rqmts</p> <p>Manpower/ Personnel Training</p> <p>Test Funding Summary</p>
<p>•AoA Overview (T&E Perspective)</p> <ul style="list-style-type: none"> -AoA System/Mission Evaluation Approach -AoA's Basis for Test Planning -AoA as Basis for evaluation of Test Results <p>•Acquisition Strategy Overview</p> <ul style="list-style-type: none"> -Milestone Information Needs -System Maturity Schedule 		<ul style="list-style-type: none"> -M&S, Test Limitations •Live Fire Evaluation Approach <ul style="list-style-type: none"> -Test Objectives, M&S, Test Limitations •Certification for IOT&E •Operational Evaluation Approach <ul style="list-style-type: none"> -Operational Test Approach -M&S, Test Limitations •Other Certifications •Reliability Growth •Future T&E Activities 	

Describing an Evaluation-Based Test Program



Benefits from an Enhanced AoA

- **Enhanced Confidence in ACQ Decision Making**
 - Early Testing of Key AoA Assumptions and Representations
 - Responsive to pre-Milestone A Program Reviews
 - Tasking and Resource Planning in the TEMP for:
 - To validate Assumptions and M&S
 - For M&S DT and OT Planning and Test Events
 - MDAs and Field Commanders Better Informed on System Performance, Deficiencies Significance & Mitigation
- **More Effective and Efficient Test Programs**
 - Evaluation Based
 - Testing integral to the AoA/ Evaluation Process
 - Testing Focused on Most Important Performance Characteristics and Conditions
 - Test Results Designed for Evaluation in the AoA Framework
 - System Performance, Suitability and Mission Effectiveness
 - Mission Oriented
 - AoA's Authoritative Operational Context used to Derive Operational Environments for Testing
 - Context Facilitates Integrated DT/OT Planning; Operational Evaluation of DT ...(DT/OE)
 - AoA Context Defines common Test and Training Environments

Harmonizing T&E and Acquisition Decision Support

System Design, Cost / Effectiveness Evaluation, Acquisition Strategy, and Test Program

Characteristics of an Enhanced AoA

•Cost vs Capability
•Flexible Use

- **A Persistent Analytic Activity**
 - Relates the Key System Performance Characteristics to Mission Effectiveness and Cost
 - Usually Animated by the JCIDS/ ICD; but sometimes as part of the CBA or sooner within a Service ; Enduring through Milestone B; may extent through Milestone C & System Life Cycle
 - Initially Focused on Selecting among Alternative Materiel Solution Approaches
 - **(Enhanced)** Develops and Maintains the Operational Oriented Evaluation “Trade Space” to Support Acquisition & Operational Decision Making
- **Informing:**
 - **JCDIS, ACQ, and Joint Commanders**
 - Sensitivity of Mission Effectiveness and Costs to Variations in the Performance Levels of Mission and Suitability Related System Characteristics
 - **JCIDS** (Determination and /or Adjustment of System KPPs and KSAs)
 - **Acquisition** (MDA & PM)
 - **A Systems Engineering “Trade Space”** and the Acquisition Strategy)
 - Numbers of Systems; O&M and Logistics Implications; Procurement Schedules; Design , Effectiveness and Cost Tradeoffs
 - **T&E** (DT and OT) ; Informs on:
 - Operational Conditions and Test Objectives Aligned with Mission Effectiveness
 - Mission Effectiveness Oriented Analytic Framework for Evaluating Test Results:
 - Key Assumptions and Representations (M&S and others) Requiring Testing to Enhance Confidence in the System Design
 - **Field Commanders;** Informs on:
 - Flexibility and Limitations in Use and Support of the System

Summary Observation
SE will Inform this new DYNAMIC

Observation 5
A new & persistent paradigm for responsive SE