



U.S. Army Research, Development and Engineering Command

Mission-Based
Test & Evaluation Strategy: Creating
Linkages between Technology
Development and Mission Capability
NDIA Systems Engineering Conference



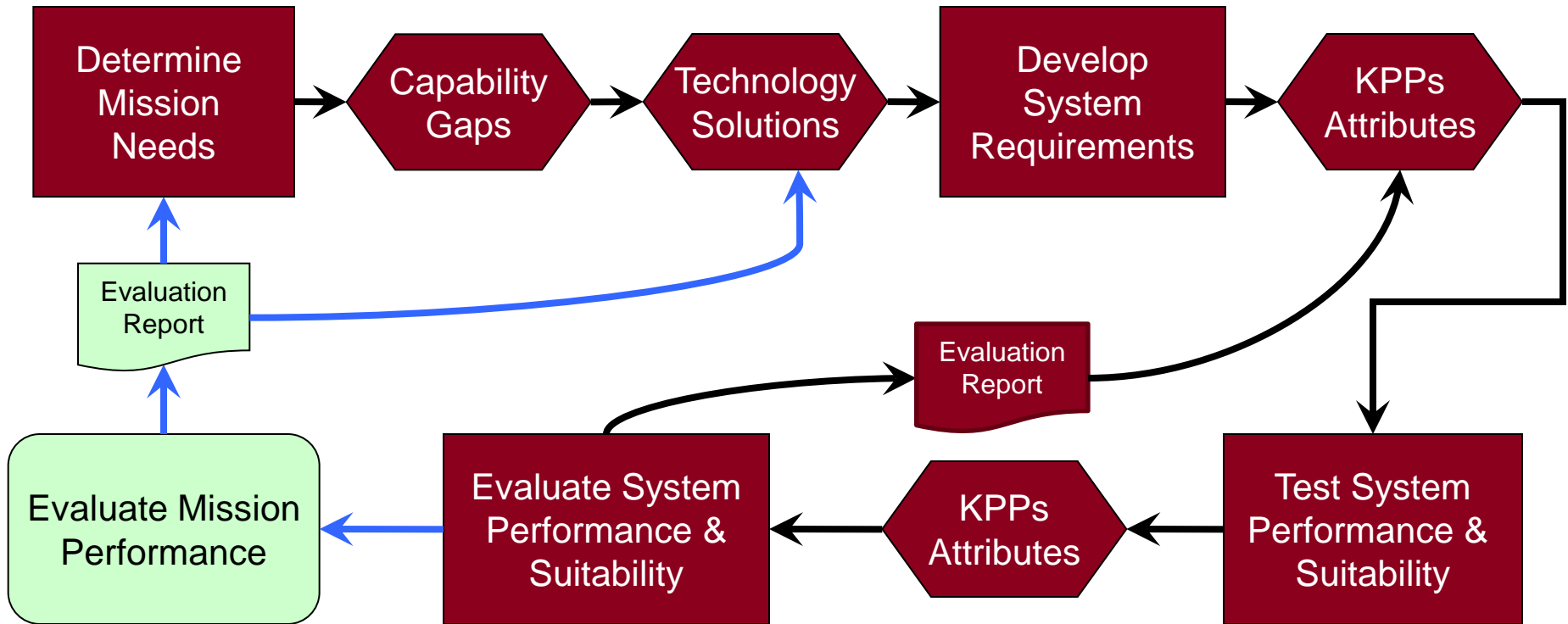
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Mr. John Beilfuss (ARL)

Mr. Chris Wilcox (ATEC/AEC)

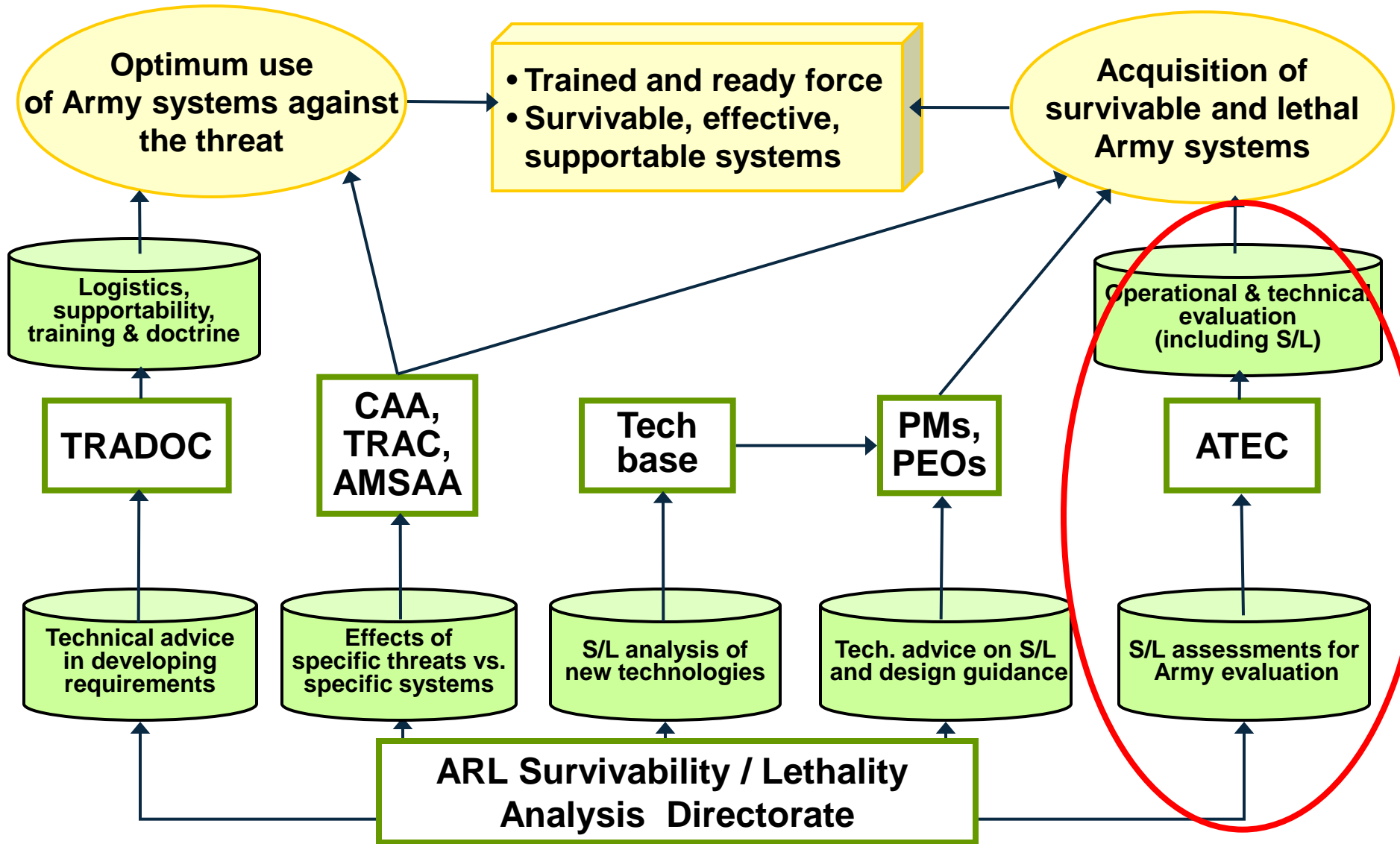
28 October 2009

Acquisition Process Paradigms: Traditional; Proposed



Leaves the "So What" question;
How does the technology/system help the Warfighter?

Completes the Feedback Loop to Mission Needs



- **Inform S&T community** of the effort to design and implement a ***mission-based test and evaluation (MBT&E)*** methodology.
- **Create awareness** of an opportunity for better transition of technology to PMs
- **Solicit questions and comments** from peers to help improve the MBT&E methodology.

- **MBT&E is a product of ATEC¹, ARL, AMSAA** and has been coordinated with acquisition, T&E, and user communities.
- **Note:** ARL/SLAD is a provider of survivability/lethality/vulnerability assessment data to ATEC/AEC. Our products to ATEC now have a capabilities dimension.

¹ Program lead is Mr. Chris Wilcox of Army Evaluation Center



- **What is MBT&E?**
- **Why** was MBT&E developed?
- **What does MBT&E provide?**
- **How** is MBT&E implemented?
- **Where** is MBT&E headed?
- **What** is the potential impact on Army Technology Objectives?



Mission-Based Test and Evaluation

is a methodology that focuses T&E on the mission task **capabilities** provided to the warfighter. It provides a framework and procedure to:

- link materiel system attributes to the operational capabilities;
- examine the SoS required to enable the operational capability; and
- enable synergistic use of all available data sources.

- Prepare for networked system-of-systems evaluation
- Address Acquisition Initiatives
 - Capability-based acquisition
- Apply MBT&E to all evaluation programs
- Provide “feedback” to capabilities integration and development
- Draw from capability documents as basis for the evaluation strategy

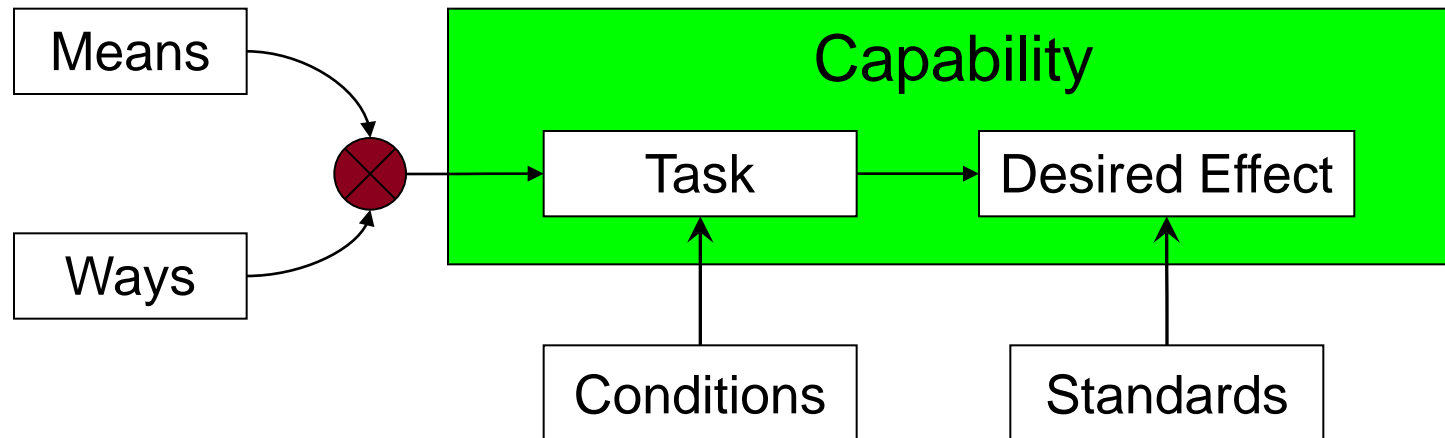
“We will continue to examine and challenge our most basic institutional assumptions, organizational structure paradigms, policies, and procedures to better serve the Army.”

CG, ATEC Commander’s Priorities for FY 10-15

Term	Definition	Reference
Mission	An assignment (task) with a purpose that provides direction to a command under prescribed conditions.	CJCS 3500.04C
Essential	Constituting the intrinsic, fundamental nature of something	Webster New World Dictionary
Task	A discrete event or action, not specific to a single unit, weapon system, or individual that enables a mission or function to be accomplished.	Cliff Whitcome Naval Postgraduate School
Conditions	Conditions are variables of the environment that affect the performance of tasks. Conditions include the physical, military, and civil environment	Joint mission essential task list development handbook CJCS.
METL	A document that provides the major input to planning, executing, and assessing joint training. A commander's list of priority joint tasks, derived from plans and orders, along with associated conditions and measurable standards.	Joint mission essential task list development handbook CJCS.
UJTL	A comprehensive integrated menu of functional tasks, conditions, measures, and criteria supporting all levels of the Department of Defense in executing the National Military Strategy. This document translates missions into tasks.	CJCS 3500.04C

Capability¹ – The ability to achieve a **desired effect** [or result, outcome, or consequence of a task²] ...

- under specified **standards and conditions**
- through a combination of **means and ways**
- to perform a set of tasks.



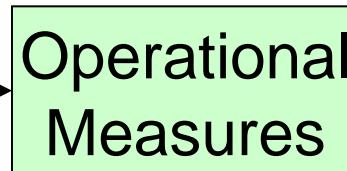
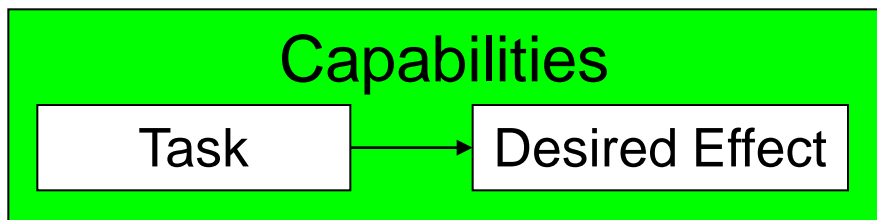
1. CJCSI 3170.01F, May 2007

2. Taken from JP 1-02, Mar 2007, definition of effect.

MISSION AND SYSTEM

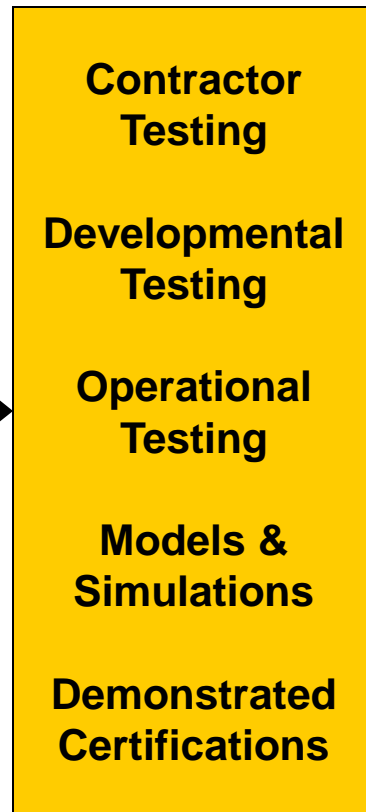
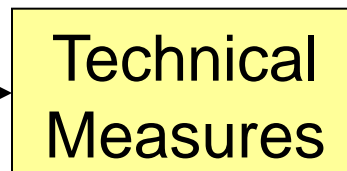
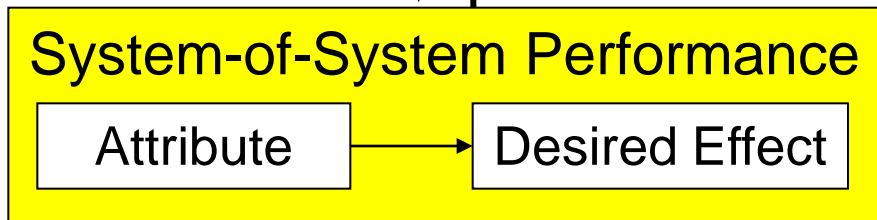
EVALUATED BY

TESTED BY

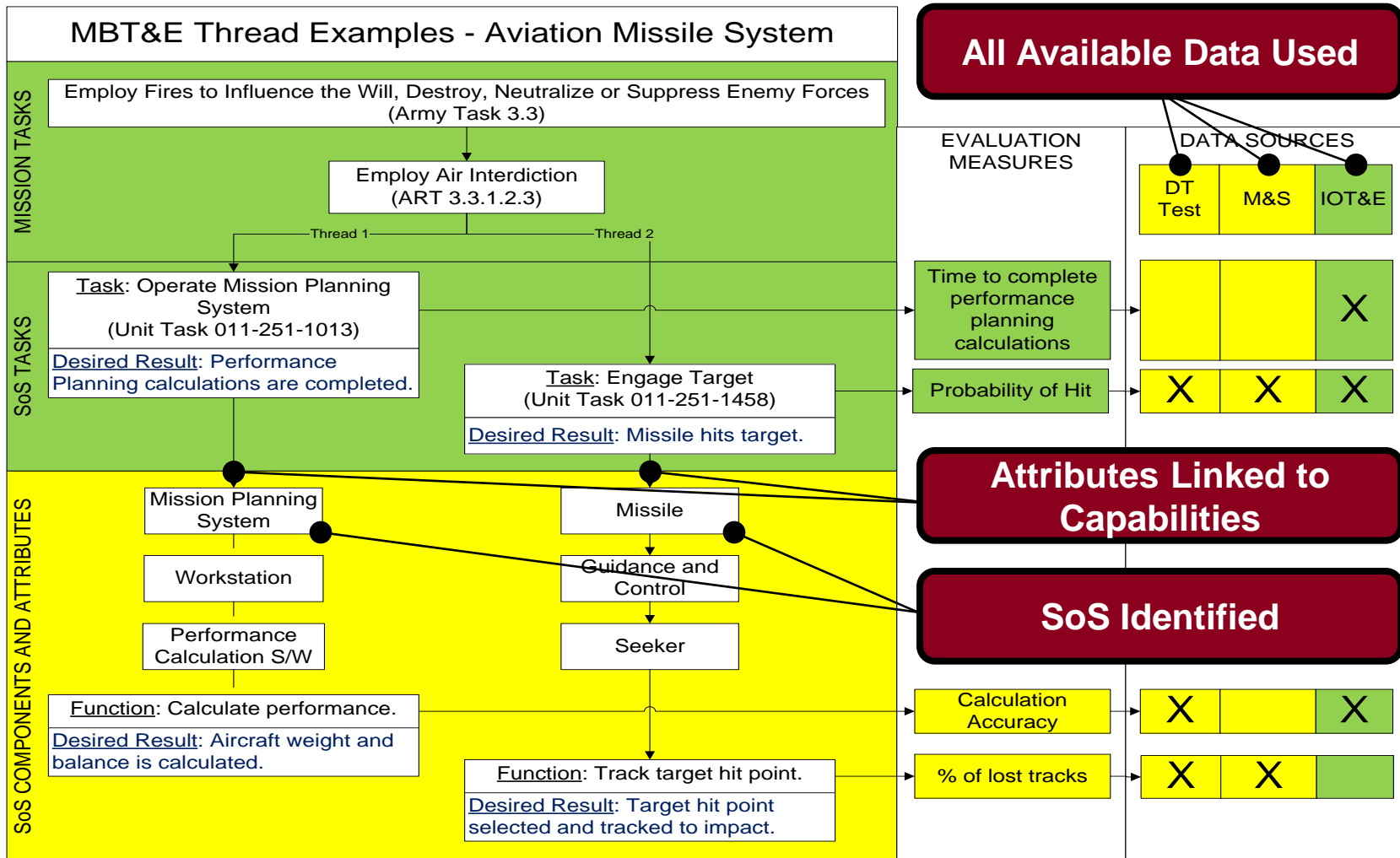


SYSTEMS
ENGINEERING

ENABLES



Task Capability Linked to System Performance



Capability and Performance Linked to Integrated T&E

- Process divided into steps.
- Steps divided into 5 major purpose areas.

UNDERSTAND THE MISSION

- Mission and task context.

UNDERSTAND THE SYSTEM

- Materiel components and attributes.
- **Linkages between** mission and materiel.

DESIGN THE TEST AND EVALUATION

- Test design and evaluation measures.

DETERMINE THE RESULTS

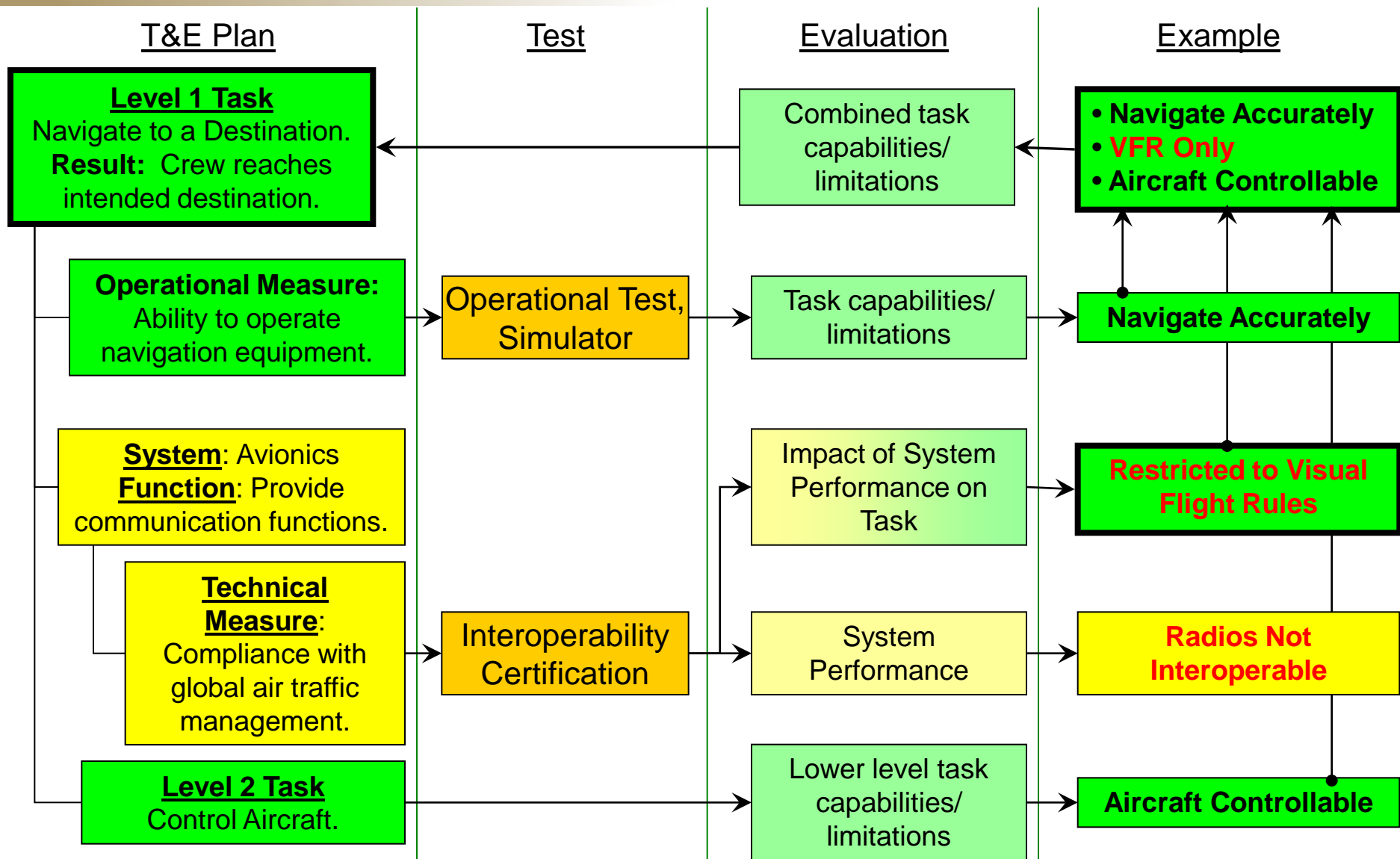
- Execute test and evaluation.

REPORT THE RESULTS

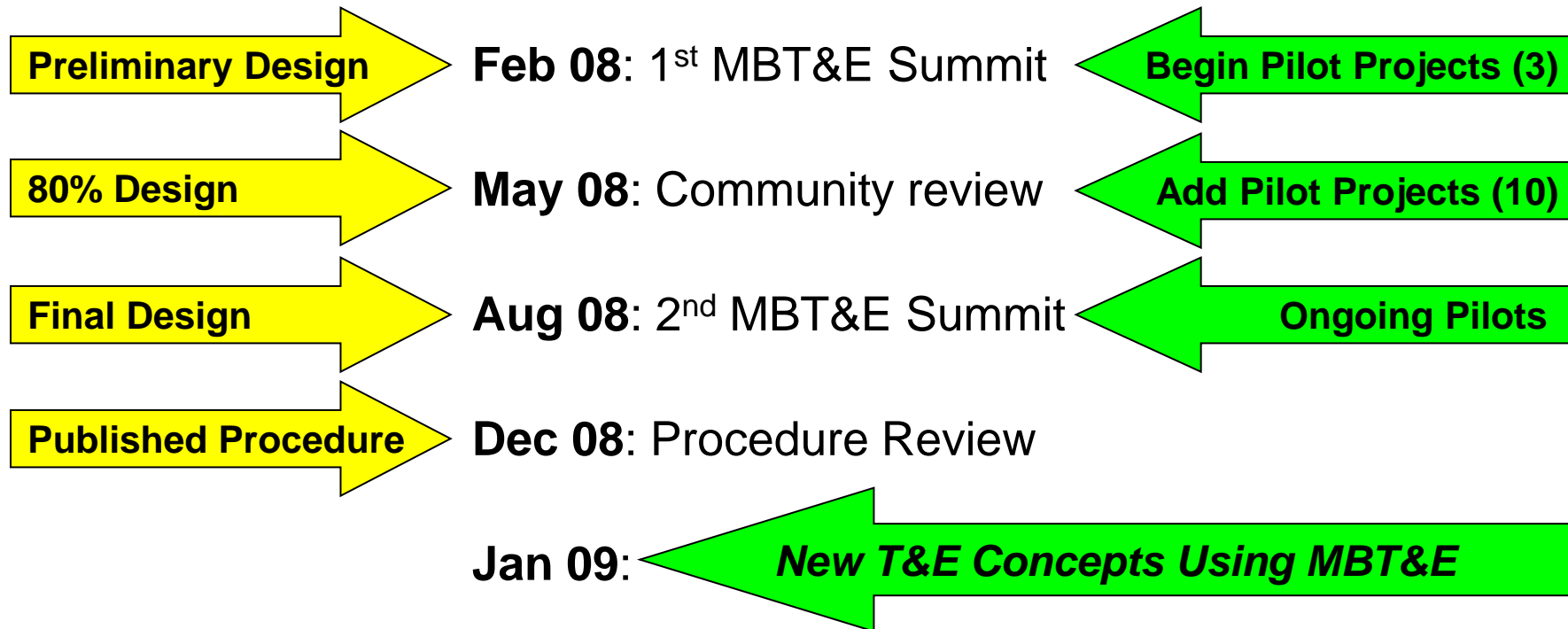
- Format and report the results.

Reports on:

- Operational capabilities and limitations
- Materiel system performance and effect on operational capabilities as specified in:
 - FAA: Functional area analysis
 - FNA: Functional need analysis
 - FSA: Functional solution analysis
- Effectiveness, suitability and survivability based on task



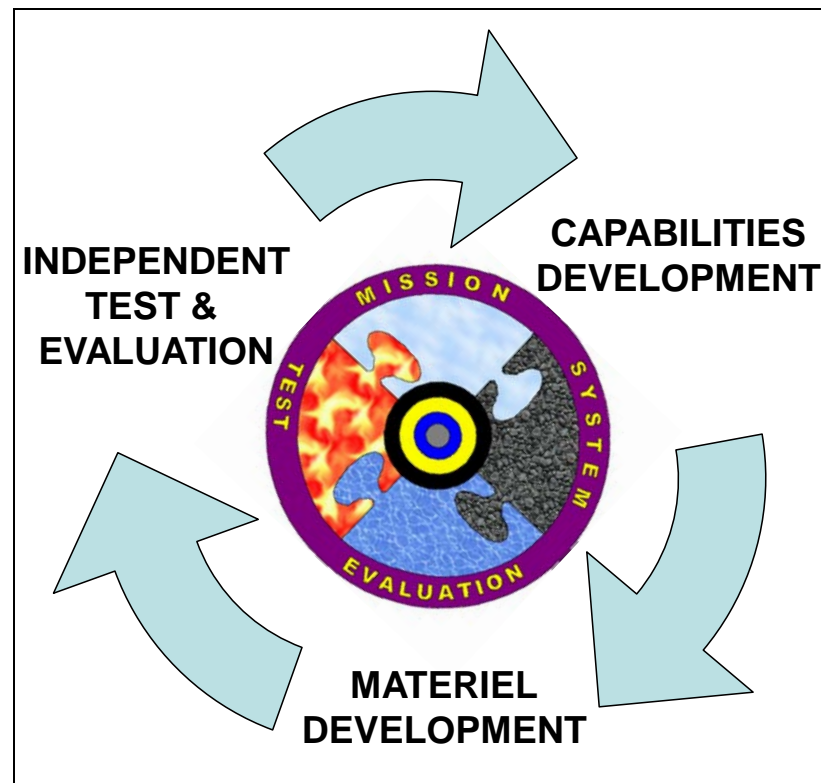
TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.



Lessons Learned:

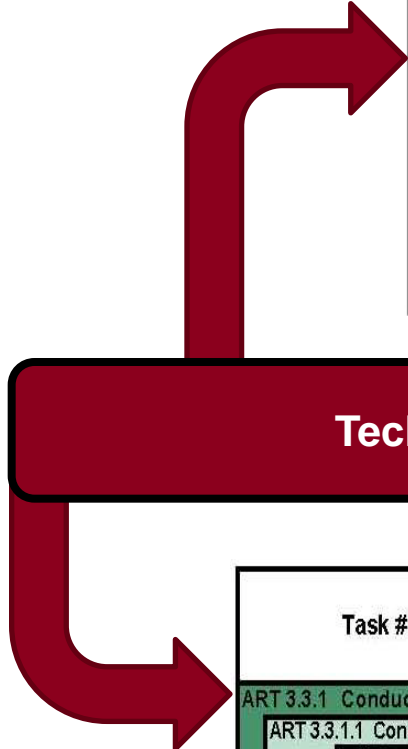
- MBT&E framework providing context of operational capability.
- MBT&E process is executable with current personnel skill set.
- Efficiencies can be increased through:
 - Improved tools (templates, IT, training, etc.); and
 - Combat and materiel developer participation.

- Synchronize with capabilities-based analysis.
- Synchronize with systems engineering.
- Collaborative environment.
- Pilot programs ongoing
 - Paladin
 - JLTV
- Address technology development and maturation



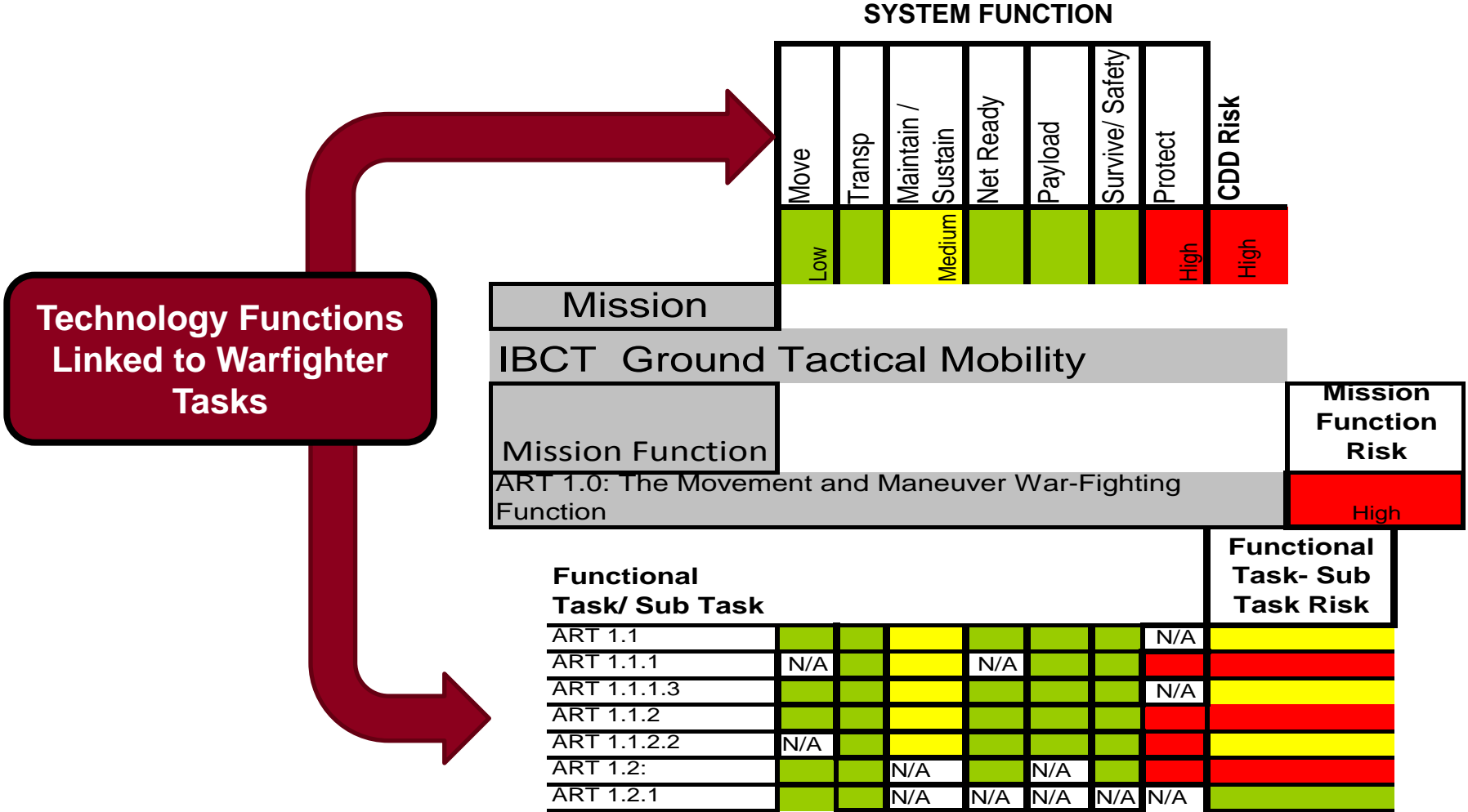


EFD		System(s)	
CREW			
c1	Commander Incapacitated	Commander	
c3	Driver Incapacitated	Driver	
c6	Gunner Incapacitated	Gunner	
c7	Loader Incapacitated	Loader	
CATASTROPHIC LOSS			
k1	Fuel/Ammo	Ammunition Fuel Fire	OR
MOBILITY			
m1.1	Reduced Maximum Speed 0-10%	Turbocharger System	OR
		Supercharger System	OR
		Two Intermediate Roadwheels	
m1.2	Reduced Maximum Speed 10-50%	Road Wheel Left 1 System	OR
		Shock Absorber Right Rear System	OR
		Shock Absorber Right Front System	OR
		Shock Absorber Left Rear System	OR
		Shock Absorber Left Front System	OR
		Track Tensioner Right System	OR
		Track Tensioner Left System	OR
		Road Wheel Right 1 System	



Technology Functions Linked to Warfighter Tasks

Task #	Crew				Cat	Mobility							
	C1	C3	C6	C7	K1	M1			M2			M3	
						M1.1	M1.2	M1.3	M2.2 2.2.1	M2.3	M2.4	M3.2	M3.4
ART 3.3.1 Conduct Lethal Fire Support													
ART 3.3.1.1 Conduct Surface to Surface Attack													
1	Establish Firing Capability at Firing Position												
2	Conduct Emergency Missions												
3	Conduct Direct Fire												
4	Process Fire Missions												
5	Conduct Indirect Fire Missions												
6	Perform Fire Missions in Degraded Mode on the M109A6												



How does this impact an ATO? A mission-based evaluation may measure operational performance instead of technology performance.

- Technology programs feed programs of record
 - Consider planning for a mission-based evaluation with metrics
 - Ability of the technology to provide a capability to perform a set of tasks
 - Non-technical metrics
 - Improve the connection between the mission, tasks, and the technology objectives
 - Recognize the customer cares about performance of the mission
 - Influence a test strategy during the ATO process
 - Involve evaluators during the ATO planning and execution
 - Influence technology transfer agreements with PMs

At Milestone A, the PM shall submit a Test and Evaluation Strategy (TES) that describes the overall test approach for integrating developmental, operational, and live-fire test and evaluation and addresses test resource planning.

The TES shall include a test plan that addresses *Technology Development* phase activity, including the identification and management of technology risk, and the evaluation of system design concepts against the preliminary mission requirements resulting from the Analysis of Alternatives.

Test planning shall address the T&E aspects of competitive prototyping, early demonstration of technologies in relevant environments, and the development of an integrated test approach.

The Milestone A test plan shall rely on the Initial Capability Document as the basis for the evaluation strategy.

- PM is required to Sync T&E Strategy with Technology Development Strategy and System Engineering Plan
- Addresses how component technologies being developed will be demonstrated in a relevant environment
- Identifies technology risk
- Identifies evaluation of system design concepts against preliminary mission and sustainment requirements.
- Supports the technology transition into the program
- Considers development, demonstration, production, and deployment
- Should take a mission-oriented approach
- Identifies key system attributes that support key capabilities in ICD.
- Enhances success in validating performance

Ref: DAU Defense Acquisition Guidebook; SE chapter 9

- MBT&E methodology has been developed
- Positive results and path forward toward increased efficiencies
- MBT&E aligns the efforts of the capabilities developer, materiel developer, and independent T&E
- Early integration of mission-based thinking supports technology transition to PMs

Questions?