

# Role of T & E



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# Report Documentation Page

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# Overview

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- T&E's Role
  - Acquisition Lifecycle
  - Systems Engineering
- DoD T&E Types & Differences
- Test & Evaluation Planning

# What is Test & Evaluation?

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- **Principal tool to measure progress in system development and to provide essential information to acquisition decision makers**
- **Conducted to...**
  - **Facilitate learning**
  - **Assess technical maturity & interoperability**
  - **Facilitate integration into fielded forces**
  - **Confirm performance**
  - **Reduce Risk**

# T&E Contributions During Concept & Technology Development

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- **At Milestone A...**
  - **Concept development team and the integrated test team...**
  - **Develop T&E Strategy (TES)**

# T&E Contributions During Engineering & Manufacturing Development Phase

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- **At Milestone B...**
- **Executed by a T&E IPT...**
  - **TEMP**
  - **Coordinated Test Events**
  - **Developmental Testing**
  - **Operational Assessments**
  - **Resources**

# T&E Contributions During Production & Deployment

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- **Prior to LRIP:**
  - **DT&E**
    - **How well did system meet spec?**
    - **System safe and ready for LRIP and IOT&E?**
  
- **Prior to FRP:**
  - **OTA conducts IOT&E**
    - **Evaluate Operational Effectiveness & Suitability**
  - **LFT&E Completed**
    - **Evaluate Vulnerability, Survivability, Lethality, and Recoverability**

# T&E Contributions Post FRP

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- **Follow-on Operational Test and Evaluation (FOT&E)**
- **Residual DT&E and Technical Testing**

# T&E Role In Requirements Analysis

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- **As Member of Acquisition IPT:**
  - Advise on testability of requirements
  - Advise on risk on testing requirements
  - Determine if the threat in the STA can be portrayed or simulated
  - Help prepare the Test & Evaluation Master Plan (TEMP)

# Verification Loop

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- Each requirement must be verifiable
- Verification confirms that solution meets requirements
  
- Types of verification
  - Inspection
  - Demonstrations
  - Simulations / analysis
  - Certifications
  - Test

# Types of DoD T&E

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- Contractor Testing
- Developmental T&E (DT&E)
- Operational T&E (OT&E)
- Operational Assessment (OA)
- Combined Testing
- Joint Testing (with other Services)

**DT&E**

**OT&E**

**Contractor**

**Govt.**

**IOT&E**

**FOT&E**

**Combined Testing**

**DT&E**

**OT&E**

**EOA**

**OA**

# T&E IPT

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- Empowered by PM
- Includes representatives from organizations involved with test program, such as:
  - PMO/TARDEC, Test Agencies (DT/OT), Operating Commands/User Representatives, Logistics/TACOM, Contractors, Services & OSD
  - Integrates test requirements & assists in TEMP development

# Test Conduct

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- **DT&E**
  - **Technical**
  - **Controlled environment**
  - **Specification tested**
  - **Technical personnel**
- **OT&E**
  - **Realistic environment**
  - **Typical operators & maintainers**
  - **Simulated enemy engagements**

# Measurements

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- **DT&E**
  - **Specific parameters**
    - **Gross Vehicle Weight (GVW)**
    - **Fuel Consumption**
    - **Drawbar Pull**
  - **Tests must be repeatable**
- **OT&E**
  - **Generally specific measurements not taken**
  - **Create combat conditions & observe results**
  - **Test not repeatable, interactions usually unique**

# *What is a TEMP ?*

- ▶ **Executive level strategy and basic planning document for all life cycle T&E for a particular system acquisition**
- ▶ **Overall T&E structure, major elements, and objectives**
- ▶ **Consistent with Acquisition Strategy and SEP**
- ▶ **Sufficient detail to permit planning for timely availability of test resources required to support the T&E program**
- ▶ **Road Map for integrated: Simulation, test, and evaluation plans, Resource requirements, Schedules**

# Test Plans Should Include...

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- **Test Objectives**
- **MOE's, MOP's and Measures of Suitability**
- **Planned Operational Scenarios**
- **Threat Representations**
- **Targets**
- **Resources**
- **Test Limitations**
- **Data Collection, Certification, and Analysis Procedures**

# Evaluation Planning

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- **Identify:**
  - Technical Parameters
  - Critical Operational (Mission) Issues
  - Data requirements for each parameter & issue
- **Develop Baseline Correlation Matrix for:**
  - MOP, MOE, MOS, COIC
  - Analysis technique for each parameter & issue

# ATEC Organizations

**ATEC**

(Army Test & Evaluation Command)  
Independent Evaluator

**DTC**

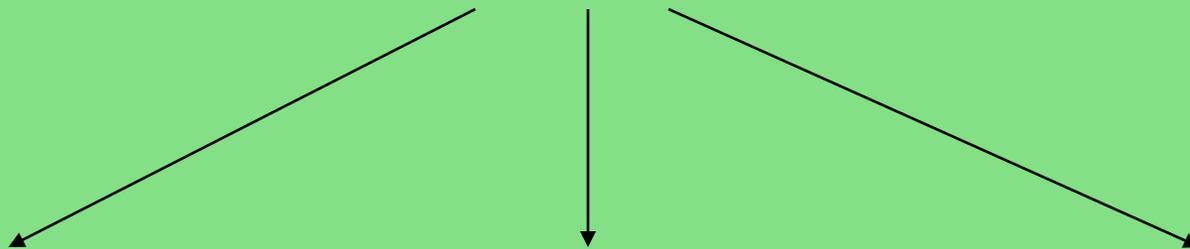
(Development Test Command)

**AEC**

(Army Evaluation Center)

**OTC**

(Operational Test Command)



# Typical Technical Tests

<b><u>Test Title</u></b>	<b><u>TOP #</u></b>
<b>Transportability</b>	<b>1-2-500</b>
<b>Endurance &amp; Reliability</b>	<b>2-2-507, 2-1-001</b>
<b>Noise</b>	<b>3-2-811</b>
<b>Fording</b>	<b>2-2-612</b>
<b>Vehicle Fuel Consumption</b>	<b>2-2-603</b>
<b>High Altitude Effects</b>	<b>2-2-702</b>
<b>Standard Obstacles</b>	<b>2-2-611</b>
<b>Acceleration- Maximum &amp; Minimum Speeds</b>	<b>2-2-602</b>
<b>Gradeability and Slide Slope Performance</b>	<b>2-2-610</b>
<b>Center of Gravity</b>	<b>2-2-800</b>
<b>Steering</b>	<b>2-2-609</b>

## Typical Operational Tests

### Evaluates:

- **Offensive Role**
- **Defensive Role**
- **Command and Control**
- **Optimum number of Systems per unit**
- **Battle Drill Evaluation**
- **Adequacy of Support Structure**
- **Fightability**

# Reliability

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Reliability is the probability of performing a given function for a specified length of time under stated conditions.

**Example:**

$$R = e^{-\text{Mission Length}/\text{MTBF}}$$

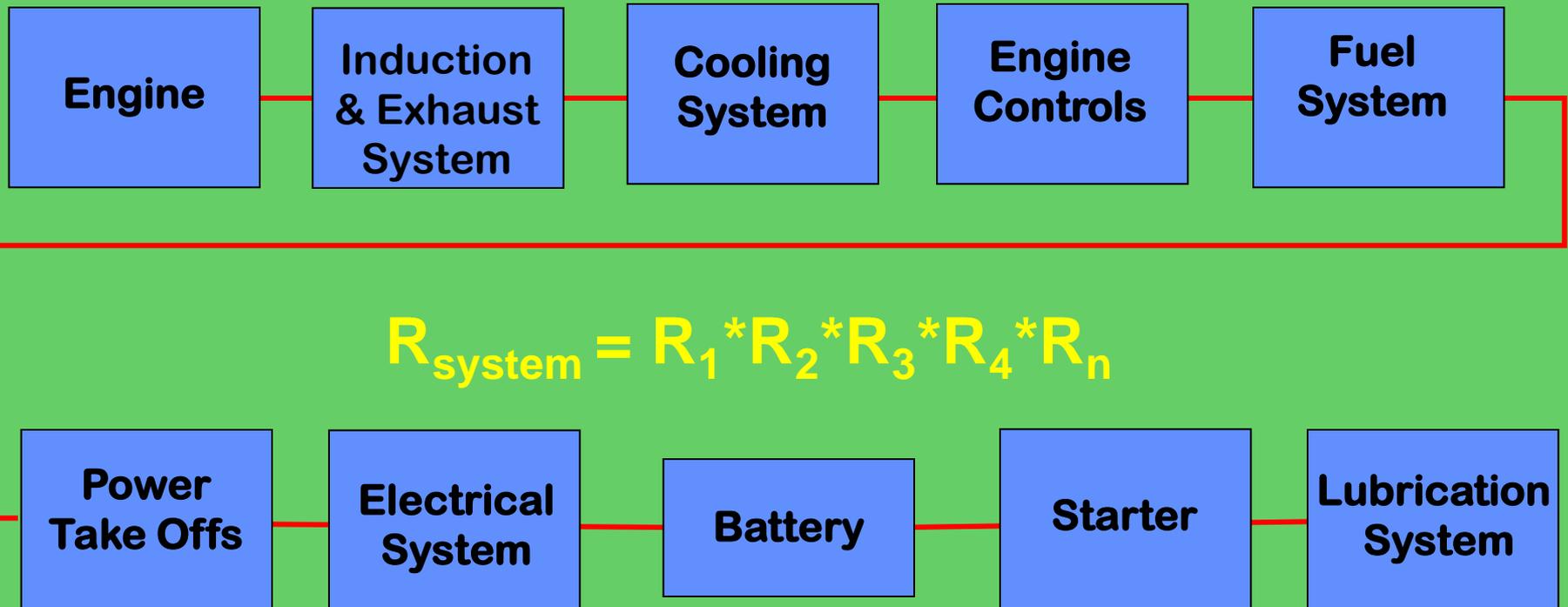
$$R = 95\%$$

**Mission Length = 300 Miles**

**MTBF = 5800 Miles**

**Total Operating Time (Hours, Miles, Cycles, Etc.)**  
**Total Failures**

# Reliability Block Diagram



# Maintainability

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- **Maintainability is the probability that a system can be restored to its specified operational condition within a specified period.**

# Availability

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- Availability is the probability that at any point in time the system is either operating satisfactorily or ready to be placed in operation on demand when used under stated conditions.

# AVAILABILITY

$$A_i = \frac{\text{MTBF}}{\text{MTBF} + \text{MTTR}}$$

$A_i$  - Inherent Availability  
 $A_o$  - Operational Availability

$$A_o = \frac{\text{MTBM}}{\text{MTBM} + \text{MMT} + \text{MLDT} + \text{LDT} + \text{ADT}}$$

MTBF - Mean Time Between Failure  
MTTR - Mean Time to Repair  
MLDT - Mean Logistics Down Time  
MTBM - Mean Time Between Maintenance  
MMT - Mean Maintenance Time  
LDT - Logistics Delay Time  
ADT - Administrative Delay Time

# HOW RAM BENEFITS THE FIELD

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- Increased combat capability
  - Improve operational readiness / availability
  - Better system utilization
  - Higher probability of mission success
- Reduced Life Cycle Costs
  - Less maintenance manning
  - Decreased logistics support footprint

**\*\* RAM characteristics are not important in themselves. Achieving the objectives listed herein is what is important**

# Perryman Test Ranges



# Munson Test Ranges



# Test Instrumentation Facility



## Vulnerability / Survivability Range



# Hi Speed Electronic Imaging



## Air Transport (External)



# Automotive Tilt Table

