
Sustainment
T&E
in Army
Acquisition
March 13, 2007
NDIA, T&E Conference
ARMY TEST AND EVALUATION COMMAND

Outline

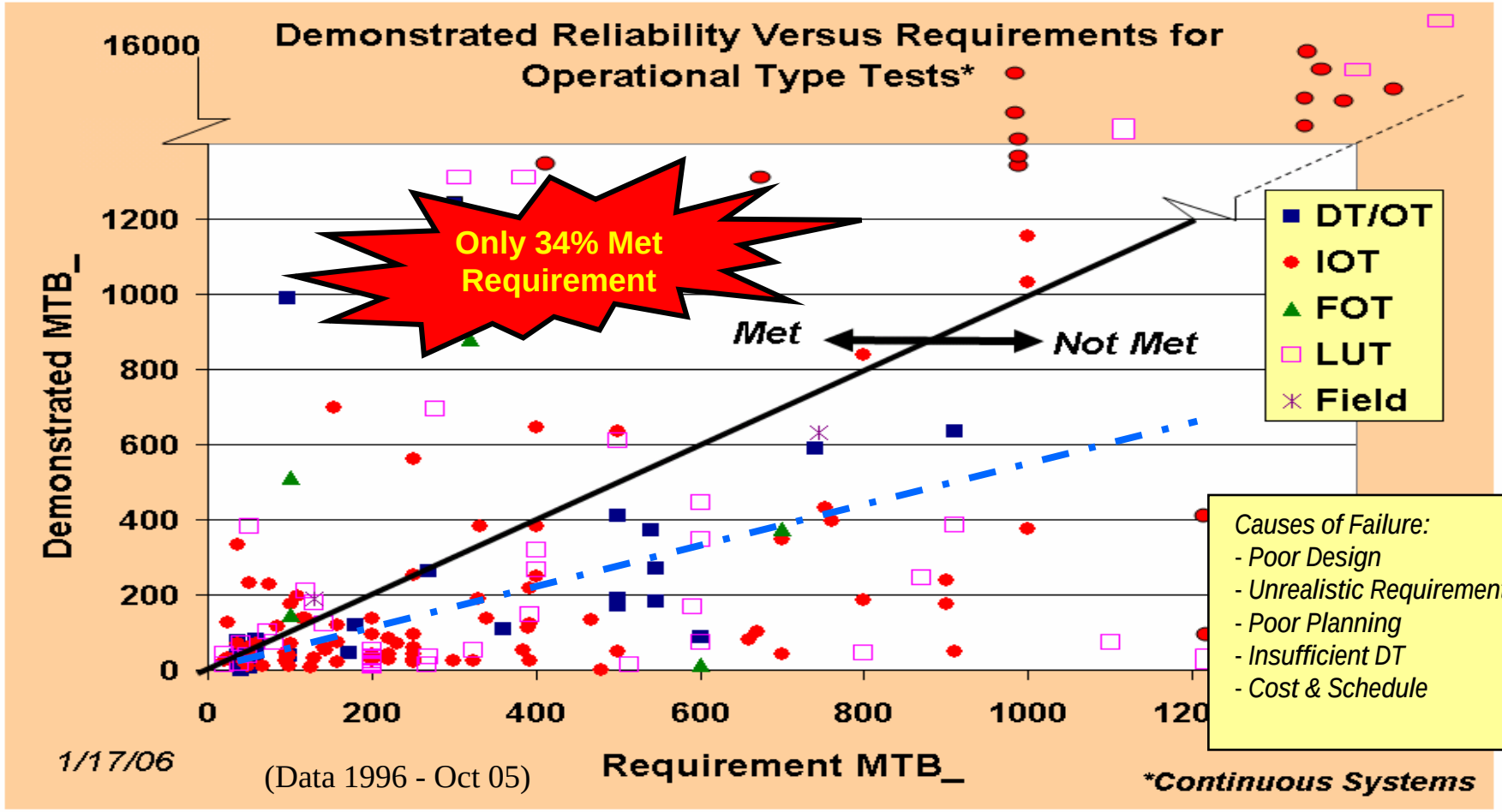
Sustainment in the ARMY

- The Need for Change
- Impacts
- Testing
- How To Enable Success
  - Reliability
  - Maintainability
  - Sustainability
  - Testing
  - Policy Changes
- Challenges
- ATEC Support of GWOT Fielding

ISSUE

Army Systems Consistently Fail To Achieve Reliability Requirements During Operational Testing!

The Need for Change



Amongst Systems Which Did Not Meet Reliability Requirements In OT
75% Of Them Failed To Achieve Half Of Their Requirement

Impacts

- **Affects Warfighter**
  - **Mission Success**
  - **Ao & Force Effectiveness**
  - **Log Footprint**
  - **Safety & Soldier Confidence**
- **Life Cycle Costs (LCC)**
  - **Sustainment accounts for 60% LCC**
  - **Spares & Maintenance contribute to 90% of Sustainment Costs – Reliability is the driver.**
  - **Reliability impacts billions of $$$**

Distribution of Life Cycle Costs
(Percentages)

Type System	R&D	Investment	O&S
Ground combat vehicles	5	35	60
Surface ships	<5	30-50	45-65
Jet fighters	5-10	25-50	40-70

Sources: Selected Acquisition Reports, VAMOSC systems

We need a process to improve Sustainability for Army Systems

Reliability Is Not Just About Testing

Why?

- **accelerated acquisitions & immature designs**
- **more complicated systems**
- **software intensive systems**
- **fielding of system of systems**

And

<u>Increased</u> emphasis on Sustainability

We have to do things differently …

Reliability Enablers
(Embedded in FCS Program)

Physics of Failure (PoF)

Design In Reliability Early On

- Early Design Influence through Physics- Based Modeling of Critical Component Designs
  - Model the root causes of Failure (Fatigue, Fracture, Corrosion & Wear)

Tangible benefits of PoF

Improved Ribbon Bridge

Sys. Req: 104,520 Crossings

PoF Usage
- **Avoided lengthy retest- saved $1-2M**
- **Supported Urgent Materiel Release**
- **IRB deployed**

***Army Materiel Systems Analysis Activity**

Reliability Enhancement Testing (RET)

- Used to Find Weak Areas of the Design and Correct them Before Production Begins
- Destructive test which incrementally increases environmental stresses to determine Failure Modes - Find Design Faults

Emphasize Early ID & Elimination of Failure Modes

Maintainability Enabler: The Pit Stop Philosophy
(Embedded in FCS Program)

Pit Stop Design is an approach for designing maintainability in military systems that is derived from auto racing. Emphasis is on simplicity of design to minimize downtime due to repair. Pit Stop Design is not designing to minimally meet a requirement, it is designing to win

Some Characteristics of the design approach are:

- Design component packaging minimizing weight and volume
- Modular design to allow commonality and upgrades
- Reduction of tools, with none being the goal
- Service by a single soldier, whether a 1st percentile female or a 99th percentile male, in MOPP IV or winter gear
- Handles and grip areas on components
- Simplicity of design minimizes maintenance training

Designs for Maintainability And Producibility

Planning, Tracking & Verification Reliability Use Case*

The R&M Case Is A Reasoned, Auditable Record To Document How Well A System Supports Requirement Realization. It Contains Evidence For R&M Achievement

Evidence includes 3 objectives:

1. Understanding the Requirements
2. Planning & Implementation necessary to satisfy requirements
3. Assurance that the requirements are being met

Forces Contractor to Plan for R&M Maturation; Develop Associated Tasks and Activities; and Provide Evidence Requirements Are Met

Examples of Types of Evidence

- ✓ Design M&S
- ✓ RAM Modeling, Component, subsystem, system testing
- ✓ Environmental Stress Analysis
- ✓ Structural Finite Element analysis
- ✓ Fatigue Analysis
- ✓ FMECA & Fault Tree Analysis
- ✓ Prognostics Assessments
- ✓ Rel. Enhancement Testing
- ✓ Pit Stop Engineering
- ✓ Software Reliability

**Contract deliverable for each FCS vendor*

What Needs to Be Done Differently: ILS Perspective

Conduct Smarter Logistics Demonstrations

- Implement Readiness Reviews prior to test conduct
- Make more operationally realistic

Apply Systems of Systems Approach To Sustainment Concepts

- Eliminates stove piping & reduces cost and logistics footprint

Incorporate Prognostics As It Matures

- Big potential for gains in operational availability

Apply Greater Use Of Sustainment Based M&S

- Supports more accurate sustainment estimates

Implement the Common Logistics Operating Environment (CLOE)

- Enables real time visibility of sustainment requirements for fielded systems

Strive To Decrease Maintenance Burden And Expedite Repairs

Why Integrated System Testing?

- Technical/Developmental Testing Conducted
  - to find faults, implement corrective actions, and mature the design
  - to confirm technical capabilities/functionality and manufacturability.

ATEC Studies Indicate Failure To Meet RAM Requirements In DT Almost Always Results In Failure In OT

- Operational Testing Conducted
  - to provide info. on integration of the Soldier, the support system, training & doctrine, and materiel in an operational environment.
  - to confirm/demonstrate operational suitability requirements.

Need Earlier Testing With Operational Realism

The Costs Of Operational Testing And The Importance Of Correctly Deciding Whether To Proceed To Full Rate Production Makes It Important To Base Decisions On <u>All Available Relevant Information!</u>

RAM Operational Testing Concerns

- **Difficult to get sufficient sample in OT to address RAM**
  - **Cost, schedule, soldier availability, data collection on non-interference basis difficulties**
- **Leverage DT to address Reliability requirement compliance**
  - **Historical data indicates no difference in DT-OT reliability performance for: AV, CMBT. Vehicles, Automotive, AMMO, Soldier & Combat Support Items**
  - **OT does not have to be "sized" for RAM. Can provide info on induced operator/maintainer failure modes**
  - **For electronics, DT not a good predictor of OT Reliability performance**

Strive to make DT more "Operationally" relevant!

Requirements & Policy Changes

- Mandatory Sustainability KPP for all JROC programs along with two Key System Attributes (KSAs)
  - *KPP - Availability*
  - *KSA – Materiel Reliability*
  - *KSA – Lifecycle Ownership Costs*

(TRADOC Reg. 71-20)

- DOTE has emphasized the Need for Change/Improvement in Reliability/Sustainability

- Type Classification-Standard and Full Materiel Release now required for FRP
  - *Sustainability & RAM requirements must be met*

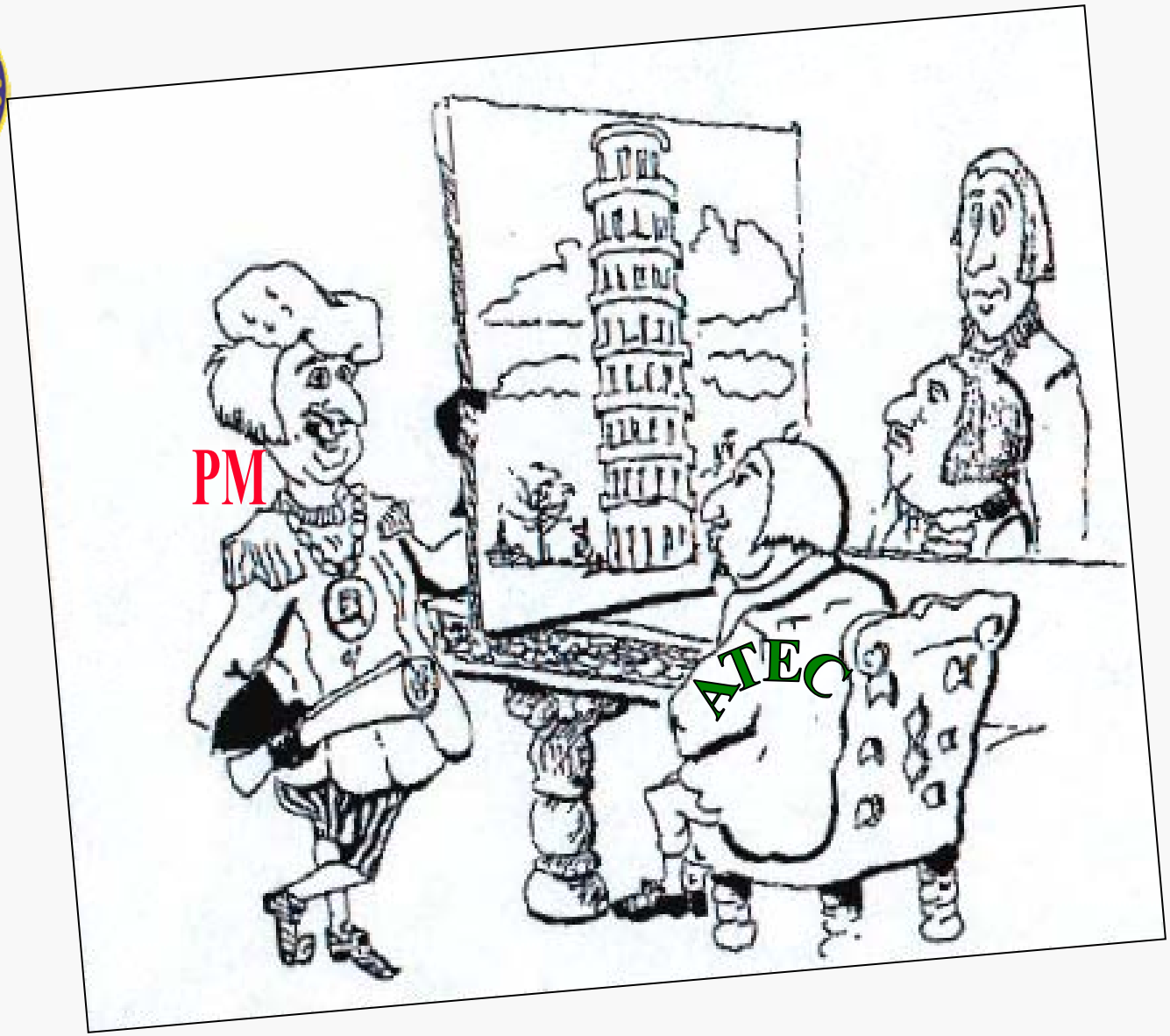
- Army T&E Acquisition Executive Initiative
  - *Establishment of Reliability Thresholds early in SDD phase*

Importance of Sustainability Supported by Key Policy Changes

Challenges

- Need To Design Reliability And Maintainability Up-Front – Minimize Log Footprint And Associated Costs
- Need To Force The Contractor To Plan For R&M Maturation And RAM Requirement Compliance
- Ensure System Of Systems Approach Is Applied To The Sustainability Concept
- Need To Better Utilize All Relevant Data In Assessing RAM And Sustainability
  - Benefit through early testing with operational realism
  - Integration of developmental and operational testing
  - Better use of Modeling and Simulation to address Sustainability

The Incorporation of High Levels Of RAM/Sustainability In Our Systems Must Be Enabled Through Aggressive Up-Front Design, Realistic Testing, And Policies Which Support These Practices



“ We’ve already run this through our Abacus model and we can save 900 Lira by not taking soil tests.”

Direct Support to GWOT by ATEC

- Detailed Brief by Brian Simmons (AEC Director) on Thursday
- Normal Test Process Did Not Meet Urgency Timeline
- Soldiers and Commanders Still Need to Know:
  - Does It Work?
  - How Do I Know?
- “Leaned” T&E Processes
  - SER → Capabilities and Limitations Report
- Long Term Reliability Remains a Concern