Test & Evaluation Strategy for Technology Development Phase

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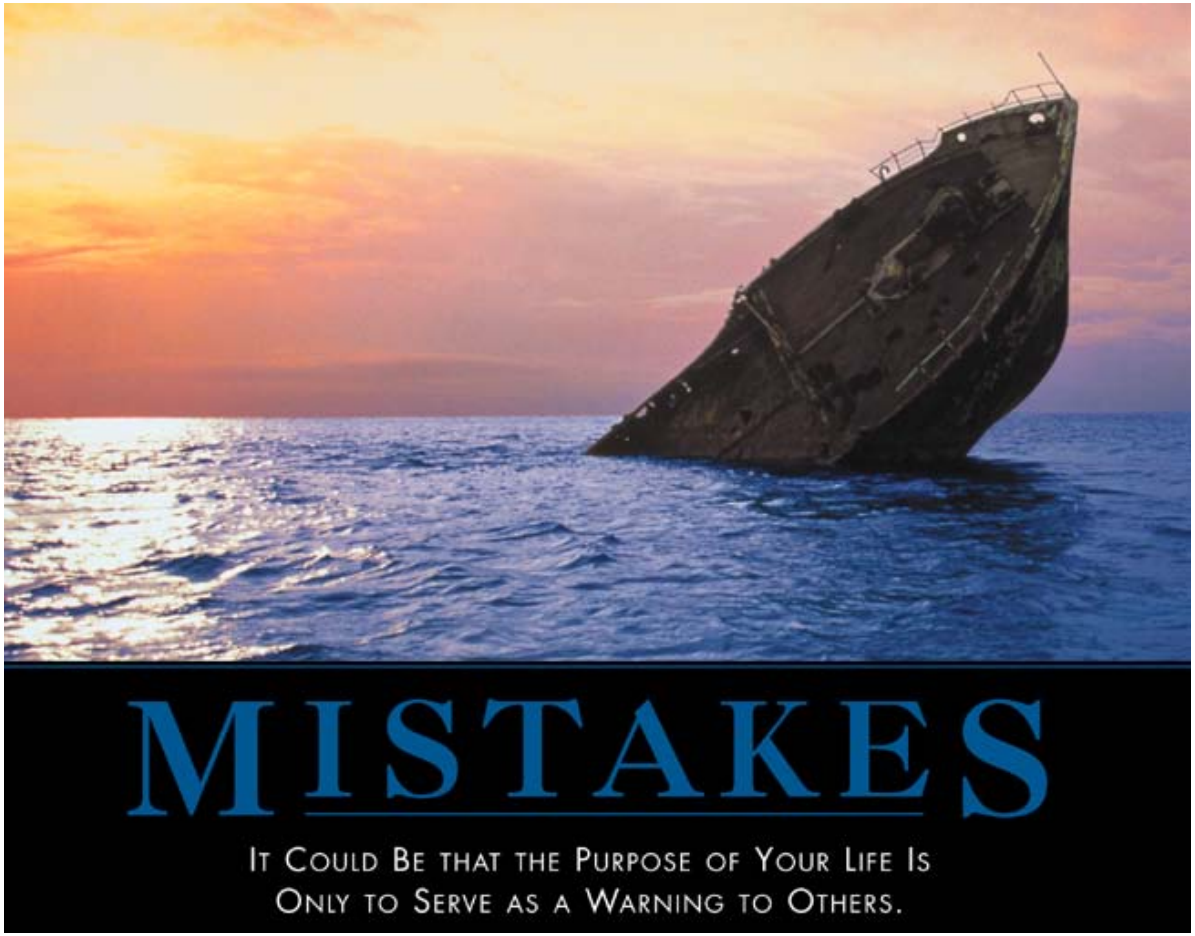
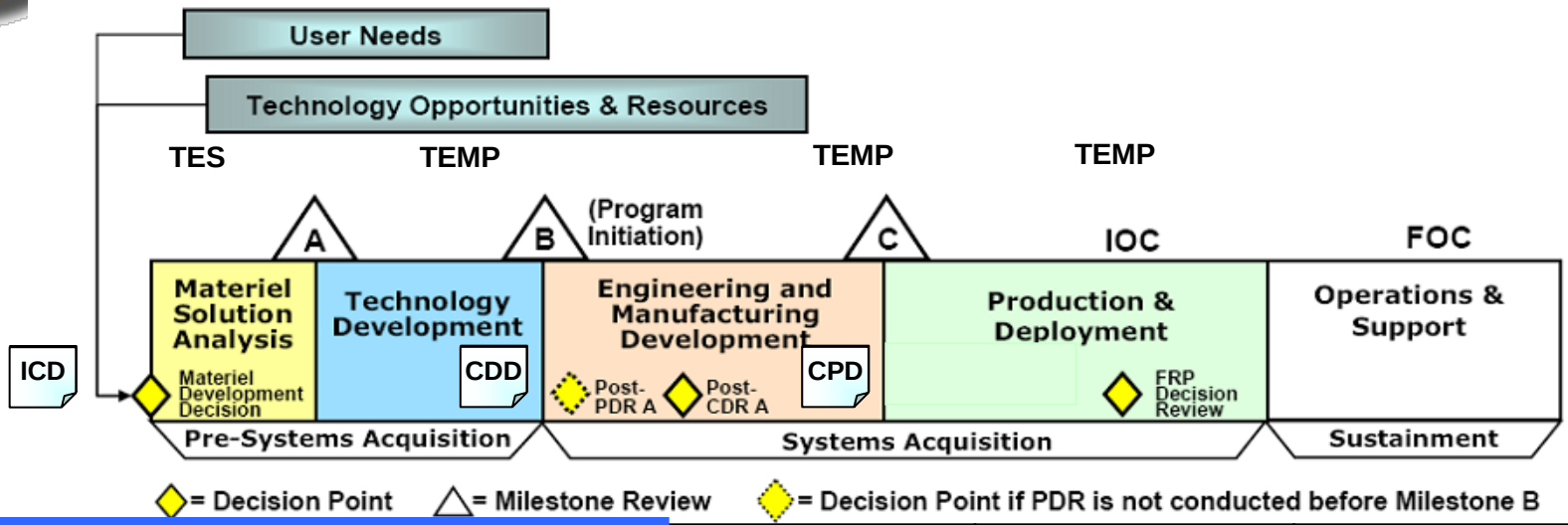
Why T&E?

PURPOSE OF T&E:
- Manage and
  Reduce Risk

PRODUCT OF T&E:
- Knowledge to
  Decision Makers



T&E in DoD: What and When



▪ Technology Development Strategy (TDS) ▪ Test Evaluation Strategy (TES) ▪ ID emerging T&E capability requirements ▪ ID T&E resources ▪ Develop T&E requirements in RFP ▪ Reporting	▪ Test and Evaluation Master Plan (TEMP) ▪ Execute T&E Program ▪ Provide T&E results for OIPT/DAB ▪ CDD requirements for evaluatability ▪ TRL Evaluation ▪ T&E requirements in RFP ▪ Reporting	▪ TEMP ▪ Execute T&E Program ▪ T&E results to OIPT/DAB ▪ Support PDR/CDR ▪ CPD requirements for testability and evaluation ▪ TRL Evaluation ▪ T&E requirements in RFP ▪ Discovery and deficiencies ▪ Reporting	▪ TEMP ▪ Execute T&E Program ▪ Characterize system capabilities and limitations ▪ T&E results for OIPT/DAB ▪ AOTR / OTRR ▪ Support training for IOT&E ▪ Reporting	▪ Follow-on DT and OT ▪ Verification of corrections for deficiencies ▪ Develop T&E programs to support upgrades, modifications, increments

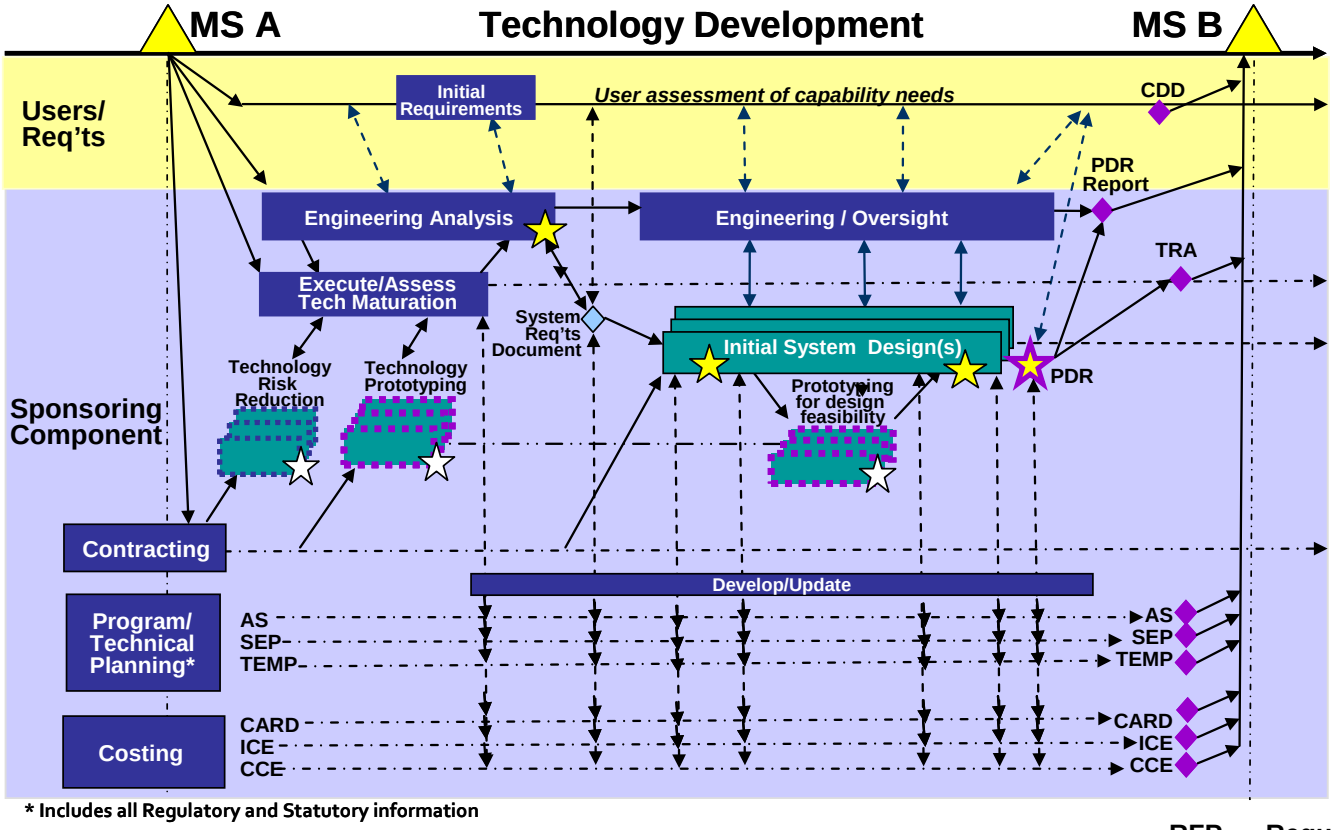
Service/Component/Agency report on accomplishing DT&E role, include earlier phases.

T&E in DoDI 5000.02

December 2008

- **Integrated Testing - IOT&E still separate**
- **Capability Comparison**
  - **Additional perspective for programmatic decisions**
- **Data Sharing**
  - **Common data set (contractor, government) for evaluations**
- **Programs required to execute a RAM strategy that includes a reliability growth program**
  - **Documented in SEP and Life Cycle Sustainment Plan**
  - **Assessed during technical reviews and T&E**
- **MS-A T&E Strategy (TES) for Technology Development (TD) Phase**
  - **Tailor content for competitive prototyping and prep for PDR**
  - **Focus on TD Strategy (TDS) and ICD**
  - **Support maturation of technology**
  - **Fulfill statutory test planning**

Technology Development



* Includes all Regulatory and Statutory information

Activities Products

Government
Industry
Required

Required
Recommended

Technical Review
Developmental Test

Leads to
Informs
Ongoing activity

RFP	Request for Proposals
AS	Acquisition Strategy
SEP	Systems Engineering Plan
TEMP	T&E Master Plan
CCE	Component Cost Estimate
CARD	Cost Analysis Requirements Description
ICE	Independent Cost Estimate
PDR	Preliminary Design Review

Early Evaluation of Technology Maturity

- AoA, early Systems Engineering, and Early Evaluation of Technology Maturity form basis for evaluating technology options in the materiel solution to the capability need identified in the approved Initial Capabilities Document (ICD).
- Best practice is to use results as follows:
  - To provide basis for modifying requirements if technological risks are too high
  - To support development of Technology Maturation Plans (TMP) that show how Critical Technology Elements (CTE) will be demonstrated in a relevant environment before preliminary design begins at the full system level
  - To refine the Technology Development Strategy (TDS)
  - **To inform T&E community about technology maturity needs**
  - To ensure potential CTEs are included in program's risk management
  - To establish Technology Transition Agreements (TTAs) to articulate external dependencies on technology base projects and to define the specific technologies, technology demonstration events, and exit criteria for the technology to transition into the acquisition program.

Pre-MS B Test and Evaluation

- T&E results (contractor & government) reported at technical (SRR, SFR, PDR) and MS B reviews
  - T&E knowledge (from prototypes, system concepts) used to address key technologies and risks
  - Ensure requirements are “evaluatable” and trace back to AoA/ICD/draft CDD
- Test and Evaluation Strategy (TES) at MS A
  - Start with evaluation objectives – What do you need to know
  - Includes statutory “test plan” for TD phase (previously in TDS) to show maturity of CTEs and mitigation of risks
    - Technology maturation demonstrations (TRL 6 by MS B)
  - Provides initial view of strategy for T&E in TD phase and beyond
    - Integrated testing approach
    - Use of M&S
    - Identifies significant and long-lead T&E resources

T&E Considerations for Pre-MS B

- **Planning Issues**
  - Technology development / maturation
  - System development
  - T&E program strategy
- **Requirements**
  - Operational requirement evaluatability
  - Contract / RFP issues
  - Competitive Prototyping
- **Technology / System maturation**
  - TRL 6 at Milestone B so that the Milestone Decision Authority can make the certification required by Title 10 United States Code (U.S.C.) 2366b.
  - TES should be consistent with TMP

TRL 6: System/subsystem model or prototype demonstration in a relevant environment.

T&E Planning Considerations

- Technology Development and Maturation
- System Development
  - System of Systems
  - Software development – T&E “hooks”
- Contracting Issues
- Modeling & Simulation – capabilities, development, VV&A
- Integrated testing – include the contractor(s)
- Data sharing – include the subs
- Test and Evaluation assets / Range resources
- Establishing the T&E WIPT
- Live Fire waiver

T&E Requirements Considerations

- Operational requirements evaluatability
  - AoA measure development – discrimination
  - CDD / KPP / CONOPS development
- System of Systems interface / interoperability reqts
- Contracting – RFPs
  - Competitive prototyping
  - Data sharing – include the subs
  - Software development – T&E “hooks”
  - Integrated testing – include the contractor(s)
- Establishing CTPs – use CTE, TMP and SE!

T&E Considerations for Technology Maturation

- TDS “Test Plan” included in TES
  - Informed by Early Evaluation of Technology Maturity
  - Critical Technology Elements
    - Test objectives
    - Relevant environment
    - M&S
    - Exit Criteria
    - Constraints and limitations
- Software development
- System risks – identification and investigation
- Reliability growth – finding the subsystem failure modes
- Susceptibility / vulnerability / lethality
  - Coupon tests and M&S

Test & Evaluation Strategy

- Basis for T&E budgetary estimates
- Addresses SE verification and validation
- Enables integration of developmental and operational test objectives
- Addresses technological capabilities and limitations of alternative concepts and design options
- Addresses technological & design risks
- Assessment of technical progress and maturity
- Stresses the system to ID failure modes
- Supports Technology Development Strategy

Recommended TES Content

Part I Introduction	Part II Mgmt & Sched	Part III Integrated T&E Strategy	Part IV Resources
Brief mission description paragraph System description Brief Threat Assessment Program Background Key Capabilities	Describe T&E management Common Data Overarching integrated schedule that includes sequencing of T&E activities (CT, DT, OT, LFT, M&S)	The philosophy recognizes a T&E continuum & emphasizes evaluations Evaluation Framework ties T&E knowledge to decisions, requirements, etc Developmental Eval - Technology Development - CTEs - Test objectives - Relevant environment - M&S - Exit criteria Operational Eval Future Testing	Include in para form or table: •Test articles needed/event •Special equip/ instr costs •Target / expendable costs •Threat representation costs •Manpower needs •M&S costs

Linkage of decisions to evaluations, requirements, test phases, and resources

What ***Who, When*** ***Why, How*** **Resources required**

Include Joint requirements throughout

Example Evaluation Framework

Key Requirements and T&E Measures				Test Methodologies/Key Resources (M&S, SIL, MF, ISTF, HITL, OAR)	Decisions Supported
Key Reqs	**COIs**	**Key MOEs/ MOSs**	**CTE/CTPs & Threshold**		
Combat Radius	**COI #1.** Can the UAV locate and engage the XXX enemy threat at a range and time that will ensure survivability of friendly troops?	**MOE 1.1.** Range	Alternate Fuel Consumption	Aero + Propulsion M&S Engine stand Performance profiles – OAR	TR PDR MS-B
		MOE 1.2. Speed	Airspeed	Performance M&S Wind Tunnel Performance Flt Test – OAR	TR PDR MS-B
	COI #2. Is the XXX suitable for…	**MOE 1.3.**			TR PDR MS-B
Weight	COI #2. Can the Is the XXX sustain hypersonic flight for XXX?	**MOS 2.4.**	Composite Material	Thermal Material Lab Tests Fatigue Test stand	PDR MS-B

Critical Technical Parameters

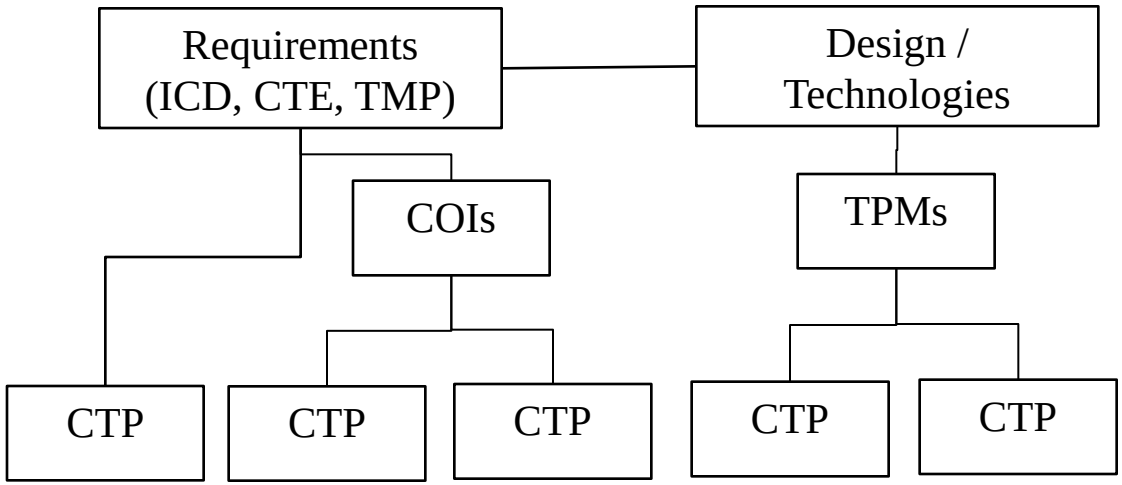
- **New to TES**
- **CTPs are not well defined or productively implemented in TEMP**
- **A short review**
  - **What are they?**
  - **How should they be determined?**
  - **How should they be used?**

- **Definition:** A CTP is a measurable critical system characteristic that, if not achieved, preclude the fulfillment of desired operational performance capabilities.
- CTPs are technical measures derived from desired user capabilities.

Critical Technical Parameters

How Derived?

- **CTP development process is the responsibility of the program T&E manager**
- **Lead Systems Engineer plays a key role in determining CTPs**



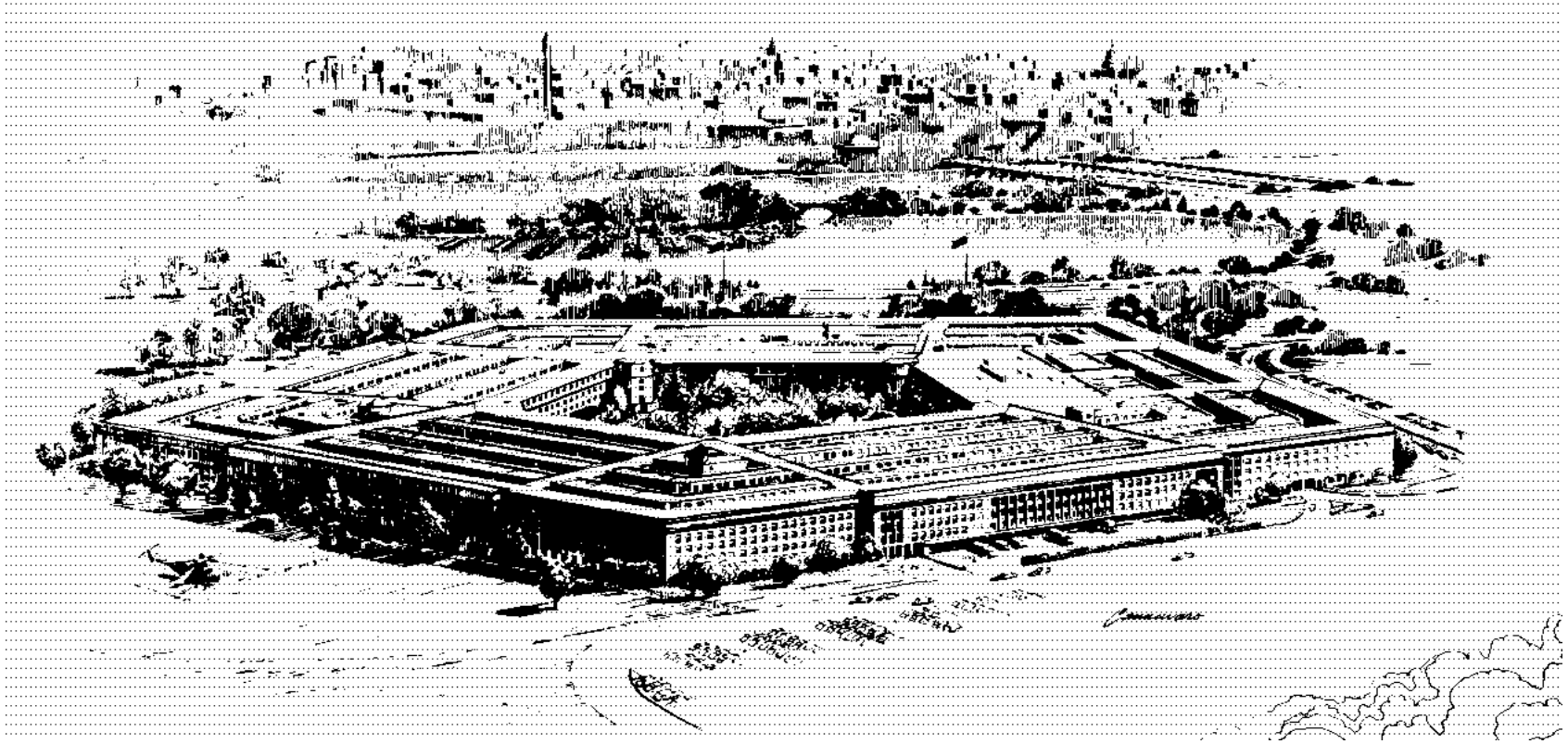
Critical Technical Parameters
How Used?

- **While not user requirements, CTPs are technical measures derived from Early Evaluation of Technology Maturity and desired user capabilities.**
- **T&E use CTPs as reliable indicators that the system is on (or behind) planned technology development schedule or likely (or not likely) achieve an operational capability.**
- **CTPs should be significant from a T&E program perspective – should drive scope / magnitude of the T&E program.**

Summary

- T&E involvement pre-MS B is necessary for success
- DT&E should focus on creation of knowledge of technology maturation, capabilities and limitations
- T&E developed knowledge should be used at the technology, component, subsystem, and system level
- Early Evaluation of Technology Maturity and TMP inform TES
- New TES Content
  - Brings evaluation focus into TES
  - Assumes a continuum of T&E
  - Life cycle view versus scoping to next milestone
  - Integrated Testing and Mission-oriented context
  - TDS test plan shifted to TES
- DAG – Chapter 9

Closing Remarks



“TESTING IS THE CONSCIENCE OF ACQUISITION”

THE HONORABLE WILLIAM PERRY
FORMER SECRETARY OF DEFENSE

Contact Info

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Contact us to provide feedback and share your experience