Tri-Service Assessment Initiative Systemic Analysis

Tri-Service Assessment Initiative
Phase 2 Systemic Analysis Results

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Presentation Objectives

• Convey what we have learned through a systemic “Cross Program” analysis of multiple DoD software intensive programs

• Describe and quantify the recurring issues that impact DoD software intensive program performance

• Characterize the identified DoD program performance issues in terms of cause and effect

• Initiate discussion on potential corrective action strategies
Phase 2 Overarching Conclusion

The analysis predicts an increasing gap between what is expected and what is capable of being achieved.
Summary Findings

• **Software intensive system development issues are still pervasive across DoD programs**

• **New emerging issues reflect complex, risk-prone acquisition trends. These include:**
  - interoperability / family of systems
  - co-dependent systems development
  - “mission resilient”, evolutionary system development
  - direct funding - Congressional plus-ups
  - expanded contractor acquisition and program management responsibilities
  - acquisition policy easements
What You Need to Know

• The causes of program performance shortfalls are extremely complex - improvement strategies and associated action plans must address this complexity

• As an Enterprise we need to start by re-addressing the performance issues we thought we were already fixing

• The longer we wait - the higher the risk
**Tri Service Assessment Initiative**

**Tri-Service Assessment Activities**

- Independent Expert Program Reviews
- Single Program Focus
- Objective - Improve Program Performance
- Program Team Insight

- Cross-Program Analysis
- Enterprise Focus
- Objective - Identify and Characterize Recurring Performance Issues
- General and Directed Analyses
- Enterprise Manager Insight

**Both Activities are Based on an Integrated Assessment Architecture**
Systemic Analysis Phases

Phase 1 - Complete July 2001
- Top down analysis approach
- Initial models - proof of concepts
- Assessment architecture integration
- Initial data set - 10 assessments

Phase 2 - Complete December 2002
- Bottom up analysis approach
- Based on quantification of recurring issues and sequences
- Information driven analysis objectives
- Systemic database
- Extended data set - 23 assessments

Phase 3 - Began January 2003
- Predictive issue pattern analysis
- Quantification of projected issue impacts
- Architecture and analysis process improvements
- Comprehensive transition program
Assessment Distribution

Distribution of Assessments by Service

Distribution of Assessments by ACAT Level

Distribution of Assessments by Domain
Systemic Analysis Process

Program Assessment Results

- Analyze Assessment Findings
  - Systemic Peer Review
  - Assessment Characterization
  - Issue Identification
  - Risk Typology Allocations
  - Initial Cause and Effect Model

- Basic Analysis
  - Issue Frequency of Occurrence Analysis - Data Normalization
  - Enterprise - Program Issue Responsibility Allocations
  - Definition of Information Needs
  - Issue Concurrency Analysis
  - Issue Sequence Identification and Analysis - Interaction
  - Issue Characterization - Triggers / Symptoms

- Directed Analysis
  - Executive Data Call
  - Basic Analysis Review
  - Definition - Prioritization of Information Needs
  - Individual Case Analysis

- Integrated Analysis
  - Issue Correlation
  - Risk Analysis
  - External Correlations
  - Systemic Analysis Model
  - Executive Level Conclusions / Summary

Action Plan
Tri-Service Assessment Initiative Systemic Analysis™

What Was Counted

• Identified Issues
  - single issues
  - composite issues
  - component issues
• Systemic Sequences
• Systemic Patterns
• Triggers and Symptoms

Identified Issue

Single Issue  Composite Issue
  Component Issue  Component Issue

Issue Structure

Trigger Issue

Systemic Issue

Symptom Issue

Systemic Issue Pattern
**Basic Analysis**

**Critical program performance problems**

<table>
<thead>
<tr>
<th>Identified Issues</th>
<th>Relative Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Capability</td>
<td>91 %</td>
</tr>
<tr>
<td>Organizational Management</td>
<td>87 %</td>
</tr>
<tr>
<td>Requirements Management</td>
<td>87 %</td>
</tr>
<tr>
<td>Product Testing</td>
<td>83 %</td>
</tr>
<tr>
<td>Program Planning</td>
<td>74 %</td>
</tr>
<tr>
<td>Product Quality - Rework</td>
<td>70 %</td>
</tr>
<tr>
<td>System Engineering</td>
<td>61 %</td>
</tr>
<tr>
<td>Process Compliance</td>
<td>52 %</td>
</tr>
<tr>
<td>Program Schedule</td>
<td>48 %</td>
</tr>
<tr>
<td>Interoperability</td>
<td>43 %</td>
</tr>
<tr>
<td>Decision Making</td>
<td>43 %</td>
</tr>
<tr>
<td>Configuration Management</td>
<td>26%</td>
</tr>
</tbody>
</table>

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Basic Analysis

Complex issues with multiple interactions across all levels of DoD management
Issue Migration

Sequence Starts - Start Responsibility by Next Responsibility

Start Responsibility

- Congress
- DoD
- Service Level
- PM
- Systems Engineering
- Working Level

Total

250
200
150
100
50
0

Congress
DoD
Service Level
PM
Systems Engineering
Working Level

TAI - Systemic Analysis
Basic Analysis

The primary causative performance issues are:

- **Process capability shortfalls:** the inability of the program team to design, integrate, and implement processes that adequately support the needs of the program
- **Requirements development and management shortfalls**
- **Organizational management and communication limitations**
- **Stakeholder agendas and related program changes**
- **Product architecture deficiencies**
Cause and Effect Impacts

• **Process Capability** problems result in:
  - Inadequate Testing
  - Poor Change Management
  - Poor Product Quality
  - Progress Shortfalls

• **Requirements Management** problems result in:
  - Poor Product Quality
  - Product Rework
  - Progress Shortfalls

• **Organizational and Program Management** problems result in:
  - Inadequate Program Planning
  - Responsibility Conflicts
  - Poor Communications
  - Product Rework
  - Progress Shortfalls
Basic Analysis

Under pressure, Program Managers make trade-off decisions that impact, in order:

- Development progress
- Product technical performance
- Product quality and rework
- System usability
- Cost
Basic Analysis Summary

- The current DoD program issue profile shows little positive impact from past corrective actions, initiatives, and policy.

- The Program Manager and the Development Team must address the majority of the program issues, even if they are caused by enterprise level decisions or behaviors.

- Causative issues multiply downstream.

- The Program Team creates many of their own performance problems.

- There are no “single issue” program performance drivers.
Directed Analysis

- Software Engineering Process
- Systems Engineering
- Software Testing
- Program Organization and Communication
Software Engineering Process

**Analysis Results**
- 91% of the assessments had process compliance issues (75% triggers)
- 52% of the assessments had process capability issues (63% triggers)
- Predominant deficiencies: requirements, risk / measurement, testing, systems engineering, change management

**Implications**
- The performance problem extends beyond developer software process compliance
- False assumption that organizational process compliance equates to required program process capability
- Compliant organizations still have significant performance shortfalls
- Key process concerns:
  a. focus is too narrow in scope
  b. impacts of program constraints
  c. large program team process incompatibilities
  d. program teams just not good enough
Systems Engineering

Analysis Results
- 61% of the assessments had systems engineering issues (23% triggers)
- 11 of the 16 programs that have requirements issues have SE issues
- 43% of the assessments have interoperability issues (50% triggers)
- Predominant deficiencies: Non-existent SE, lack of SE expertise, poor SE implementation, dispersion of SE responsibility and authority, existing SE inadequate for program requirements

Implications
- Cost overruns, schedule slips and rework will continue to plague programs
- The most technically complex systems have the most systems engineering issues
- Interoperability of systems is in doubt
- Rapid exploitation of new/innovative technology is difficult
Systems Engineering Findings

• DoD programs have significant shortfalls with respect to systems engineering yet this is where most of the identified program issues exist

• “Systems engineering by committee” is both common and ineffective

• Programs continuously face unfunded and unplanned mandates related to family of systems management and interoperability

• Trade off decisions are often extremely constrained

**Systems engineering must take a primary and renewed role in today’s DoD programs**
Software Testing

Analysis Results
- 83% of the assessments had testing related issues (53% triggers)
- Predominant deficiencies: lack of test time, facilities, testing cutbacks, poor test procedures
- 73% of the programs with schedule problems had testing issues
- 80% of the programs with requirements problems had testing issues

Implications
- Overarching testing risk - late discovery of defects (94%)
- Most testing issues result in quality shortfalls and rework
- Testing of complex systems is an emerging concern
- Primary causes of testing shortfalls:
  a. requirements (71%)
  b. test facilities (71%)
  c. test process capability (65%)
  d. schedule constraints (41%)
Program Organization and Communication

Analysis Results
- 87% of the assessments had communications issues (65% triggers)
- Every program with IPT related issues had communications issues
- Predominant deficiencies: unclear roles and responsibilities, delayed decision making, conflicting decisions, proprietary information (all exacerbated by widely dispersed organizational teams and complex organizational structures not suited for traditional management approaches)

Implications
- IPTs appear to create more management issues than they resolve
- Poor implementation of IPTs: proliferation, structure, membership, authority and decision responsibility issues
Systemic Analysis Model

**Enterprise Level**
- Congress
- DoD
- Service

**Program Level**
- Program Manager
- Systems Engineering
- Working Level

Program Decision Space

- **Expectations**
  - Cost
  - Schedule
  - Performance
  - Quality

- **Constraints**
  - Funding
  - Resources
  - Time
  - Capability

- **Mission Allocation**

- **Implementation Issues**
  - Complexity
  - Capability
  - Planning
  - Program Trades
  - Resource Allocation
  - Management
  - Organization
  - Interoperability
  - Conformance
  - Leadership

- **Execution Issues**
  - Process
  - Product
  - Information
  - Capability
  - Performance

**Acquisition Requirements**
- Process
- Politics
- Strategy
- Assumptions

**Policy Culture**

**Acquisition Environment**
(Threats, Economy, Technology)
New Solution Strategy Required?

- Past DoD acquisition solutions (strategies, policies, and initiatives) have had only limited success in reversing poor performance trends:
  - Single point solutions
  - Poorly evaluated
  - Focused on symptoms not causes
  - Lacking in implementation guidance
  - Conflicting
  - Volatile
  - Lack insight into solution effectiveness
  - Long lasting impacts and residuals
Key Considerations

• Need to establish performance parameters that can be implemented with success across the life of the program
  - Feasible plan
  - Understood constraints
  - Change tolerance

• Need to improve the capabilities of the development teams
  - Real systems engineering
  - Funded management and technical approaches critical to interoperability
  - Foundational processes
Key Considerations

• Need to ensure that all program stakeholders agree on an integrated strategy for attacking the high priority overarching program issues
  - Congress and enterprise
  - Program team
  - Education and technology infrastructures

• Need to augment recent acquisition policy changes with
  - A clear understanding of the complex interactions and constraints that programs are faced with
  - Adequate implementation guidance
  - Directed education
Assessment & Analysis Essentials

- Focus on performance improvement
- Enterprise performance is a composite of project performance
- Use a common architecture for project and systemic evaluation
- Address a wide scope of issues and issue sources
- Risk management and measurement processes are critical
- Flexibility is important – typology not taxonomy
- Relate subjective and quantitative information
- Information needs drive the analysis process
- Frequency of occurrence counts are just the first step
- Data integrity – data integrity – data integrity
- Consistent terminology
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