

# Relating RMS&L to the 21st Century Warfighter

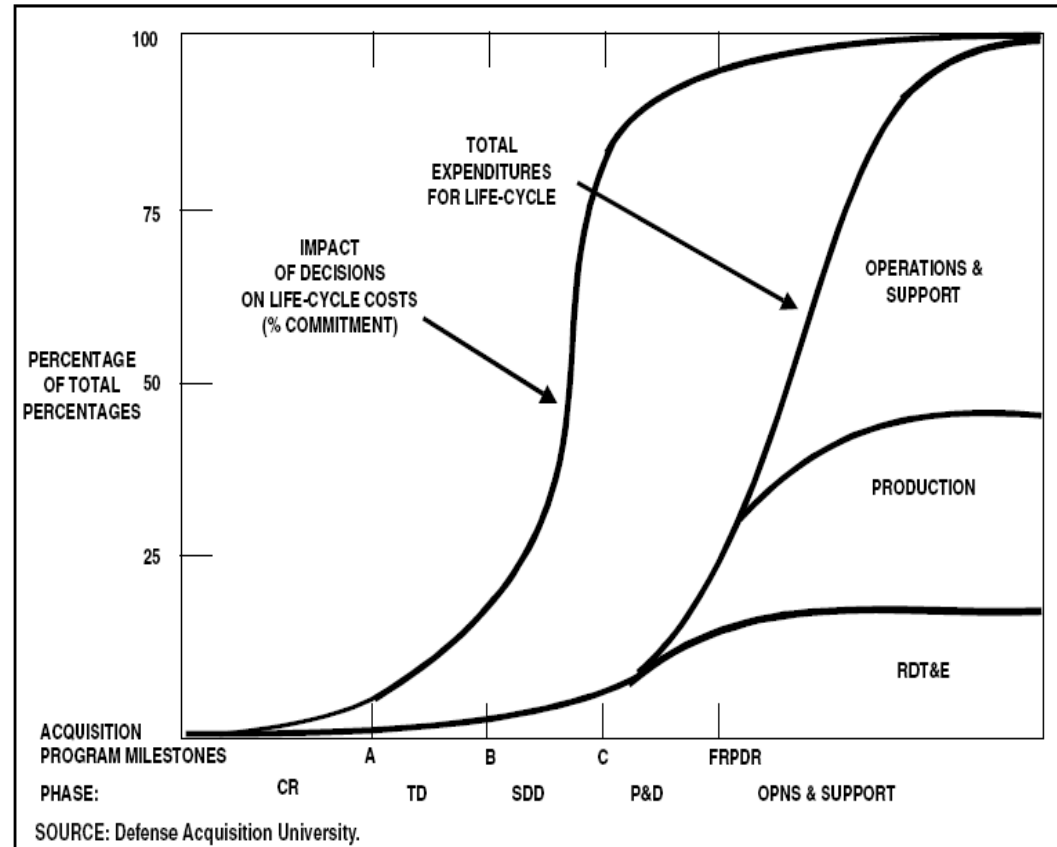
- Bottom line up front:
  - **Equip the Marine rather than manning the equipment**
    - Marine's equipment must have excellent RMS&L...
    - Otherwise marines are not well equipped
  - Two suggestions to help get there:
    - Changes to current Integrated Product Teams (IPT)
    - Integrated developmental and operational testing

# Relating RMS&L to the 21st Century Warfighter

- **Background**
- Integrated Product Teams (IPTs)
- Integrated Developmental and Operational Testing
- Case Study
- Conclusion

# Informing Early Acquisition Decision Making...

- Requirements & specs are straw men
  - Disciplined testing mentality helps discovery process
  - Specialty engineers advocate for fixes to likely problems



**Increase the testers and specialty engineers impact... have them participate from the beginning**

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# IPT Evolution

- Pre-1990, systems developers used design teams
  - Testers and specialty engineers only in final phases
- Mid-90s system development used **authentic** IPTs
- Authentic IPTs had **early and continuous** involvement of:
  - Test, reliability, maintainability, supportability and logistics engineers
- Lately, systems' development is IPT-like in name only
  - **Once again the specialty and test engineers are being minimalized, left out and ignored**
  - The increase in operational test failures and deficiencies illustrate the failure of this approach

# Pre1990s - Life with design teams

- Electrical, mechanical, software, systems engineer
- Design engineers ran tests
  - Many problems unnoticed or ignored
- Testers and specialty engineers added near the end
  - Original design team disappointed that problems were found
  - Testers and specialty engineers were frustrated by
    - Poor requirements
    - Lack of support
    - Time constraints
- The whole program suffered...redesigns and retests

# Mid 1990s - Authentic IPTs

- Design, systems, reliability, maintainability, logistics, information assurance, producability and test engineers from the beginning
  - Each has responsibility and authority to represent their discipline.
  - True team members participating in:
    - Requirements definition
    - Preliminary design
    - Detailed design
    - Building
    - Fielding.
  - Process benefits from the various discipline's perspectives
  - Issues resolved through consensus
  - Level of effort tailored as program goes through development cycle

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# Integrated Testing Defined

- Defense Acquisition Guidebook, Chapter 9

- Whenever feasible, DT&E and OT&E events should be combined, if that supports technical and operational test objectives, minimizes the time and cost of testing, and provides a benefit for reasonable cost and time. The user community involvement of desired capabilities is intended to provide information useful to developmental and operational evaluators and tend themselves to the DT and OT approach. The concept is to conduct a single combined test program that produces credible, qualitative and quantitative information that can be used to address developmental and operational issues. Examples of this approach include: combined DT/OT events or piggybacking developmental testing data requirements on OT&E events to reduce the time and expense of conducting separate DT&E events, while still provide adequate technical information to the user community. A management structure to share control of the combined events. Combined DT and OT events and test data requirements must be identified early to prevent unnecessary duplication and to control costs. It is important that neither the DT&E nor OT&E objectives are compromised in designing combined events.

**Combined DT & OT events  
support technical and operational objectives**

**User community involved early  
to ensure desired capabilities  
interpreted correctly and tested realistically**

# Integrated Testing

- Integrated Testing combines the engineering expertise of the developer with the operational expertise of the operational tester
  - Ensures that requirements are written correctly
  - Takes advantage of all available test data to inform acquisition and operational decisions
  - Accelerates mission capability to the Marine
- Especially critical for assuring the right equipment gets to the Marine in a timely manner

# Relating RMS&L to the 21st Century Warfighter

- Background
- Integrated Product Teams (IPTs)
- Integrated Developmental and Operational Testing
- **Case Study... Putting the concepts together**
- Conclusion

# Case study: large, complex, expensive military system

- Prototype system to demonstrate new technology could be used for military purposes **by** military people
- Mix of engineering development and production models
- Abbreviated systems engineering process:
  - IPTs included testers and specialty engineers formed from the beginning
    - One IPT for each subsystem; overarching system IPT
  - Integrated contractor/government team determined the T&E and specialty engineers resource requirements and schedule
  - Testers and specialty engineers major participants in writing top level requirements and system specification,
    - Over 5000 “shalls”

# Case Study (cont'd)

- Testers assured specs were verifiable by
  - **“If you can’t readily imagine a verification technique, it’s not a good specification”**
  - Significant rewriting/elimination of proposed specifications
- Testers and specialty engineers were system and subsystem design reviews’ key participants
  - Assured maintainability was achievable
  - Grew reliability using “Test Analyze and Fix”
- Testers brought the system together in a SIL
- Executed over 500 system-level test events at six test sites
  - Post-SIL testing satisfied both DT and OT objectives

# Case Study...cont'd

- Direct, full-time tester and specialty engineer involvement from concept through operational use resulted in:
  - Ahead of schedule
    - Successful completion of the program months ahead of schedule
    - Within weeks of the originally scheduled completion date—5 years after the start!
  - Below cost
    - 20% below budget for integration and test (I&T) and T&E
    - Program completed within 10% of budget
  - Better performance
    - Successfully completed an OT-like demonstration
    - Full scale development followed, systems based on this effort are now operational
    - Awarded the Defense Superior Management Award.

**Phenomenal success due to testers and specialty engineers involvement from the beginning!**

# Relating RMS&L to the 21st Century Warfighter

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- Integrated Product Teams (IPTs)
- Integrated Developmental and Operational Testing (IT)
- Case Study
- **Conclusion**

# From the GAO

**Early testers and specialty engineers involvement** can minimize the issues pointed out by the GAO in March 2008, *Defense Acquisitions: Assessments of Selected Weapon Programs* (GAO, 2008).

“Of the 72 programs GAO assessed this year, **none of them** had proceeded through system development meeting the best practices standards for mature technologies, stable design, or mature production processes by critical junctures of the program **Knowledge-based with stable requirements** st, schedule, and performance outcomes. The absence of wide-spread adoption of **knowledge-based acquisition** processes by DOD continues to be a major contributor to this lack of maturity. Aside from these knowledge-based issues, GAO this year gathered data on four additional factors that have the potential to influence DOD’s ability to manage programs and improve outcomes—**performance requirements changes**, program manager tenure, reliance on nongovernmental personnel to help perform program office roles, and software management. GAO found that **63 percent of the programs had changed requirements once system development began, and also experienced significant program cost increases...**”

# Finally

- Poor operational testing outcomes means...
  - Lack of RMS&L during design
  - Lack of early discovery of operational issues
- The solution...
  - IPTs with testers and specialty engineers from the beginning
  - IT is an excellent enabler of this paradigm

Why have ignorance based acquisition!?

The 21st Century Warfighter deserves better

# BACKUP

# You Might Be Conducting IT, If...

- Contractor data augments OT&E data
- DT&E and OT&E personnel recognize each other in the airport...and talk!
- OT&E personnel influence DT&E scenarios
- System in development is operated by end users
- DT and OT teams are sharing data in a common format
- OT&E confirms DT&E results
- DT&E data are used to shorten OT&E period

Adapted from:

Walking the Line with Title 10: Implementation Strategies for IT

NDIA Test & Evaluation Conference Paper #7847, March 2009

Beth Wilson, Darlene Mosser-Kerner



# During Requirements Development

- Early influence during requirement development is:
  - Articulating operational requirements with real operational impact
  - Questioning / eliminating requirements that push the state-of-the-art
  - Testers and specialty engineers ensuring requirements are testable and unambiguous
    - Can one readily imagine a verification technique for this requirement?
    - Your requirement may be ambiguous if...
      - can be satisfied hundreds of ways, all but one is wrong
      - interpretation required to design and build
      - after construction you realize *this* isn't what you intended

Getting the requirements right is  
a pothole-filled road

# During Source Selection and Program Planning

- Include test-related scheduling, budgeting, infrastructure, other resources and personnel in program's contractual documents
  - RFP, proposal, proposal evaluation, contract
  - Put “hooks” in for continuing involvement
- Play in budget and schedule planning by answering the question, “How much and what type of data need to be collected?”
  - Activities to inform early decisions
  - Test design
    - Test events / scenarios
    - Statistical sample size determination
    - Analysis planning
    - Data sufficiency

**Testers assure “right sized” test programs for contractors and customers.**

# During Test Execution

- Early, continuous IT serves both DT and OT objectives
  - Data are data: “Test once and evaluate multiple times”
  - Well planned data collect = nearly free information
  - Early look at / fix of operational issues
- Execute early reliability growth tests
  - Maintenance activities on early test units yield valuable information
    - Measure/record the time and skill to repair the unit
      - Early maintainability assessments
      - Evolve maintenance approach or design at this relatively inexpensive stage

**Earlier insight = cheaper & easier fixes**