Role of T & E

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Overview

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

What is Test & Evaluation?

- **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

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

T&E Contributions During Engineering & Manufacturing Development Phase

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

T&E Contributions During Production & Deployment

- 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

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

T&E Role In Requirements Analysis

- 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)

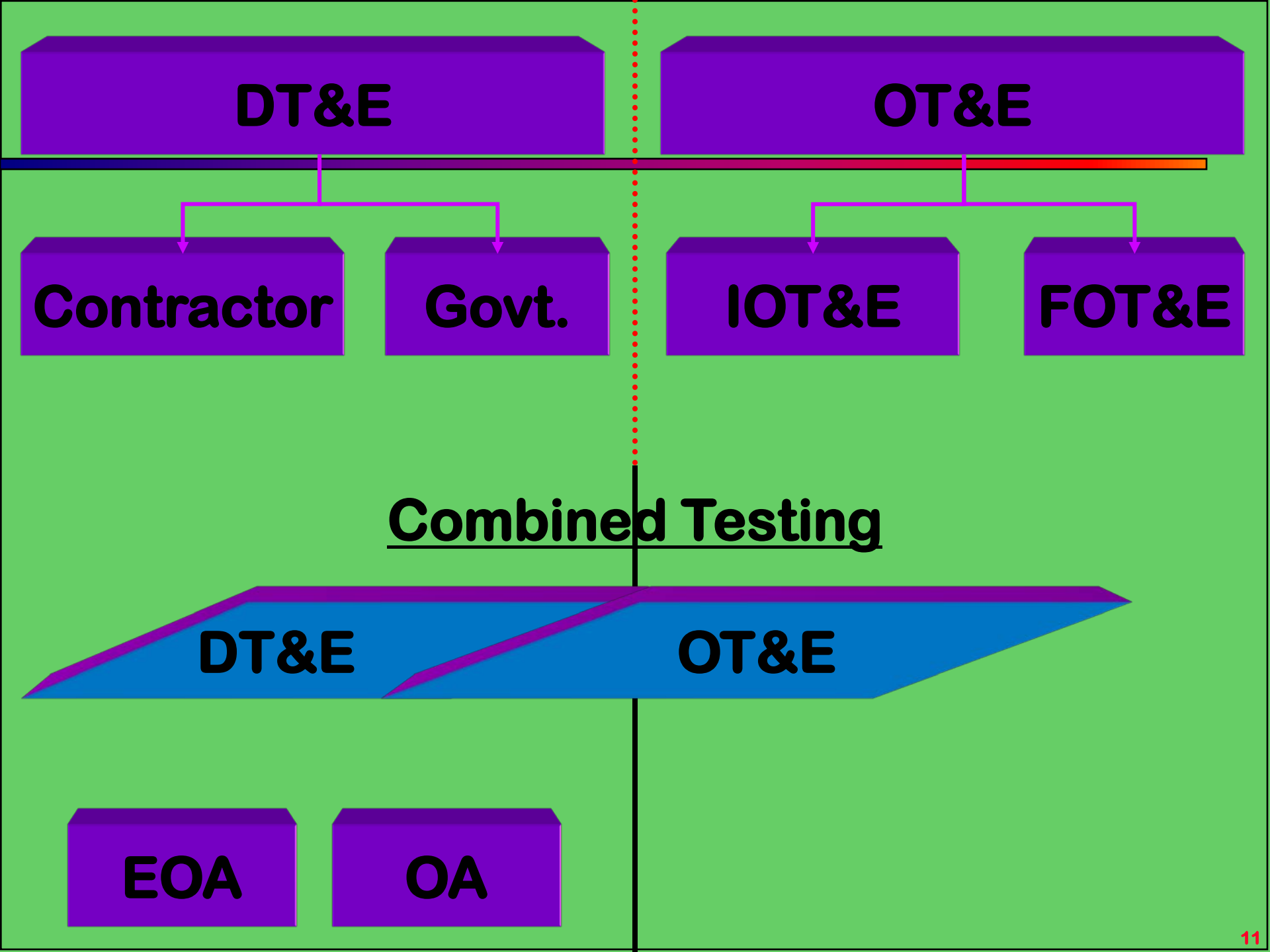
Verification Loop

- 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

- 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

- 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

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

Measurements

- 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

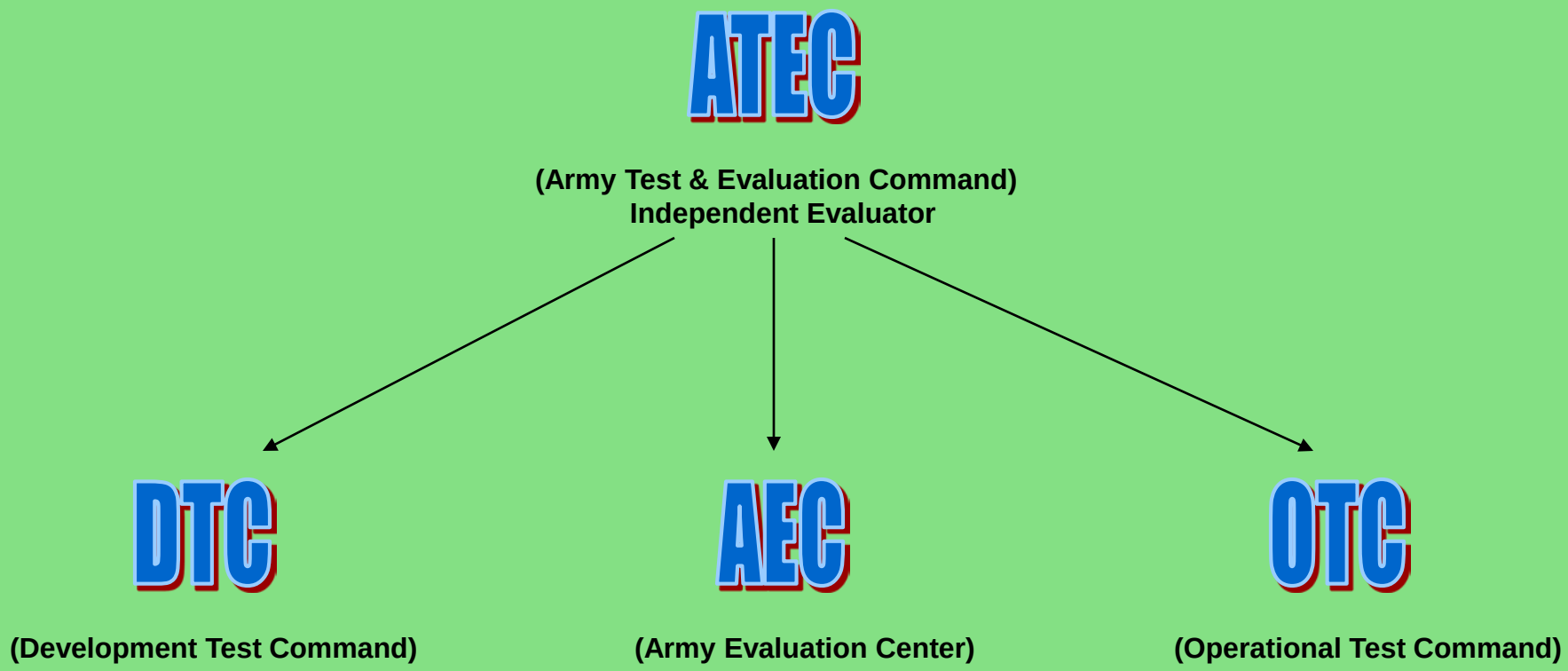
Test Plans Should Include…

- 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

- 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



Typical Technical Tests

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

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

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

Example:

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

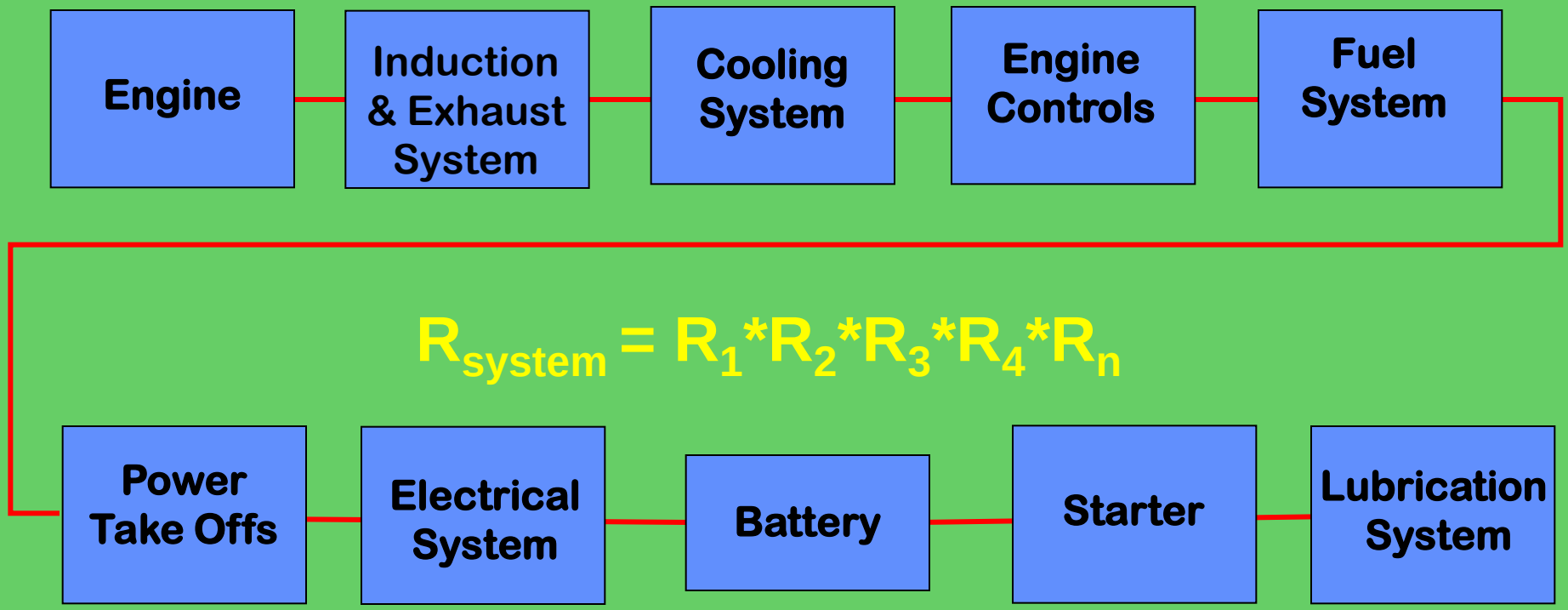
R = 95%

Mission Length = 300 Miles

MTBF = 5800 Miles

$$\frac{\text{Total Operating Time (Hours, Miles, Cycles, Etc.)}}{\text{Total Failures}}$$

Reliability Block Diagram



$$R_{system} = R_1 * R_2 * R_3 * R_4 * R_n$$

Maintainability

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

Availability

- 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

$$A_I = \frac{MTBF}{MTBF + MTTR}$$

$$A_o = \frac{MTBM}{MTBM + MMT + MLDT}$$

LDT+ADT

AI - Inherent Availability
Ao - Operational Availability

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

- 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