Program Support: Perspectives and Systemic Issues

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Deputy Director, Assessments and Support

Systems & Software Engineering
Office of the Deputy Under Secretary of Defense for Acquisition and Technology

24 October 2006
Systems and Software Engineering…
What are we all about?

Acquisition Program Excellence through sound systems and software engineering…

- **Help shape portfolio solutions and promote early corporate planning**
- **Promote the application of sound systems and software engineering, developmental test and evaluation, and related technical disciplines across the Department's acquisition community and programs**
- **Raise awareness of the importance of effective systems and software engineering, and drive the state-of-the-practice into program planning and execution**
- **Establish policy, guidance, best practices, education, and training in collaboration with academia, industry, and government communities**
- **Provide technical insight to the leadership to support effective and efficient decision making**

**Based on USD(AT&L) 2004 Imperative…**

“Provide context within which I can make decisions about individual programs.”
Driving Systems and Software Engineering Back into Programs Reduces Costly Mistakes

RDT&E Mistakes

Under estimating engineering effort is Major source of error

137 Systems

- 35%
- 30%
- 25%
- 20%
- 15%
- 10%
- 5%
- 0%
- -5%

Percent Cost Growth (CG)

Other Mistakes
- ILS Factors; Spares & Support
- Schedule Slips/Management Factors
- Engineering/Test/Development
- Production Assumptions & Estimation

% of RDT&E Total

Source: DoD Cost Avoidance Study (CAIG) 10 year ongoing

33% historical RDT&E Cost Growth

Applied to

$222.8B RDT&E FYDP**

Yields a Potential

$73.52B RDT&E Cost Growth FYDP

1/3 * SSE impact

1/3 * SSE

Positive impact on just 1/3 of RDT&E mistakes (11%)

Yields a Potential

$24.51B RDT&E Cost Avoidance FYDP

**SAR data for MAIS and MDAP programs under OSD Systems Engineering Oversight

Version 1.0 – NDIA Systems Engineering Conference
Providing Value Added Oversight & Support

• Tactical, Program and Portfolio Management
  PEOs & PMs...
  • PSR
  • AOTR
  • SEP
  • TEMP
  • DAES

  Improved Program Execution thru...
  Program Unique Recommendations

  AS Results Achieved thru
  • Open Communication/Debate
  • Insight & Information Sharing
  • Understanding of Consequences
  • Data Driven, Fact-based Information Synthesis

  Acquisition Leadership
  Improved Acquisition Decision Making thru...
  • Greater Program Transparency
  • Acquisition Insight

• Strategic Management
  DoD Acquisition Community
  Improved Acquisition Support to Warfighter

  • Systemic Issues & Risks
  • Systemic Strengths & Indicators

  Recommendations

  Improved Acquisition Support to Warfighter

  • Policy/Guidance
  • Education & Training
  • Best Practices
  • Other Processes (JCIDS, etc)
  • Oversight (DABS/ITAB)
  • Execution (staffing)
Systemic Analysis: Data Model

Tactical, Program and Portfolio Mgt

1a Program Review Findings
1b Program Causes-Effects & Root Causes
1c Program Unique Solutions
1d SEP Findings
1e T&E Findings
TBD

Steps 1A, 2-4 Underway

Value Added Oversight

Strategic Management

DoD Acquisition Community

- Policy/Guidance
- Education & Training
- Best Practices
- Other Processes (JCIDS, etc)
- Oversight (DABS/ITAB)
- Execution (staffing)

Version 1.0 – NDIA Systems Engineering Conference
A Tailorable Process Model...

**Pre-MS A (Oct 2004)**
- Initial Capabilities Documentation (ICD)
- Results of system concept studies
- Analysis of Alternatives
- Technology Development Strategy
- Technology Development Planning
- Technology Risk Reduction
- Systems Engineering planning

**Pre-MS B (Dec 2003)**
- Results of Technology Development and Maturation
- Capabilities Development Documentation (CDD)
- Feasibility and stability of requirements
- Incorporation of MOSA, Net Centric capability
- Acquisition Strategy
- Test and Evaluation Strategy
- Application of systems engineering process in design, test, and verification
- Design producibility and transition to production planning
- Logistics metrics including supportability, reliability, maintainability

**Pre-MS C (May 2004)**
- Design Baseline status
- Status of system demonstration, test, and evaluation
- Execution of systems engineering process
- Production metrics and process controls
- Transition to production planning
- Operational test verification
- Logistics metrics verification (maintenance/training)

Consolidated Web Version – Oct 2005
Program Support Review (PSR)

- Repeatable, tailorable, exportable process
- Trained workforce with in-depth understanding of PMs’ program issues

**PSR Evaluation Areas**
1. Mission Capabilities/Requirements
2. Resources
3. Management
4. Technical Process
5. Technical Product
6. Environment

**PSR Reference Mat’l’s**
- Templates
- Sample Questions
- Documented Processes
- Training Materials
- Execution Guidance

**PMs Report Process is Insightful, Valuable, and Results Oriented; better than 95% acceptance of recommendations**

“...PSR team serves as ‘disinterested 3rd party’ that allows [the PM] to approach leadership armed with powerful program truths, reinforce issues.” (PM)
PSR Effectiveness

Acceptance of Program Support Review Recommendations

<table>
<thead>
<tr>
<th>Year</th>
<th>% of Recs accepted</th>
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<tbody>
<tr>
<td>2004</td>
<td>98.04%</td>
</tr>
<tr>
<td>2005</td>
<td>96.84%</td>
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<tr>
<td>2006</td>
<td>98.0%</td>
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</table>

FY06 Return on Investment as high as 340:1, with almost $85 Million in Cost Avoidance
### PSR Data Matrix and Coverage Record

#### Pre-Milestone B PSR Areas

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Known Findings (By PMO)</th>
<th>Recs Made?</th>
<th>Unknown Findings (By PMO)</th>
<th>Recs Made?</th>
<th>Syst Issues</th>
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<tr>
<td></td>
<td>Yes No</td>
<td>Pos Neut Neg Issue Risk Chg</td>
<td>Yes No</td>
<td>Pos Neut Neg Issue Risk Chg</td>
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<td>Totals</td>
<td>18 35 83 0 20 28 16 11 23 2</td>
<td>36 4 1 18 20 35 1 37 4 55 0</td>
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<tr>
<td>Grouped Totals</td>
<td>75</td>
<td>36</td>
<td>7</td>
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#### 1.0 Mission Capabilities Assessment Area

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<thead>
<tr>
<th>Sub-Area 1.1 – Mission Requirements</th>
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<tbody>
<tr>
<td>x x 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</td>
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#### 2.0 Resources Assessment Area

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<th>Sub-Area 2.1 – Program Allocation</th>
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#### 3.0 Management Assessment Area

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<th>Sub-Area 3.1 – Acquisition Strategy/Process</th>
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<tr>
<td>1 1 2 0 2 2 2 1 2 0 3 0 0 0 1 1 0 2 0 3 0</td>
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Unknown Findings (By PMO):

- Jim Alexander
- Dick Scott
- Mike Zsak

Known Findings (By PMO):

- Ron Dalton
- Peter Lierni
- Andy Foote
- Robin Gulifer

Recs Made?

- By PMO

Pre-Milestone B PSR Areas

- Doc Rev?
- Site Visit Review?
Program Support Review Activity

- PSRs/NARs completed: 37
- AOTRs completed: 7
- Nunn-McCurdy Certifications: 3
- Support to Service-led reviews: 2
- Technical Reviews: 9

Service-Managed Acquisitions

- Air Force: 40%
- Navy: 19%
- Marine Corps: 9%
- Army: 22%
- Agencies: 10%

Programs by Domain Area

- Fixed Wing: 21%
- C2-ISR: 10%
- Unmanned: 2%
- Ships: 7%
- Munitions: 3%
- Space: 7%
- Rotary Wing: 21%
- Business: 3%
- Other: 3%
- Land: 16%
- Missiles: 7%
“Quotable Quotes” from Program Reviews

- Management…
  - “Decisions that should take a week, took a year…”
  - “They were the Romulans, but now we are working with them…”
  - “Often an issue is gone before getting through the process…”
  - “Perfection is the enemy of good enough…”
  - “We tried to co-locate, but it was just too hard…”
  - “Nine women can’t have a baby in one month”
  - “CPI can be gamed…”
  - “EVMS is meaningless…”
“Quotable Quotes” from Program Reviews

• Process…
  – “Death by a thousand cuts…”
  – “It’s OK to be different…”
  – “We thought that would be good enough”
  – “I wouldn’t do it this way again…”
  – “…we allow that, but strongly discourage it…”
  – “…we’re not going to tell them about all of our test cases”
  – “That doesn’t mean what you think it means…”
    » Indigo Montoya, The Princess Bride
Systemic Analysis: Data Model

Systemic Issues

Steps 1A, 2-4 Underway

Strategic Management

1a Program Review
1b DAES Findings
1c T&E Findings
1d Other Findings
1e TBD

DoD Acquisition Community

- Policy/Guidance
- Education & Training
- Best Practices

Corrective Actions

- Other Processes (JCIDS, etc)
- Oversight (DABS/ITAB)
- Execution (staffing)
Welcome Laura Dwinnell

<table>
<thead>
<tr>
<th>Acronyms</th>
<th>Findings Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documents</td>
<td>Admin</td>
</tr>
<tr>
<td>Reports</td>
<td>Close</td>
</tr>
</tbody>
</table>

**Sponsored By:**
OUUD (AT&L) Defense System
Assessments and Support

Database Developed By:
RDECOM - ARDEC PICATINNY, NJ
Fire Control Systems & Technology
Automated Test Systems Division
Data Demographics

- Database contains 1701 findings from 29 programs to date
- Reviews conducted between 7/21/03 – 6/27/06

Count & Cumulative Count Of Findings Per DAPS Methodology Area

- Management Assessment Area: 516 (30.32%)
- Technical Product Assessment Area: 494 (29.02%)
- Technical Process Assessment Area: 284 (16.69%)
- Mission Capabilities & Operational Requirements Assessment Area: 198 (11.63%)
- Resources Assessment Area: 164 (9.64%)
- Environment Assessment Area: 27 (1.59%)
- Other Areas: 19 (1.12%)

Total Findings: 1702
Categorization of Findings

Count Of Findings Per "Common Term"
For 842 (49.5%) Of 1701 Findings Specifying A Common Term

Emerging Results…
## Top 10 Emerging Systemic Issues (1-5)

<table>
<thead>
<tr>
<th></th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• IPT Roles, responsibilities, authority, poor communication</td>
</tr>
<tr>
<td></td>
<td>• Inexperienced staff, …</td>
</tr>
<tr>
<td></td>
<td>• Lack of adequate communication and information sharing (management and technical) between government and contractor</td>
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<table>
<thead>
<tr>
<th></th>
<th>Requirements</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>• Creep/stability</td>
</tr>
<tr>
<td></td>
<td>• Tangible, measurable, testable</td>
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<tr>
<td></td>
<td>• Lack of ORD thresholds in areas that are key to the program’s goals</td>
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<table>
<thead>
<tr>
<th></th>
<th>SE Process Foul</th>
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<tbody>
<tr>
<td>3</td>
<td>• Lack of rigorous approach, technical expertise, process compliance</td>
</tr>
<tr>
<td></td>
<td>• SEP contains little mention of subcontractors and key suppliers</td>
</tr>
<tr>
<td></td>
<td>• No plan to perform System Functional Review or PDR during SDD</td>
</tr>
<tr>
<td></td>
<td>(Planned technical reviews go from SRR to CDR)</td>
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<thead>
<tr>
<th></th>
<th>Reliability</th>
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<tbody>
<tr>
<td>4</td>
<td>• Ambitious growth curves, unrealistic requirements</td>
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<tr>
<td></td>
<td>• Inadequate “test time” for statistical calculations</td>
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<tr>
<td></td>
<td>• Demonstrated acceptable levels of reliability and manufacturing process control are not included in SPO and OIPT published criteria</td>
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<thead>
<tr>
<th></th>
<th>Logistics</th>
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<tbody>
<tr>
<td>5</td>
<td>• Sustainment costs not fully considered (short-sighted)</td>
</tr>
<tr>
<td></td>
<td>• Supportability considerations traded</td>
</tr>
</tbody>
</table>
### Top 10 Emerging Systemic Issues (6-10)

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<tbody>
<tr>
<td></td>
<td><strong>6. Schedule</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Supportability considerations traded</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Realism, compression</td>
<td></td>
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<td></td>
<td><strong>7. Staffing</strong></td>
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</tr>
<tr>
<td></td>
<td>• Inadequate Government program office staff to provide oversight and technical review</td>
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<tr>
<td></td>
<td>• Lack of development acquisition expertise on the project and the staff. No acquisition-certified Program Manager (PM)</td>
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<td><strong>8. Test Planning</strong></td>
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<tr>
<td></td>
<td>• Breadth, depth of resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Details (hrs, profile, exit criteria, confidence level, OC curve) not sufficiently described in TEMP; Resource details missing in TES</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>9. Acquisition Strategy</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Competing budget priorities, schedule-driven events</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Contracting issues, poor technical assumptions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Functional and physical configuration audits not required by contract (risk to product and operational baseline)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>10. Software</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Architecture, design/development discipline</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Staffing/skill levels, organizational competency (process)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Lack of insight into contractor’s plans for development, integration and validation</td>
<td></td>
</tr>
</tbody>
</table>
Root Cause Categorization

Count Of Findings Per Root Cause Type
For 209 (12.3%) Of 1701 Findings Specifying A Root Cause Type

- Funding: 7
- Weak Contract Management: 11
- Resource Constraints: 18
- External Influences: 20
- Poor Planning/Management: 20
- Staffing Experience & Expertise: 32
- Lack of Requirements Discipline: 34
- Process/SE: 67

Emerging Results...
Root Cause Effects

Root Cause
- Process/SE
- Lack of Requirements Discipline
- Staffing Experience & Expertise
- External Influences
- Poor Planning/Management
- Resource Constraints
- Weak Contract Management
- Funding

Common Findings
- Management
- Requirements
- SE Process Foul
- Reliability
- Logistics
- Schedule
- Staffing
- Test Planning
- Software
- Maintainability
- ...

Impact
- Increased program execution risk
- Potential schedule and cost breach
- Shared engineering functions not given proper attention
- Rework
- Insufficient system performance information to make informed milestone decision
- Potential for lower readiness levels and higher maintainer workload
- Etc…

Root causes impact programs in “shotgun” style
Root Cause: Process/Systems Engineering

Count Of Findings Per Common Term
For The 66 (98.5%) of 67 Findings Specifying "Process/SE" As The Root Cause Type Where A Common Term Is Also Specified

Representative Root Causes

- Lack of a rigorous SE approach
- Lack of emphasis on software architecture when defining software requirements
- Failure to identify and address risk of program dependencies tied to requirements
- Risk management not delegated down to IPTs and sub contractor levels
- Inadequate test environments, program documentation and configuration management
Root Cause: Requirements Discipline

Count Of Findings By Common Term
For The 34 (100%) Of 34 Findings Specifying "Lack Of Requirements Discipline" As The Root Cause Type Where A Common Term Is Also Specified

Representative Root Causes

- Changing system interoperability dependencies and external interface requirements
- Evolving, maturing net-ready requirements
- NDI solution may be non-MOSA compliant
- Congressional requirements open to interpretation
- Contract awards are budget vs. effort driven
Root Cause: Staffing Experience/Expertise

Count Of Findings By Common Term
For The 18 (56.3%) of 32 Findings Specifying “Staffing Experience & Expertise” As The Root Cause Type Where A Common Term Is Also Specified

- Software: 1
- Acquisition Strategy: 2
- Schedule: 3
- Requirements: 3
- Management: 3
- Staffing: 6

Program Issues: Count

Representative Root Causes

- PEO living within constrained personnel allocation system
- Failure to recognize value of cross-functional IPTs and gov’t matrix support
- PM’s over-reliance on Industry to define technical solutions, often proprietary/NDI
- Lack of appreciation for, and value added of technical reviews
- Limited staff experience in CONOPS and TTPs; operational ramifications to meet KPPs not fully assessed
### Root Cause: External Influences

#### Count Of Findings By Common Term

For the 17 (85%) of 20 Findings Specifying "External Influences" as the Root Cause Type, Where a Common Term Is Also Specified

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<thead>
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<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Schedule</td>
<td>5</td>
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<tr>
<td>Program Issues</td>
<td>3</td>
</tr>
<tr>
<td>TEMP</td>
<td>2</td>
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<tr>
<td>Decision Criteria</td>
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<td>Performance</td>
<td>1</td>
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<tr>
<td>Production</td>
<td>1</td>
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<tr>
<td>OSD Policy</td>
<td>1</td>
</tr>
<tr>
<td>Acquisition Strategy</td>
<td>1</td>
</tr>
<tr>
<td>Testability</td>
<td>1</td>
</tr>
<tr>
<td>Test Planning</td>
<td>1</td>
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<tr>
<td>SE Process Fail</td>
<td>1</td>
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</tbody>
</table>

#### Representative Root Causes

- End date dictated by customer need, driving unrealistic schedules
- Commercial use of “band systems” takes priority over military use due to profitability
- Urgency to replace aging equipment by procuring short-term NDI solution at expense of long-term requirements
### Root Cause: Poor Planning/Management

#### Representative Root Causes

- Absence of critical path analysis
- Erroneous assumption that prime would do pre-award integration
- IPT Charters are low priority due to staffing and time constraints
- Lack of trust, collaboration and communication: unwillingness to share information
- Contractor proprietary info

<table>
<thead>
<tr>
<th>Common Term</th>
<th>Count</th>
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<td>Software</td>
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<td>Schedule</td>
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<td>Production</td>
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<tr>
<td>OSD Policy</td>
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<td>Manufacturing</td>
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<td>Logistics</td>
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<td>Configuration Mgt</td>
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<tr>
<td>Management</td>
<td>2</td>
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<tr>
<td>Organization</td>
<td>4</td>
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</tbody>
</table>

#### Count Of Findings By Common Term

For the 14 (70%) of 20 findings specifying "Poor Planning/Management" as the root cause type where a common term is also specified.

- Program Issues

- Absence of critical path analysis
- Erroneous assumption that prime would do pre-award integration
- IPT Charters are low priority due to staffing and time constraints
- Lack of trust, collaboration and communication: unwillingness to share information
- Contractor proprietary info

**Emerging Results...**
Providing Value Added Oversight & Support

- Tactical, Program and Portfolio Management
  - PEOs & PMs...
    - PSR
    - AOTR
    - SEP
    - TEMP
    - DAES
  - Improved Program Execution thru...
  - Program Unique Recommendations

- Acquisition Leadership
  - Improved Acquisition Decision Making thru...
    - Greater Program Transparency
    - Acquisition Insight

- Strategic Management
  - DoD Acquisition Community
    - Improved Acquisition Support to Warfighter
  - Systemic Issues & Risks
  - Systemic Strengths & Indicators
  - Recommendations
  - Policy/Guidance
  - Education & Training
  - Best Practices
  - Other Processes (JCIDS, etc)
  - Oversight (DABS/ITAB)
  - Execution (staffing)

Version 1.0 – NDIA Systems Engineering Conference
Systemic Analysis – Customer Model

AS = Process Owners

Systemic Analysis
- Refined DAPS methodology
- Shared/leveraged lessons

Tier I
- Program Unique Recommendations
- Policy Implementation and Effectiveness

Tier II
- Fact-based information for decision making e.g. OIPT support
- Specialized Analysis (e.g. Staffing levels)
- Policy Implementation
- Education & Training
- Best Practices

Tier III
- Oversight (DABS/ITAB)
- Execution (staffing)
- Other Processes (JCIDS, etc)

Customers
- Tier I
  - SSE, PMs & PEOs
- Tier II
  - Acquisition Leadership
- Tier III
  - Industry, Academia, OGAs, etc.

Results
- Improved Program Execution & Program Support
- Greater Program Transparency
- Improved Acquisition Decision Making
- Improved Support to Warfighter

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## Emerging Customer Products...

### Internal
- Independent study results: “Views on PSRs”
  - 24% - Very positive
  - 41% - Positive
  - Knowledgeable professional team
  - Timing relative to other program events a concern
  - Duplicative roles
  - Perceived as “gotcha”
- Improved DAPS Methodology
- Earlier support to programs
- Metrics and performance tracking
- Lean/Six Sigma application
- Customer feedback
  - PM Survey
  - % Recommendations Accepted

### External
- Risk Management Guide
- CLM on Tech Reviews
- Contracting for SE Guide
- Mandatory Management sessions

### Tier III: Acq Community
- Risk Management Guide
- CLM on Tech Reviews
- Contracting for SE Guide
- Mandatory Management sessions

### Tier I: SSE, PMs & PEOs
- Actionable and useful program execution recommendations for PMs
- Working with SE WIPTS to develop better SEP Guidance and Templates
- Facilitate SEP approval

### Assessments & Support
- Continuous Improvement & Measurable Effectiveness

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**Work In Progress**

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Questions/Discussion

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