Improving System Reliability Through Better Systems Engineering

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Operational Test and Evaluation
IOT&E Results: Effective, Suitable

Cumulative Numbers

Reports

Effective

Suitable
DOT&E Priorities

1. Improve Suitability

2. Enhance operational realism in early tests

3. Provide timely performance information to the war fighters and fielding decision makers

4. Facilitate adequate OT resources

5. Ensure DOT&E personnel are well trained and prepared
1. Used star cluster ammo can mounted to the TC’s 50 Cal ammo can with tie down straps.
2. Fabricated feed chute from old road sign to top feed ammo across the top of the turret and to help prevent stoppages.
3. Door providing access to the coax held open to allow ammo to feed into the COAX.
DoD O&S Costs
Largest Fraction of Life Cycle Costs

Ground Combat Systems
- RDT&E: 4%
- Procurement: 28%
- O&S: 68%

Rotary Wing Aircraft
- RDT&E: 4%
- Procurement: 31%
- O&S: 65%

Surface Ships
- RDT&E: 1%
- Procurement: 39%
- O&S: 60%

Fighter Aircraft
- RDT&E: 5%
- Procurement: 29%
- O&S: 66%

* Source: OSD CAIG
"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)
Logistics Management Institute Study
Reliability Investment ROI 5:1 to 128:1

Reliability Investment and Support Cost Reduction

<table>
<thead>
<tr>
<th>Case Study</th>
<th>MTBx Hours</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Was</td>
<td>Is</td>
<td>Percent Change</td>
<td>Was</td>
<td>Is</td>
<td>Percent Change</td>
<td>Reliability Investment</td>
<td>ROI</td>
<td></td>
</tr>
<tr>
<td>Predator</td>
<td>40</td>
<td>77</td>
<td>92.5%</td>
<td>$1,463</td>
<td>$576</td>
<td>60.6%</td>
<td>$39.1</td>
<td>22.7:1</td>
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<tr>
<td>Global Hawk</td>
<td>67.7</td>
<td>120</td>
<td>77.3%</td>
<td>$2,547</td>
<td>$1,958</td>
<td>23.1%</td>
<td>$121.9</td>
<td>5:1</td>
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<tr>
<td>FBCB2</td>
<td>47</td>
<td>364</td>
<td>674.5%</td>
<td>$13,060</td>
<td>$1,880</td>
<td>85.6%</td>
<td>$87.4</td>
<td>128:1</td>
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</tbody>
</table>

* CASA – Cost Analysis Strategy Assessment

- Reliability investments resulted in 20-yr support cost reductions
- Returns-on-Investment ranged from 5:1 to 128:1
### DLA Reliability Investment Summary

<table>
<thead>
<tr>
<th>Service</th>
<th>Investment ($M)</th>
<th>Estimated 10 year LC Savings ($M)</th>
<th>ROI</th>
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<tbody>
<tr>
<td>Army</td>
<td>14.1</td>
<td>187.0</td>
<td>13.3:1</td>
</tr>
<tr>
<td>Navy</td>
<td>9.7</td>
<td>207.0</td>
<td>21.3:1</td>
</tr>
<tr>
<td>Air Force</td>
<td>8.3</td>
<td>102.0</td>
<td>12.3:1</td>
</tr>
<tr>
<td>Total</td>
<td>32.1</td>
<td>496.0</td>
<td>15.5:1</td>
</tr>
</tbody>
</table>

Source: Karron Small, Aviation Engineering Directorate, Defense Supply Center Richmond, Nov 2005

Returns-on-Investment in reliability 15.5:1
Empirical Relationship
Reliability Investment & Reliability Growth

\[ y = 0.349x - 0.8371 \]

\[ R^2 = 0.9844 \]
Areas That Need Engagement of SE Community

1. **Requirements**
   - Need to be fully understood so that a good reliability program can be characterized
   - Government must articulate the reliability requirements in RFPs or Request for Proposals, to provide both the incentive and understanding for industry
   - Industry must propose appropriate solutions; and then systems engineers and management must follow through with an appropriate design

2. **Reliability Objectives**
   - Need to be an integral part of the business strategy and have the commitment of senior management - and appropriate incentives must be in place

3. **Reliability tasks**
   - Must be an integral part of SE and addressed early in the design phase

4. **Operational-use-environment, Duty cycles, Related stresses**
   - Must be understood for the entire life cycle

5. **Root cause analysis of critical failure modes**
   - Must be done to eliminate or minimize their consequences

6. **Reliability of the design**
   - Should be verified by testing and analysis to ensure requirements are achieved
Actions to Improve Suitability

1. Key Performance Parameter (KPP) for Materiel Availability with two Key System Attributes (KSA) - Materiel Reliability and Ownership Costs
2. Sustainment Metrics Rationale Report
3. DoD Guide for Achieving Reliability, Availability, and Maintainability
4. Four new metrics for acquisition program oversight process
5. New industry based reliability program management standard
6. Standard data elements associated with the KPP and KSAs
7. Reliability training for select OSD staff
8. NDIA conference focusing on improving suitability
9. NDIA/DT&E committee proposing changes to improve suitability