Effective When Needed, Not Just Effective When Available

DESIGN / DEVELOP / DELIVER / DOMINATE *SOLDIERS AS THE DECISIVE EDGE*

16th Annual System Engineering NDIA Conference 2013

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Outline

- Takeaways
- The Problem
- The Issues Preventing Resolution
- What We've Already Done
- What We Still Can Do
- What We Know
- What We Want You To Takeaway

Takeaways

- System availability and system reliability are essential to systems achieving intended purpose.
- Improving system reliability and system availability reduces life cycle cost.
- Success of system engineering process is measured by system availability and system reliability and not just system performance.
- Reliability practitioners and activities are essential to successful system engineering.

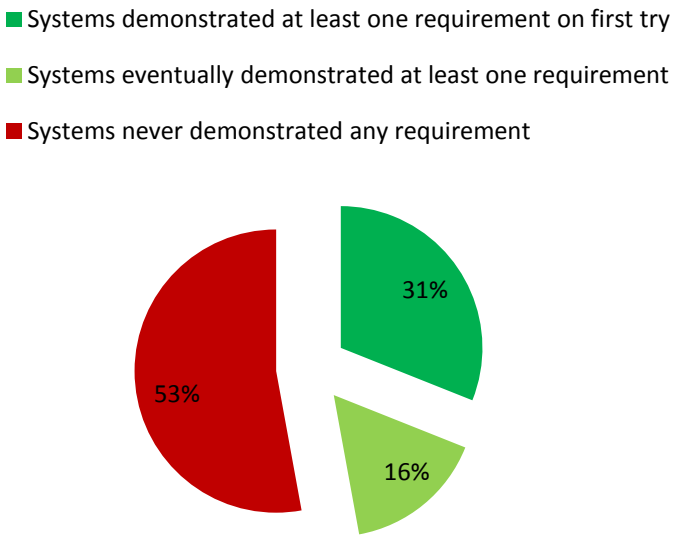
The Problem, Broken Down

- ✓One of the major issues across Department of Defense (DoD) acquisition is System Reliability and Operational Availability.
- ✓System Reliability is a key factor in Operation and Sustainment (O&S) costs.
- ✓Sustainment costs dominate total system costs: close to 65% of costs on average across all DoD acquisitions.
- ✓Poor reliability leads to higher sustainment costs for replacement spares, unscheduled maintenance, repair parts, facilities, staff, etc.
- ✓Poor reliability puts additional burden to the user and hinders warfighter effectiveness and can essentially render weapons useless.

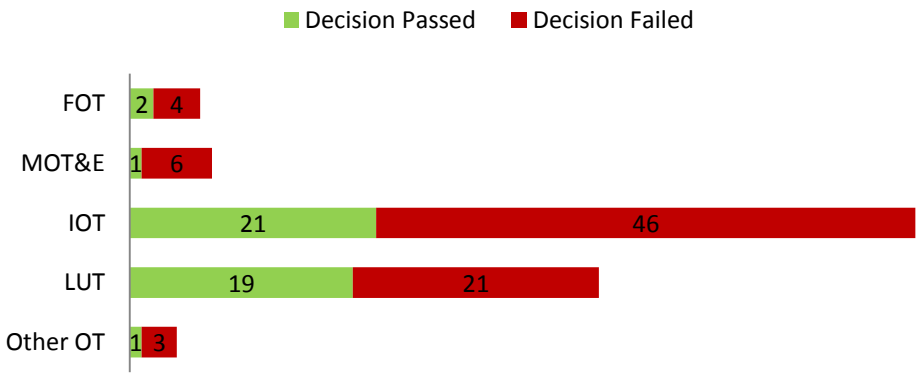
IF WE IMPROVE SYSTEM RELIABILITY IN DEVELOPMENT
IT WILL REDUCE SUSTAINMENT COST AND
RESULT IN MORE EFFECTIVE SYSTEMS FOR THE WARFIGHTER

Army Reliability Trends,
2004-2011 Operational Testing

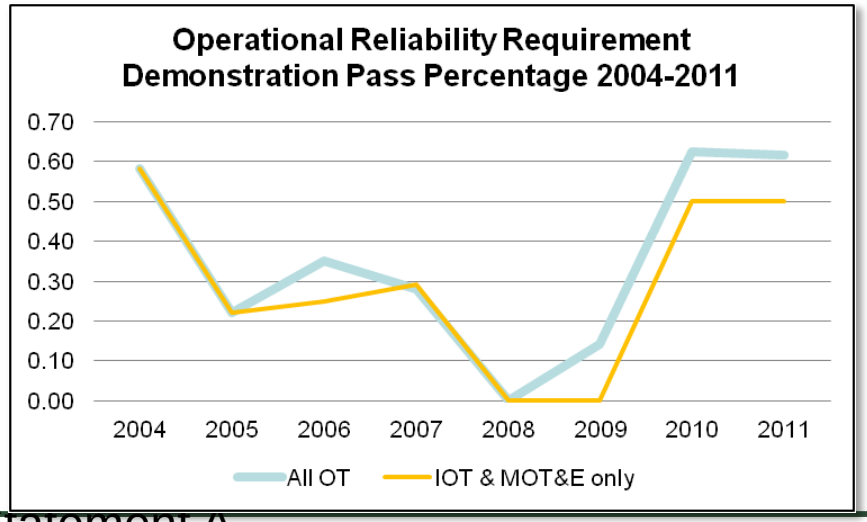
Reliability Requirements Demonstrated in Operational Testing 2004-2011



Reliability Requirement Decision Attempts in Operational Testing 2004-2011



System reliability maturity level tends to be lower than anticipated at the start of the T&E program

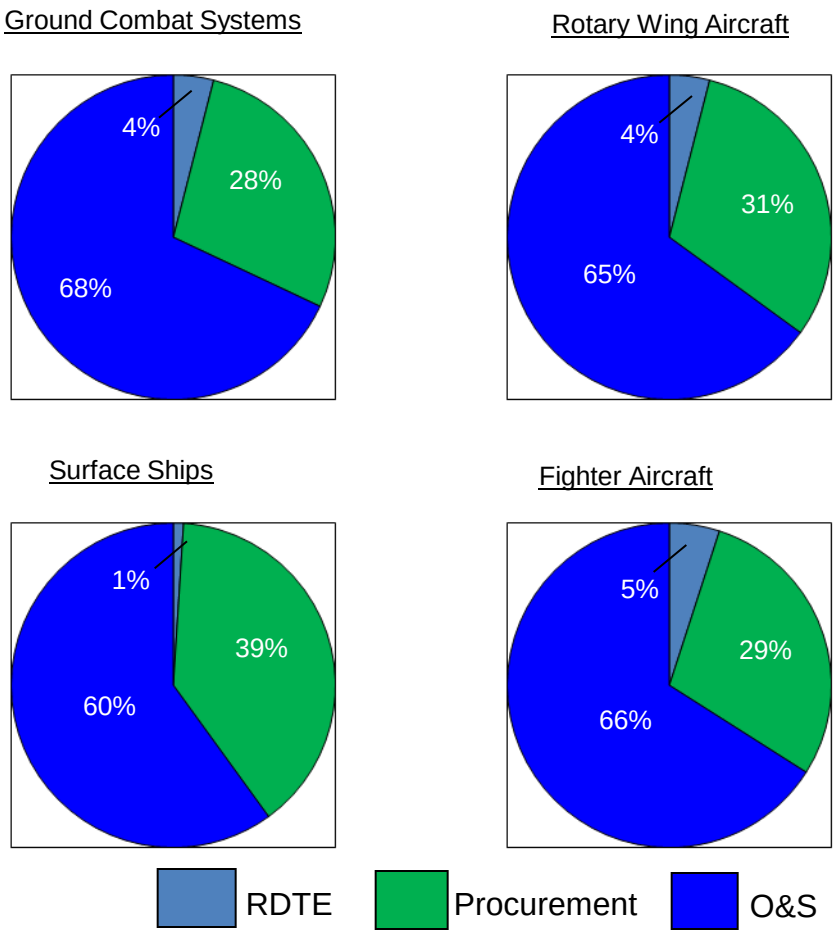


Operations and Support Costs Largest Fraction of Life Cycle Cost

"We have a tendency to look at what it takes to get a program out the door. We don't think too much about what the life cycle [cost] is. It's 'Can I build it?' I would like us all to be mindful of what it costs to operate whatever we are building for whatever its life is going to be because I have to pay that bill every single year."

- *CNO, ADM Michael G. Mullen in an interview with "Government Executive" magazine May 15, 2006*

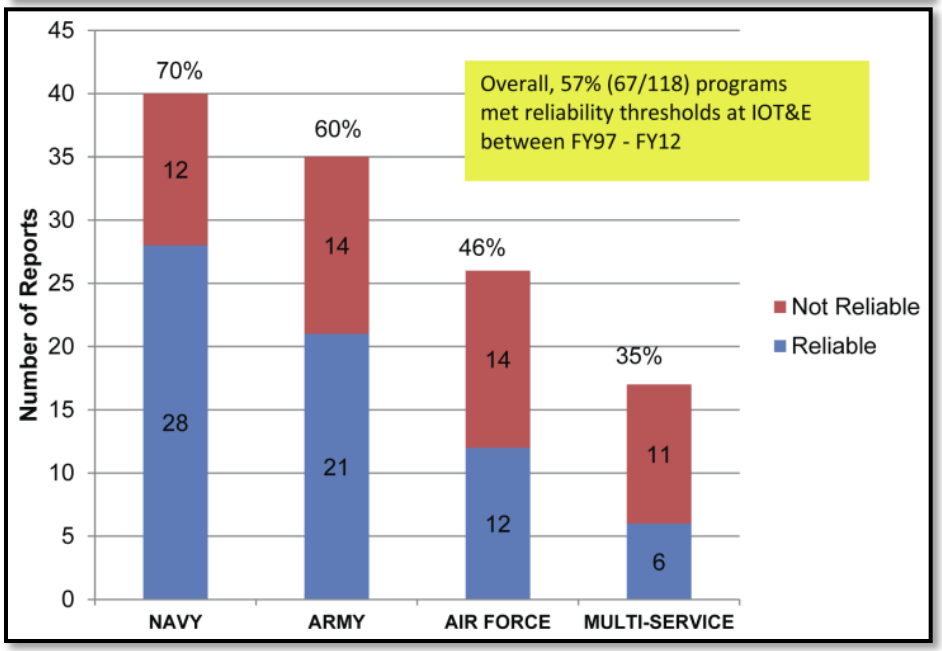
From "Improving System Reliability Through Better Systems Engineering," Dr. Charles E. McQueary, Director, OT&E NDIA SE Conference, October 2007



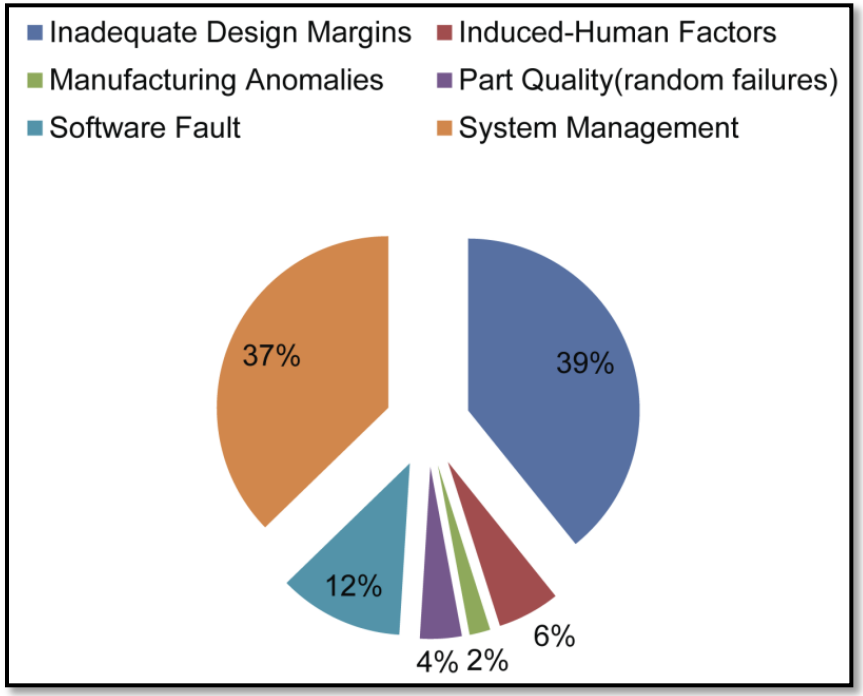
DoD Reliability Trends

Source: DOT&E FY2012 Annual Report

Fraction of Programs Meeting Reliability Thresholds at IOT&E, by Service (FY97-FY12)

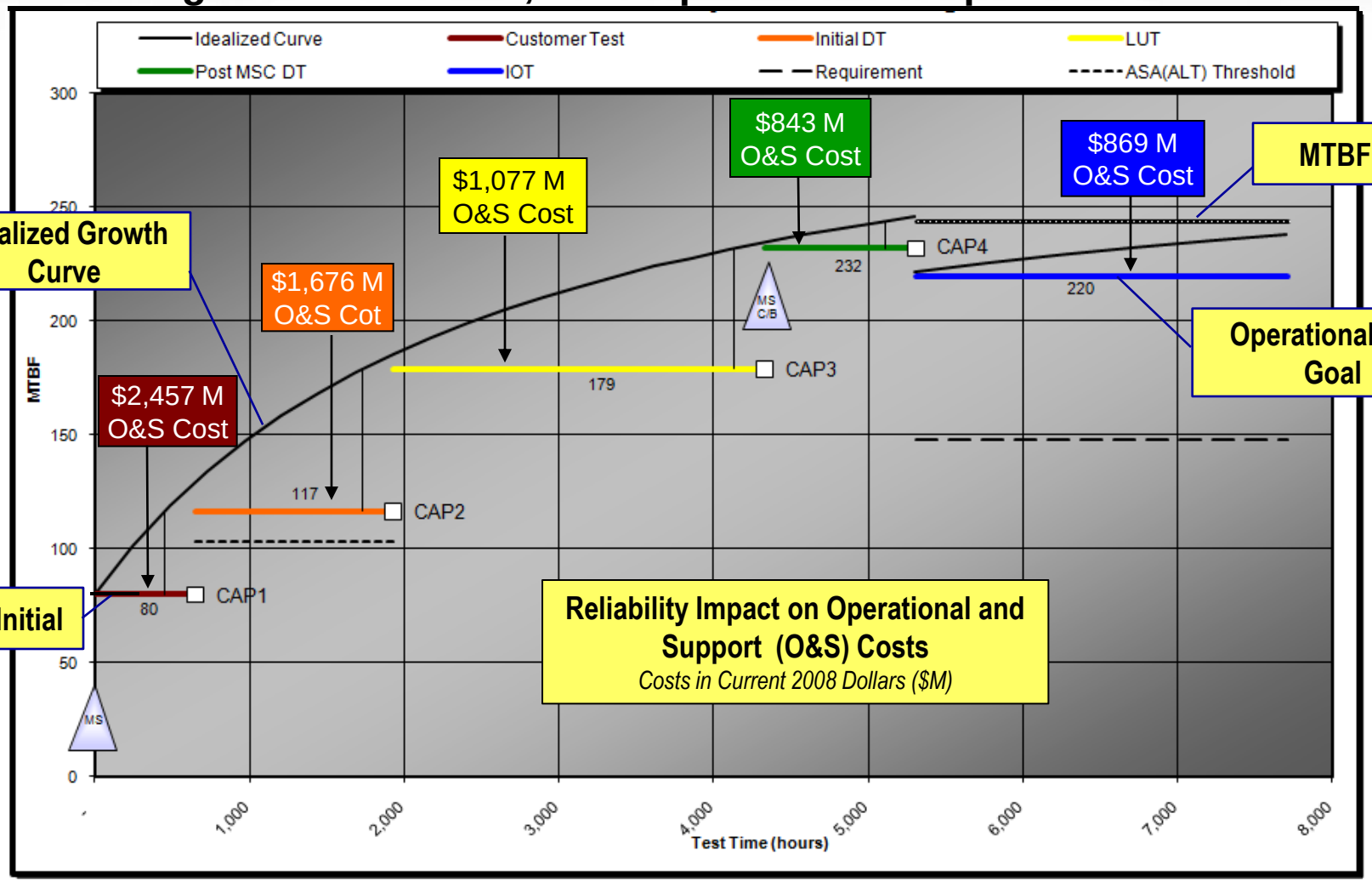


Root Failure Causes for the 51 Programs Not Meeting Reliability Thresholds between FY97 and FY12



Reliability Growth Planning Curve

Integrates Contractor, Developmental and Operational Tests



Reference: Army Reliability Policy, 26 June 2011

Issues Preventing Problem Resolution

The essential issues for reliability:

- ❑Reliability requirements compete with achieving more operant capabilities
- ❑Reliability requirements increase design, development and testing schedule and costs
- ❑Consistent use of Failure Definition and Scoring Criteria (FD/SC) and OMS/MP to decompose technical requirements and traced to Performance Specification
- ❑Reliability requirements not being used to design the system
- ❑Reliability requirements are sometimes traded due to increasing costs and schedule delays
- ❑Software reliability is being worked in ad-hoc manner. But with new programs being software intensive, software reliability is critical.
- ❑System of Systems Reliability in the field is hardly ever tested for and is a realized Risk

What We've Already Done

- Over the past decade, DoD has taken significant steps to improve system Reliability but the overall situation is not improving. A lot still needs to be done in the implementation of Reliability, Availability, and Maintainability Engineering (RAM) Programs into acquisition programs.

✓Defense Science Board (DSB) RAM Recommendations

✓Army Reliability Policy, 26 June 2011

✓DoD Reliability Policy, DTM 11-003, 21 March 2011

DSB RAM Recommendations

- Use RAM in source selection
- Make JCIDS RAM requirements and reliability growth program contractual
- Flow RAM requirements down to subcontractors
- Develop a standard that can be readily referenced in DoD contracts
- Assess reliability growth progress at technical and program reviews
- Strengthen PM accountability for RAM
- Rebuild the cadre of RAM personnel on DoD acquisition and engineering staffs

Source: Report of the Defense Science Board Task Force On Developmental Test & Evaluation (May 2008)

Army Reliability Policy

26 June 2011

1. Reliability Growth Planning Curve (RGPC)
   - Operation and support costs overlaid on the RGPC
   - Incorporated in SEP, TEMP and EMD contract
   - Use AMSAA Planning Model based on Projection Methodology (PM2) to develop RGPC
2. Early EMD Reliability Test Threshold
   - Early identification of significant departures from RGPC
   - Determined by RAM sub-IPT (event and value)
   - Threshold assessment by ATEC; PM develops corrective action plan
3. Early Engineering-based Reliability Program Review
   - Independent (ATEC/AMSAA) review of PM reliability documentation and reliability program
   - RGPC risk assessment and AMSAA Reliability Scorecard used as primary tools

- Applies to all ACAT I & II programs that are pre-Milestone B or have increments that are pre-Milestone B
- Does not apply to IT systems that include no hardware procurement

DoD Reliability Policy

DTM 11-003, 21 Mar 2011

- PMs shall formulate a comprehensive R&M program using appropriate reliability growth strategy until R&M requirements are satisfied.
- PM shall prepare preliminary RAM-C plan for MS-A decision.
- RGCs shall be employed to plan, illustrate, and report reliability growth.
- RGC shall be included in the SEP at MS A and updated in TEMP at MS B.
- PMs and operational test agencies shall assess the reliability growth required for the system to achieve its reliability threshold during initial operational test and evaluation.
- Reliability growth shall be monitored and reported throughout the acquisition process
  - RGC shall be employed to report reliability growth status at Defense Acquisition Executive System (DAES) reviews.

DTM 11-003 language incorporated into update to DoDI 5000.02

What We Still Can Do

- To improve Reliability in our systems we need to execute a viable systems engineering strategy from the beginning, including a robust and disciplined Reliability, Availability, and Maintainability (RAM) program. We need to look at following key areas:

- Reliability Policies and Guidance

- Reliability Training

- Validation of requirements, FD/SCs, and OMS/MPs

- Reliability Management and Oversight

What We Know

- We know the problem persists despite previous efforts.
- We know that it results in higher costs and less effective systems.
- We know more stringent reliability engineering is required to deliver reliable products.
- If the decision to develop capabilities is made in the absence of the design constraints forced by realistic battlefield reliability needs, then programs waste time and money developing capabilities that cannot be suitably realized.
- DoD needs systems that are effective when needed, not just effective when available.

What We Want You To Takeaway

- System availability and system reliability are essential to systems achieving intended purpose.
- Improving system reliability and system availability reduces life cycle cost.
- Success of system engineering process is measured by system availability and system reliability and not just system performance.
- Reliability practitioners and activities are essential to successful system engineering.

QUESTIONS?