Program Support: Perspectives and Systemic Issues

Dave Castellano
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?

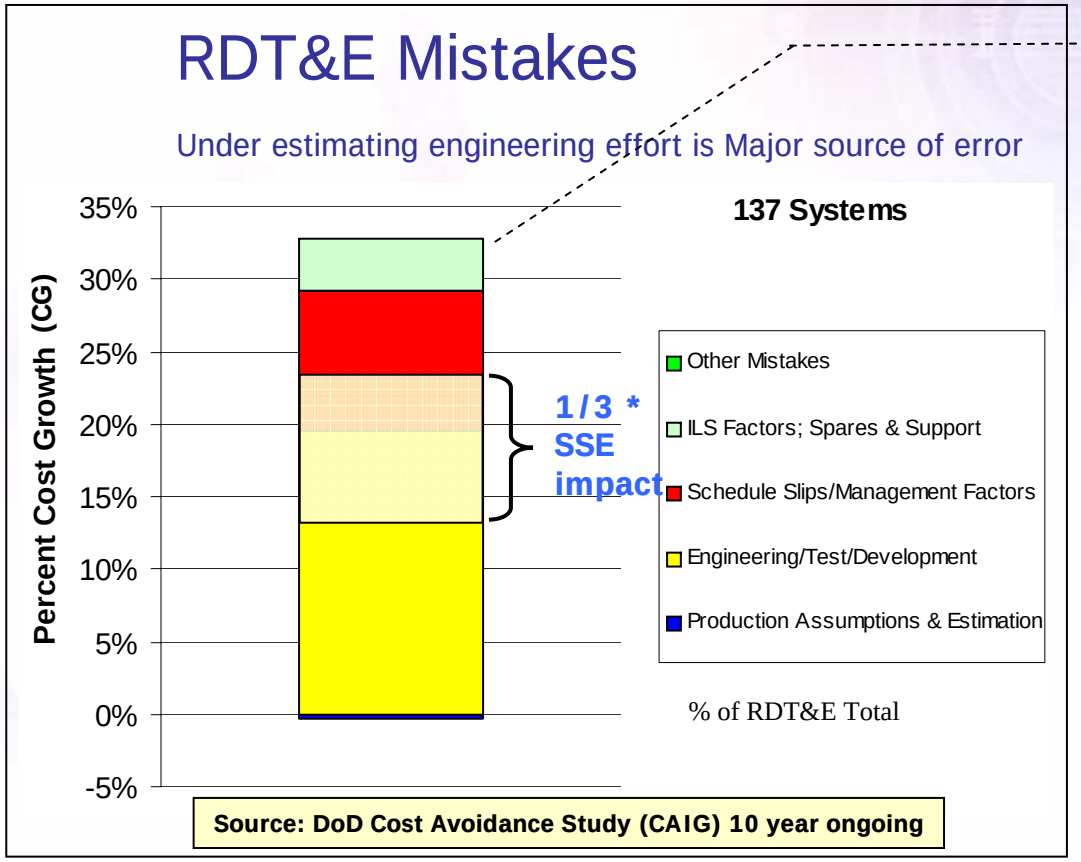
Acquisition Program Excellence through sound systems and software engineering…

- *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



33% historical RDT&E **Cost Growth**

Applied to

$222.8B RDT&E FYDP**

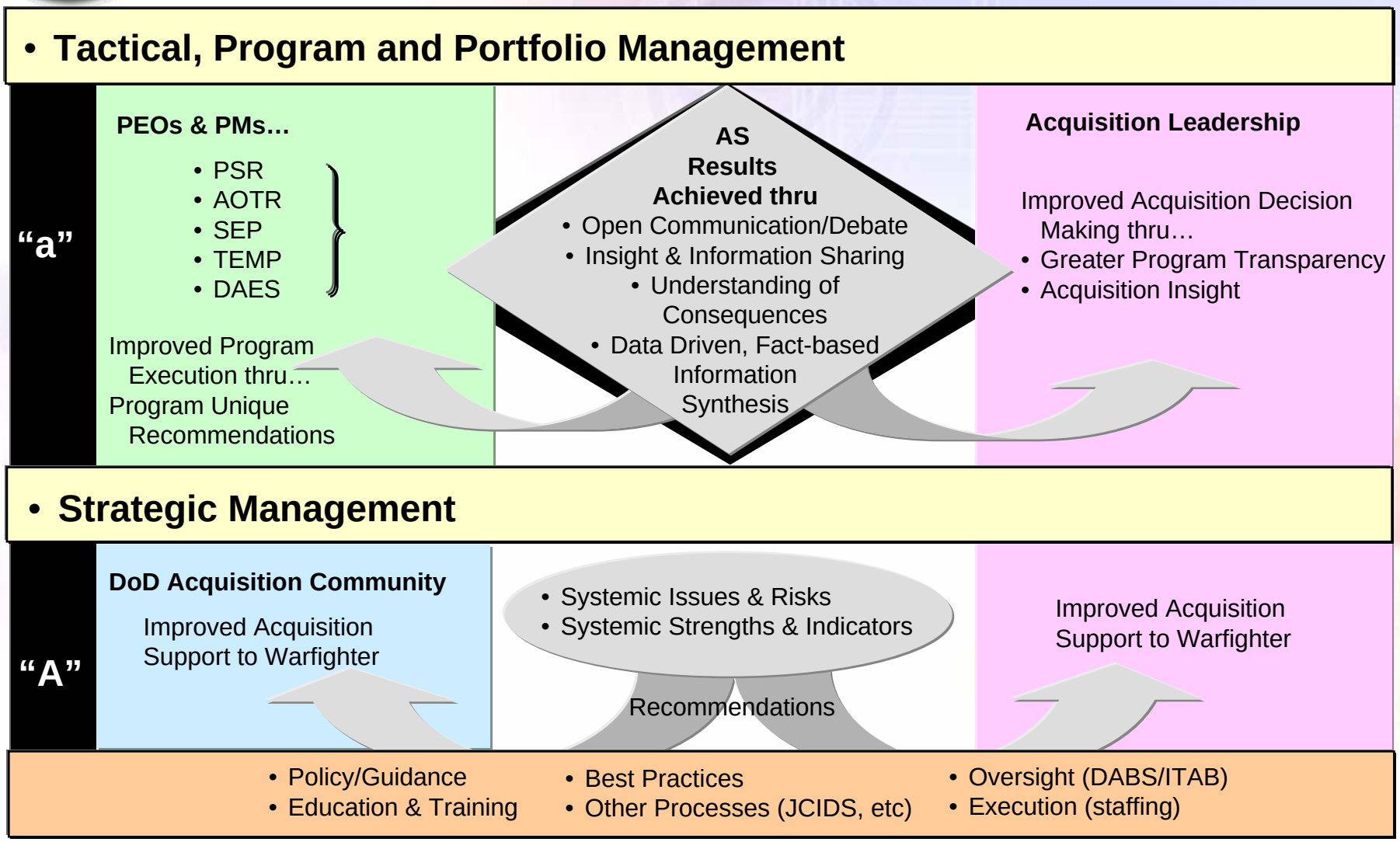
Yields a Potential → $73.52B **RDT&E Cost Growth FYDP**

* SSE positive impact on just 1/3 of RDT&E mistakes (11%)

Yields a Potential → $24.51B **RDT&E Cost Avoidance FYDP**

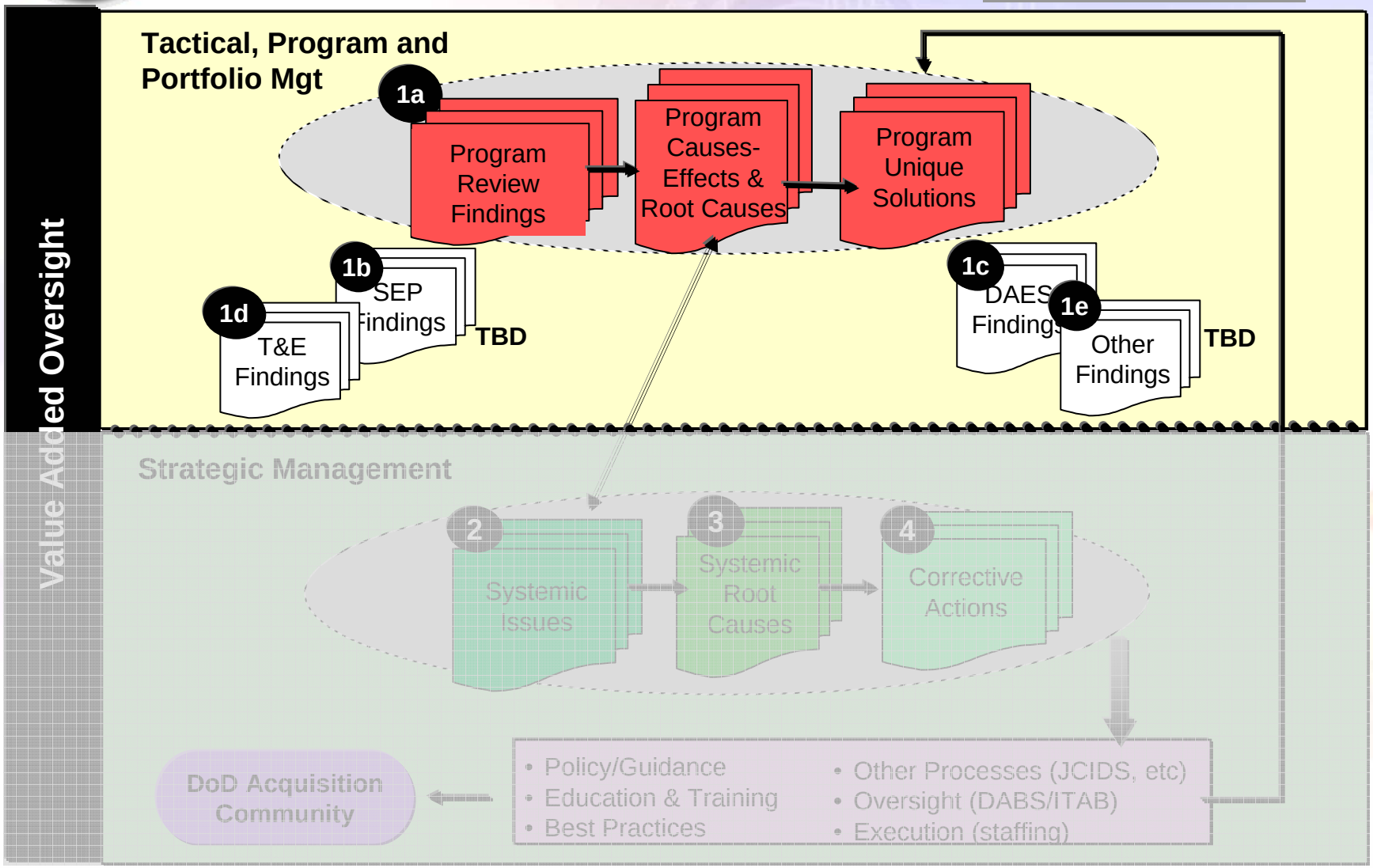
****SAR data for MAIS and MDAP programs under OSD Systems Engineering Oversight**

Providing Value Added Oversight & Support



Systemic Analysis: Data Model

Steps 1A, 2-4 Underway



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)

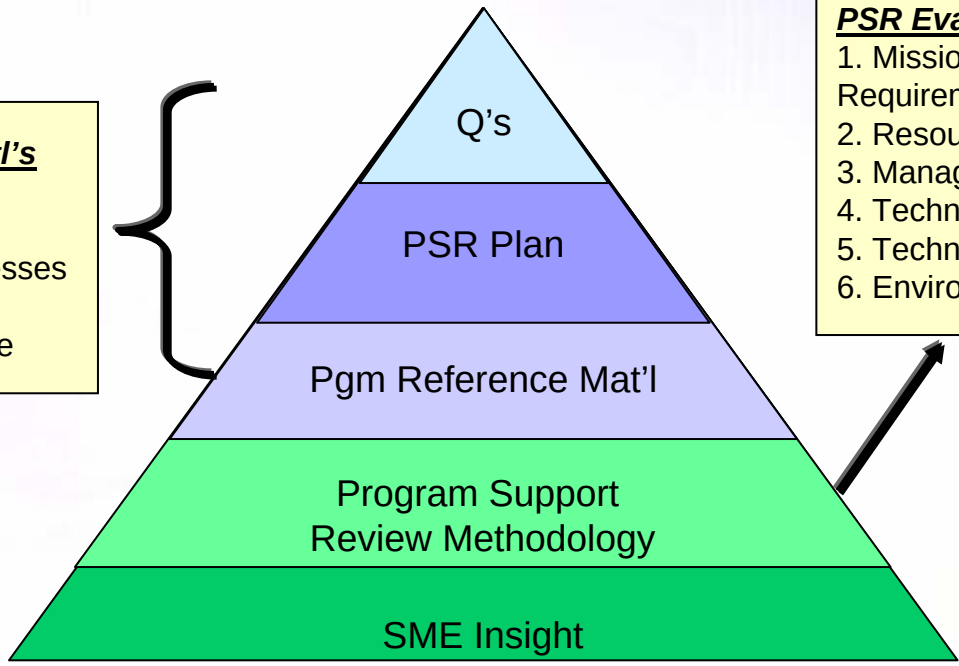
- Design Baseline status
- Status of system demonstration, test, and evaluation
- Execution of systems engineering process
- Production metrics and process controls
- Transition to production planning
- Operational test verification
- Logistics metrics verification (maintenance/training)

Consolidated Web Version – Oct 2005

Program Support Review (PSR)

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

PSR Reference Matl's
- Templates
- Sample Questions
- Documented Processes
- Training Materials
- Execution Guidance



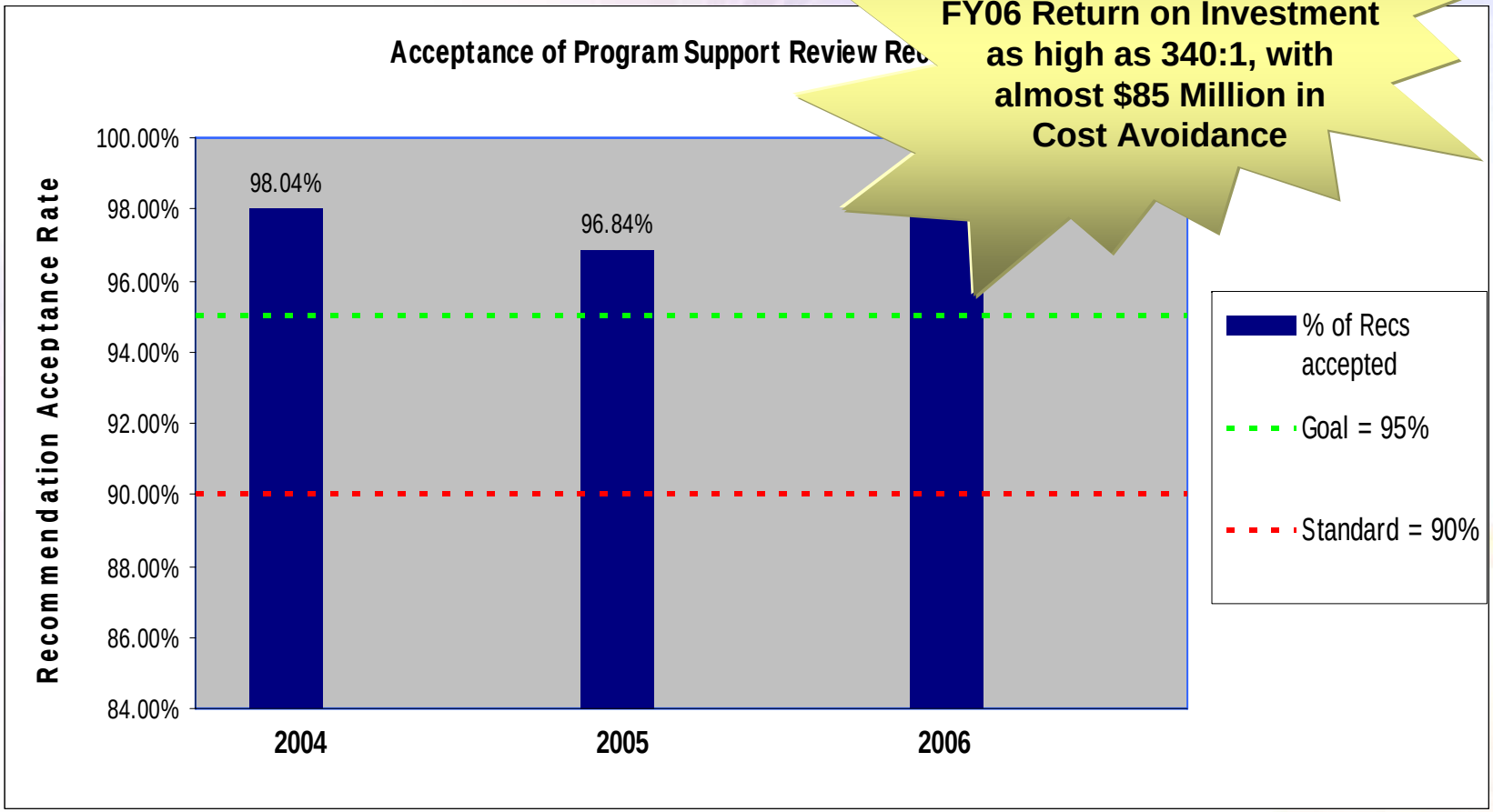
PSR Evaluation Areas
1. Mission Capabilities/ Requirements
2. Resources
3. Management
4. Technical Process
5. Technical Product
6. Environment

"…PSR team serves as 'disinterested 3rd party' that allows [the PM] to approach leadership armed with powerful program truths, reinforce issues." (PM)

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

PSR Effectiveness

FY06 Return on Investment as high as 340:1, with almost $85 Million in Cost Avoidance



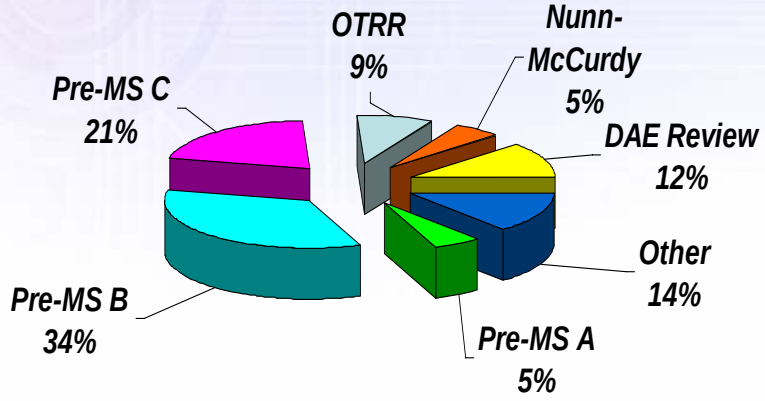
PSR Data Matrix and Coverage Record

Pre-Milestone B PSR Areas	Doc Rev?		Site Visit Review?		Known Findings (By PMO)						Recs Made?		Unknown Findings (By PMO)					Recs Made?		Syst Issues		Assignment
	Yes	No	Yes	No	Pos	Neut	Neg	Issue	Risk	Chg	Yes	Rej	Pos	Neg	Issue	Risk	Chg	Yes	Rej	Yes	No	
Totals:	18	35	53	0	20	28	16	11	23	2	36	4	1	15	20	35	1	37	4	55	0	
Grouped Totals:					75								36									
1.0 Mission Capabilities Assessment Area	2	3	5	0	8	2	2	8	6	0	7	0	0	1	4	5	0	4	0	11	0	
Sub-Area 1.1 – Mission Requirements	2	3	5	0	8	2	2	8	6	0	7	0	0	1	4	5	0	4	0	11	0	**Jim Alexander** Dick Scott Mike Zsak
Factor 1.1.1 – Reasonableness		x	x		4			1	1		1				1	1		1		2		
Factor 1.1.2 – Stability	x		x		1																	
Factor 1.1.3 – Interfaces		x	x		1			1	1		1									1		
Factor 1.1.4 – Interoperability / Net-readiness	x		x		1	2	2	2			2									2		
Factor 1.1.5 – Testability		x	x		1			4	4		3			1	3	4		3		6		
2.0 Resources Assessment Area	1	8	9	0	5	7	5	1	7	1	10	1	0	1	3	4	0	3	0	10	0	
Sub-Area 2.1 – Program Allocation	1	1	2	0	2	0	2	0	2	0	3	0	0	1	0	1	0	1	0	3	0	**Ron Dalton** Peter Lierni Andy Foote Robin Gulifer
Factor 2.1.1 – Sufficiency	x		x				2		2		3									2		
Factor 2.1.2 – Continuity/Stability		x	x		2									1		1		1		1		
Sub-Area 2.2 – Personnel	0	3	3	0	3	3	1	1	2	0	3	1	0	0	2	2	0	1	0	3	0	
Factor 2.2.1 – Qualifications		x	x		1	1		1	1		1	1								1		
Factor 2.2.2 – Staffing		x	x		1	1	1		1		1				2	2		1		2		
Factor 2.2.3 – Training		x	x		1	1					1											
Sub-Area 2.3 – Facilities	0	2	2	0	0	2	1	0	2	1	2	0	0	0	0	0	0	0	0	2	0	
Factor 2.3.1 – Equipment		x	x			2			1	1	1									1		
Factor 2.3.2 – Infrastructure		x	x				1		1		1									1		
Sub-Area 2.4 – Engineering Tools	0	2	2	0	0	2	1	0	1	0	2	0	0	0	1	1	0	1	0	2	0	
Factor 2.4.1 – Systems Engineering Tools		x	x			2					1											
Factor 2.4.2 – Modeling & Simulation Tools		x	x				1		1		1				1	1		1		2		
3.0 Management Assessment Area	5	11	16	0	2	6	6	1	6	1	10	2	1	4	7	11	0	12	3	15	0	
Sub-Area 3.1 – Acquisition Strategy/Process	1	1	2	0	2	2	2	1	2	0	3	0	0	0	1	1	0	2	0	3	0	**Jim Schultz** Dick Scott Peter Lierni Mike Zsak
Factor 3.1.1 – Acceptability		x	x			2	2		2		2									2		
Factor 3.1.2 – Feasibility	x		x		2			1			1				1	1		2		1		
Sub-Area 3.2 – Planning	0	3	3	0	0	0	1	0	1	0	1	0	0	1	0	1	0	1	0	2	0	
Factor 3.2.1 – Schedule		x	x				1		1		1									1		
Factor 3.2.2 – Feasibility		x	x																			
Factor 3.2.3 – Suitability		x	x											1		1		1		1		

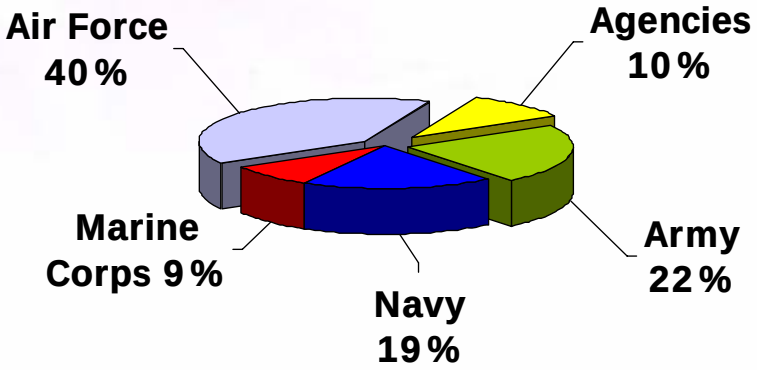
Program Support Review Activity

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

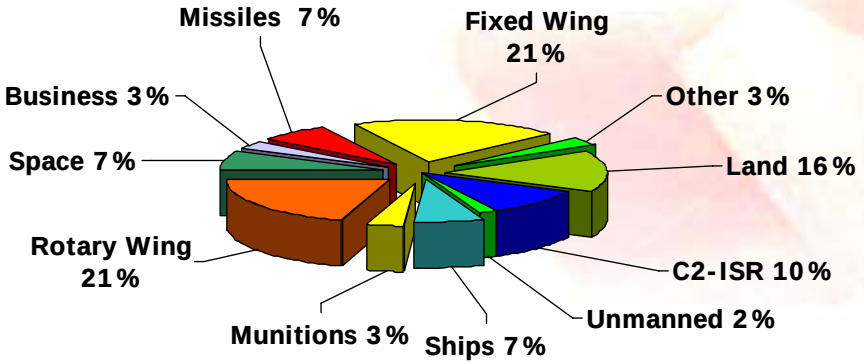
Decision Support Reviews



Service-Managed Acquisitions



Programs by Domain Area



“Quotable Quotes” from Program Reviews

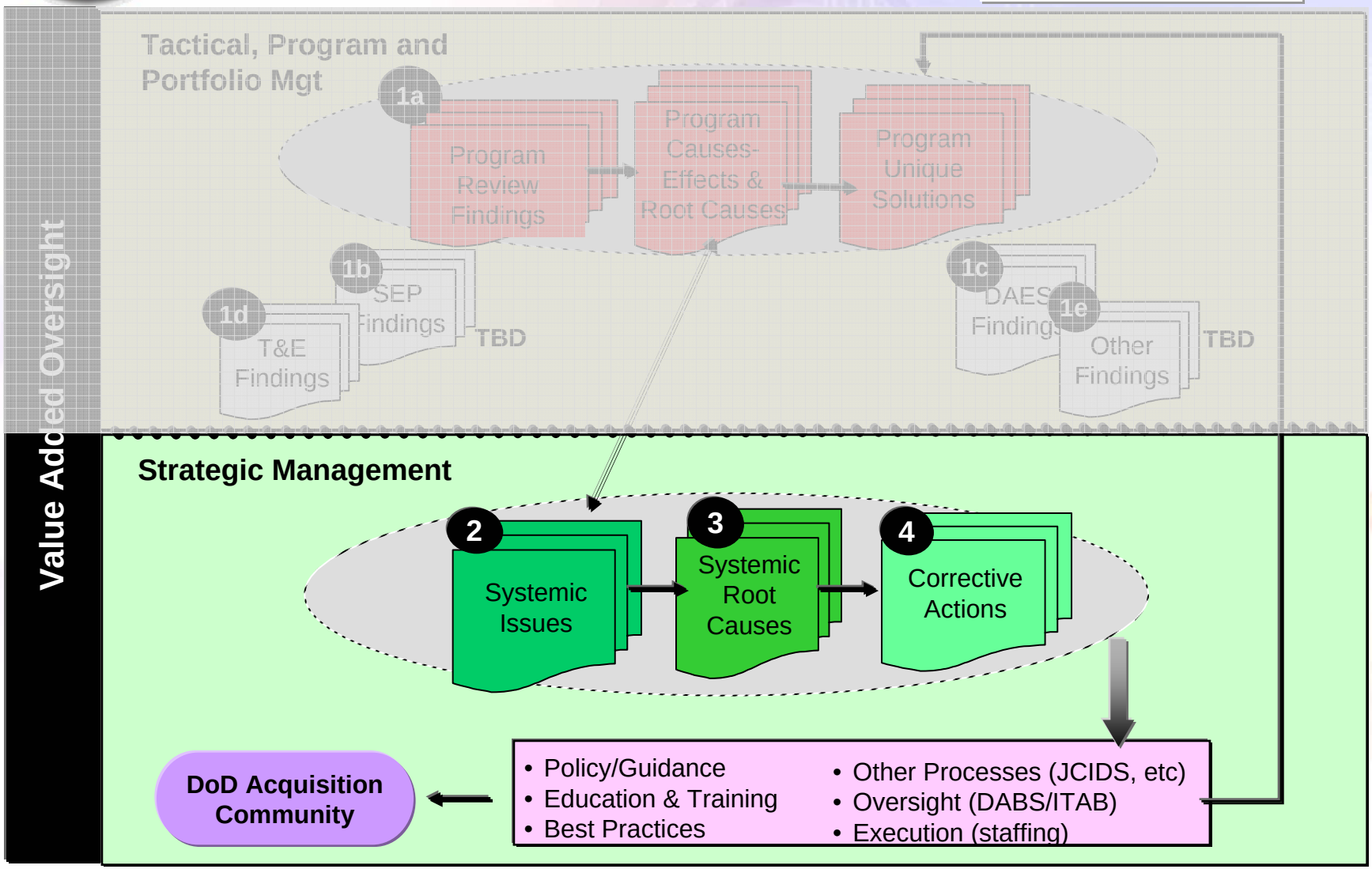
- Management…
  - “Decisions that should take a week, took a year…”
  - “They were the Romulans, but now we are working with them…”
  - “Often an issue is gone before getting through the process…”
  - “Perfection is the enemy of good enough…”
  - “We tried to co-locate, but it was just too hard…”
  -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

“Quotable Quotes” from Program Reviews

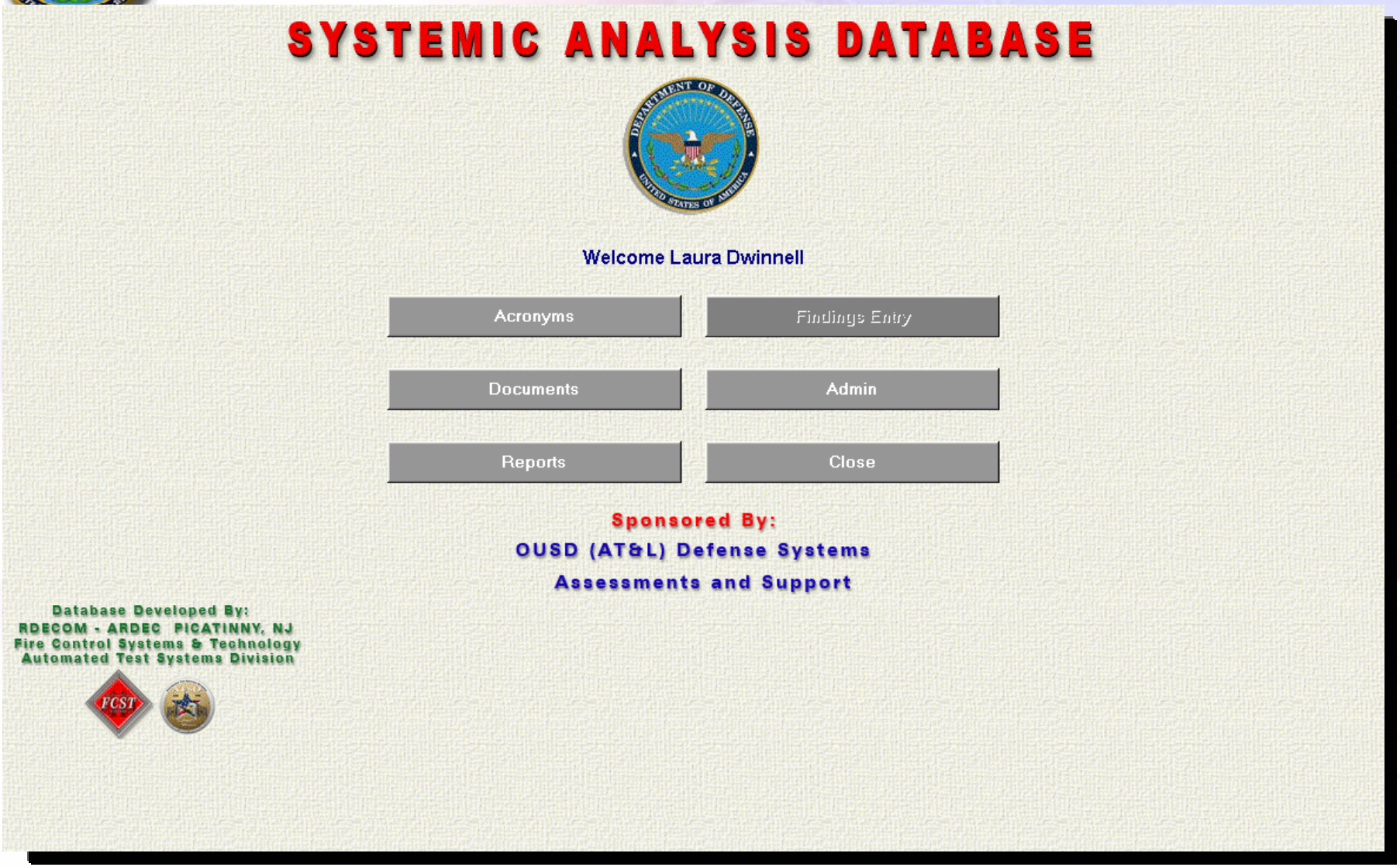
- Process…
  - “Death by a thousand cuts…”
  - “It’s OK to be different…”
  - “We thought that would be good enough”
  - “I wouldn’t do it this way again…”
  - “…we allow that, but strongly discourage it…”
  - “…we’re not going to tell them about all of our test cases”
  - “That doesn’t mean what you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

Systemic Analysis: Data Model

Steps 1A, 2-4 Underway

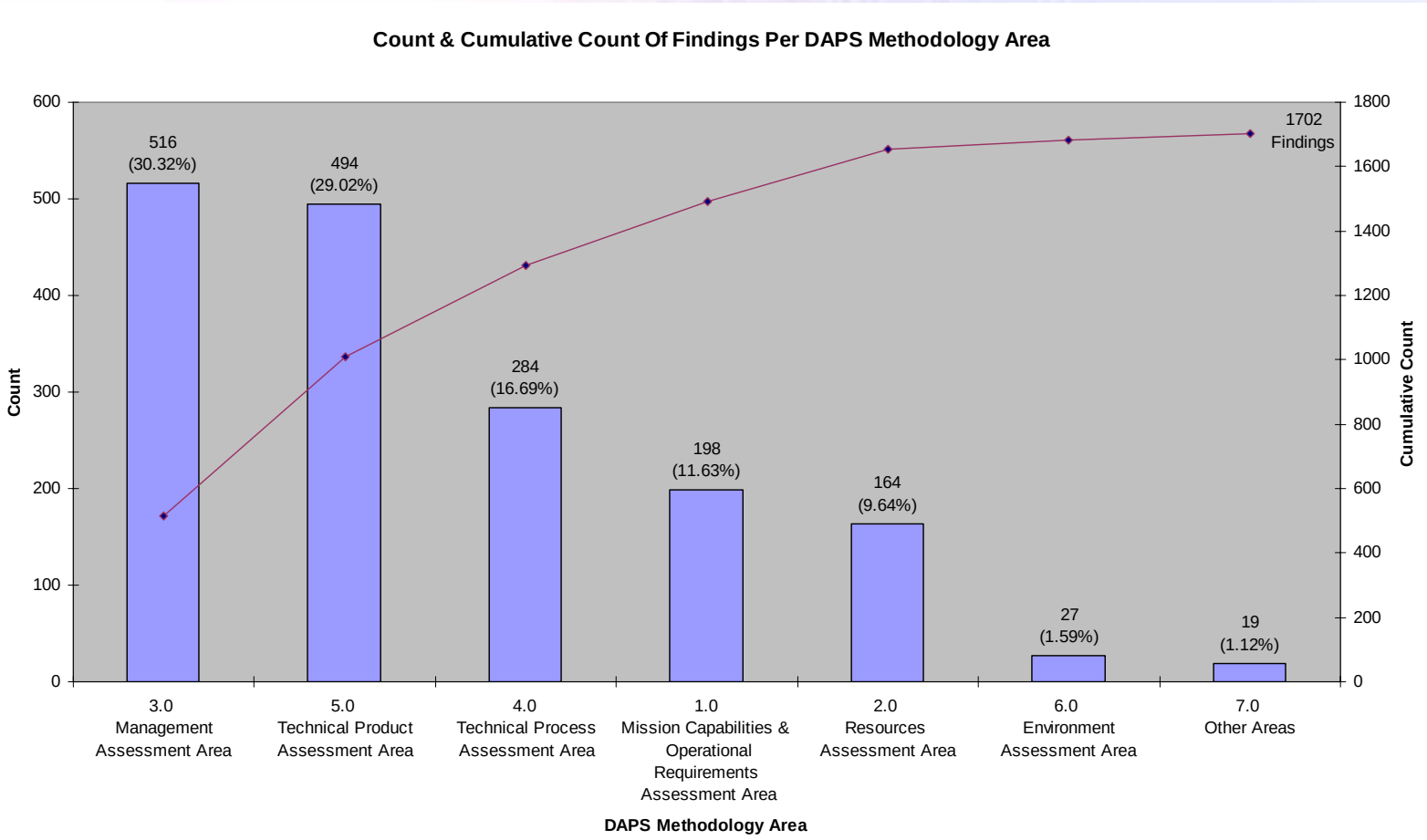


Systemic Analysis Database



Data Demographics

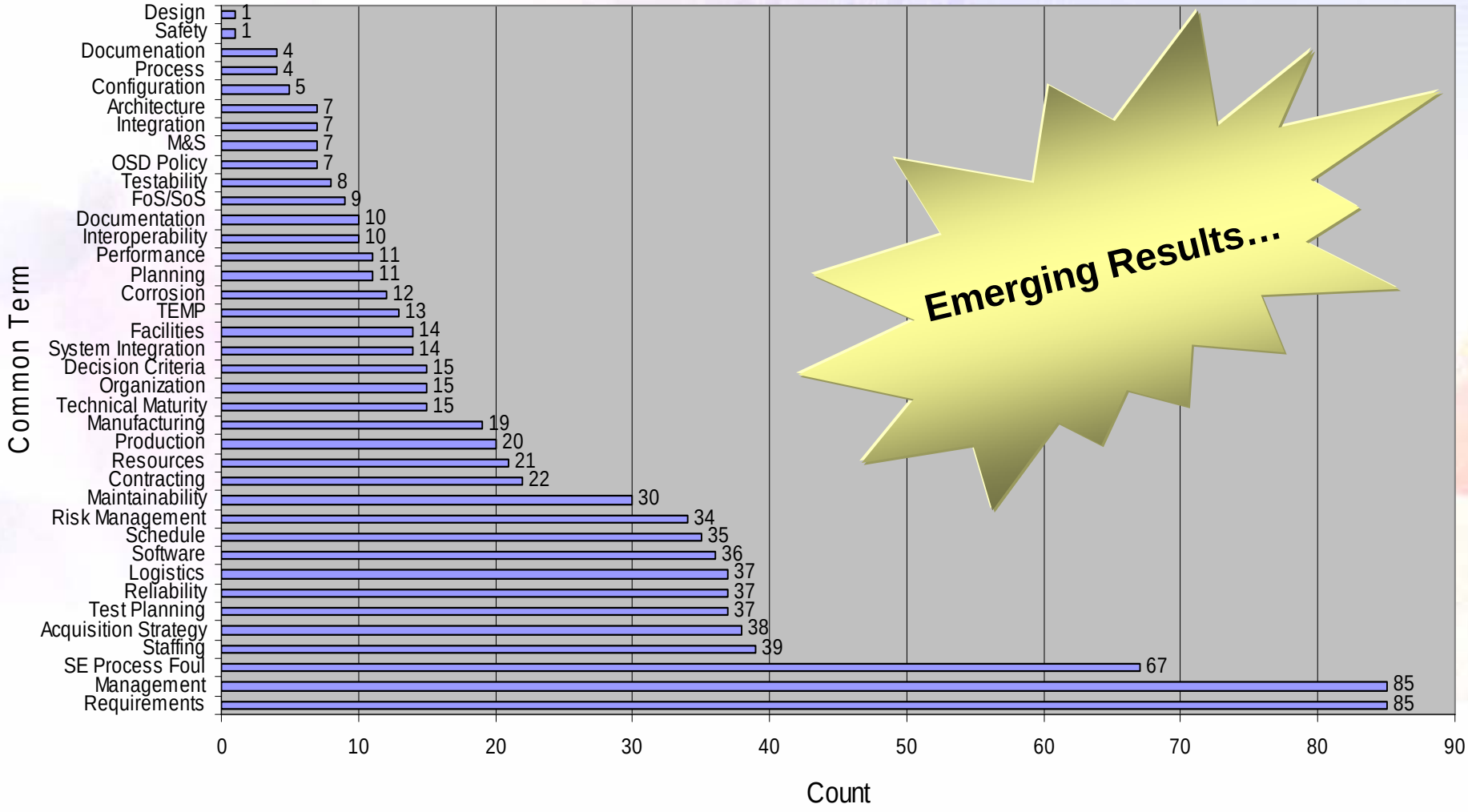
- Database contains 1701 findings from 29 programs to date
- Reviews conducted between 7/21/03 – 6/27/06



Categorization of Findings

Count Of Findings Per "Common Term"

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



Top 10 Emerging Systemic Issues (1-5)

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

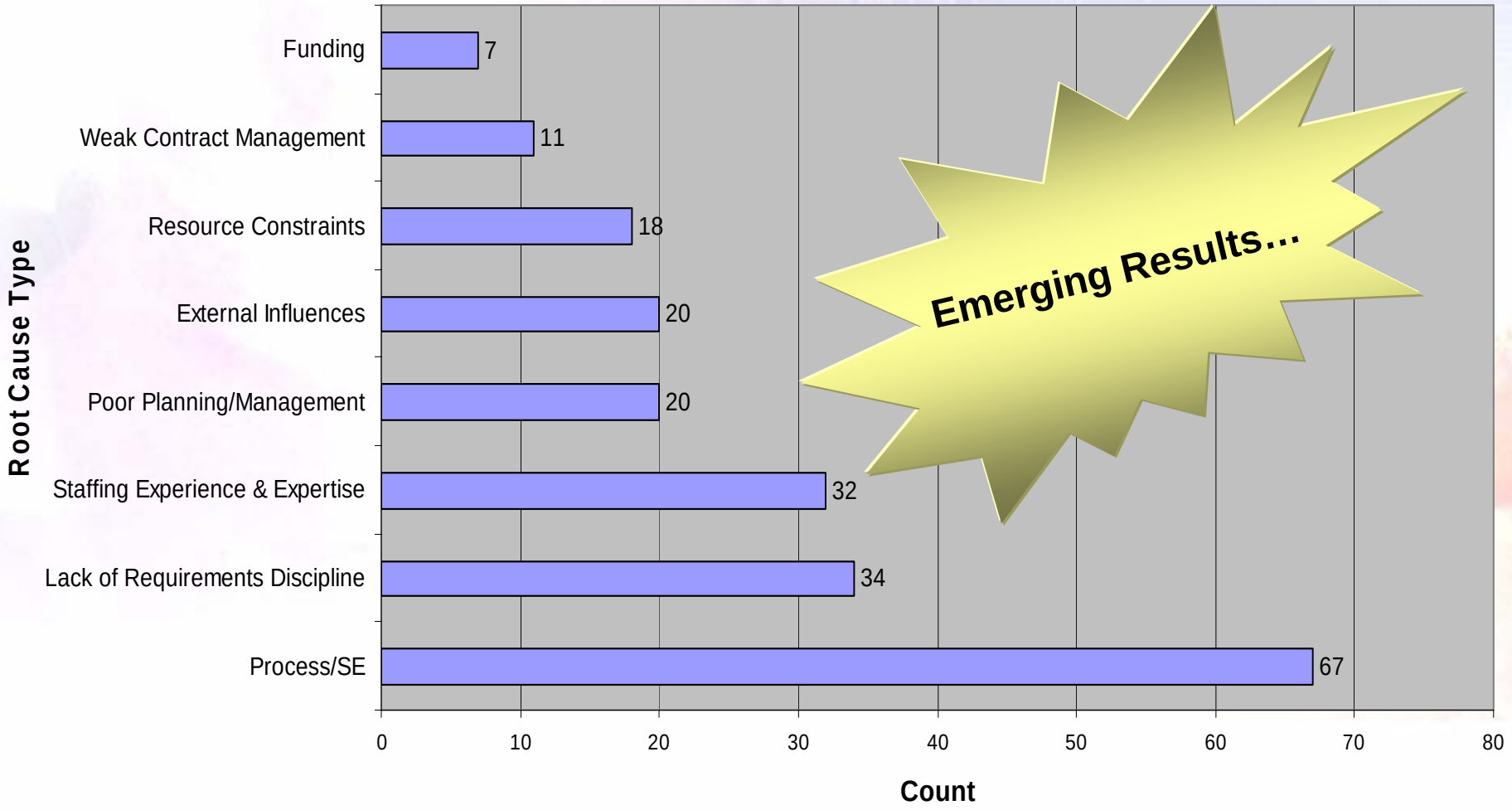
Top 10 Emerging Systemic Issues (6-10)

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

Root Cause Categorization

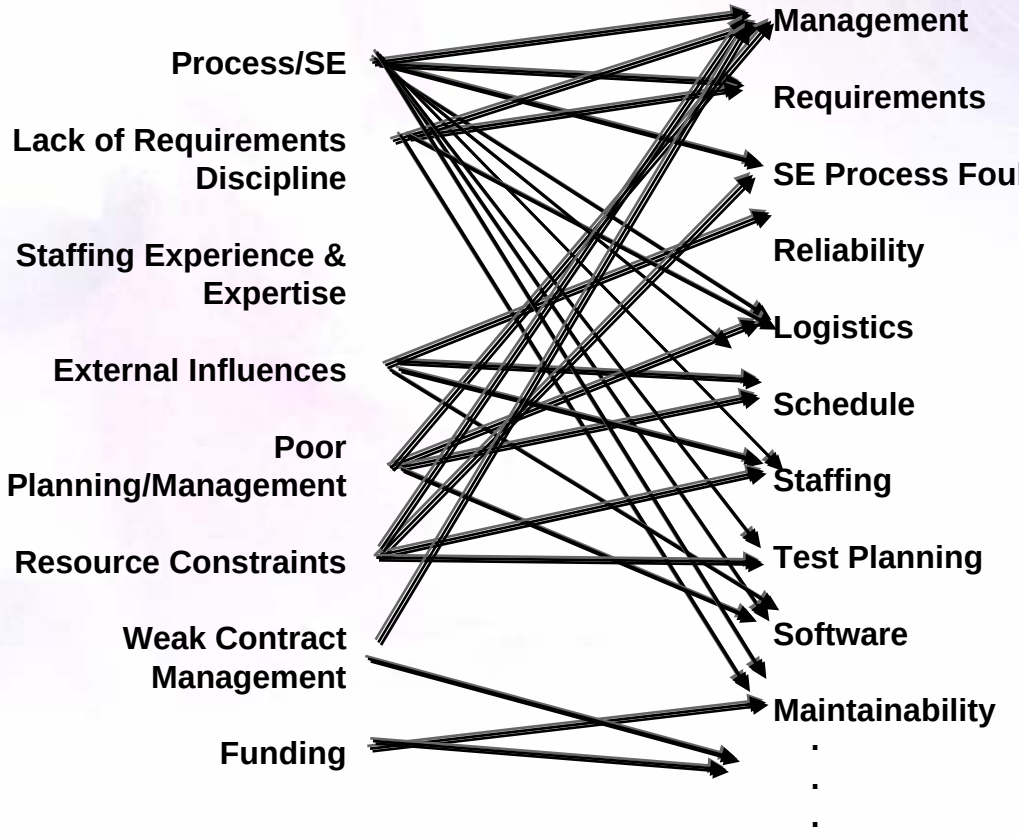
Count Of Findings Per Root Cause Type

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



Root Cause Effects

Root Cause → **Common Findings** → **Impact**



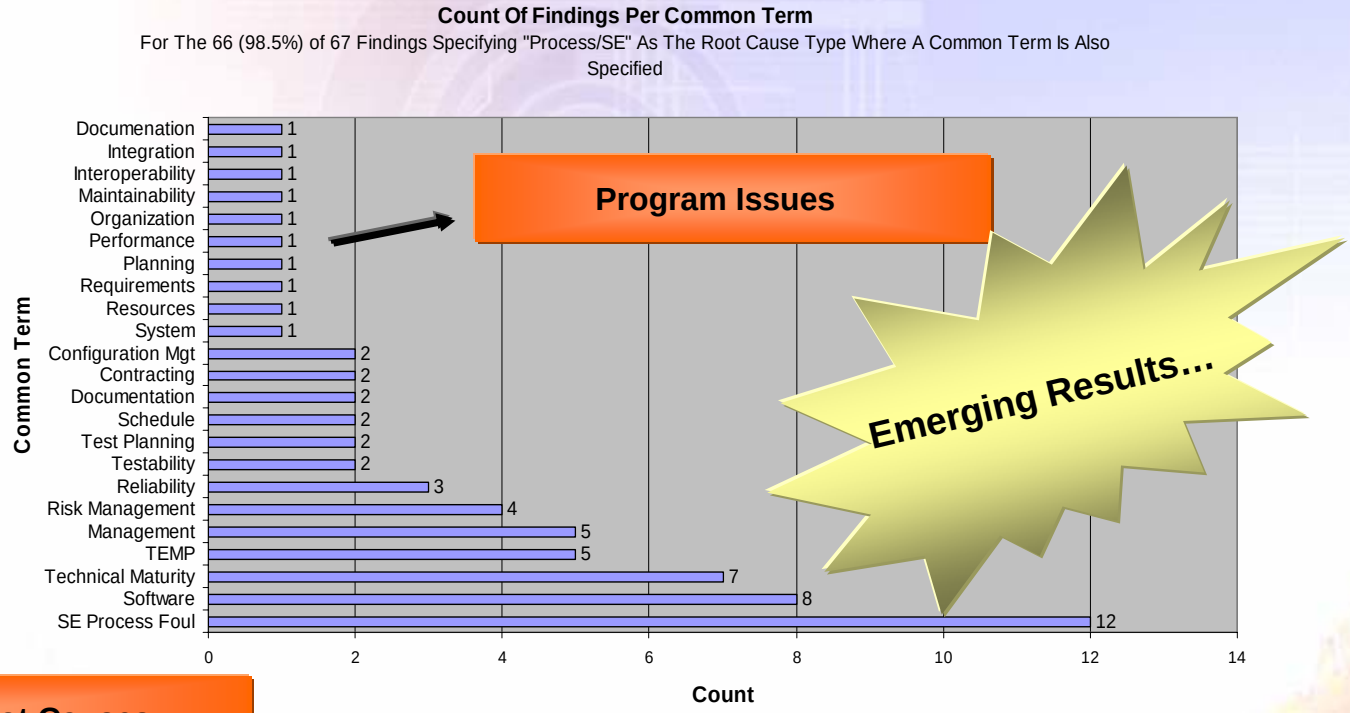
- Increased program execution risk
- Potential schedule and cost breach
- Shared engineering functions not given proper attention
- Rework
- Insufficient system performance information to make informed milestone decision
- Potential for lower readiness levels and higher maintainer workload
- Etc…

Root causes impact programs in "shotgun" style

Root Cause: Process/Systems Engineering

Root Cause

Process/ Systems Engineering



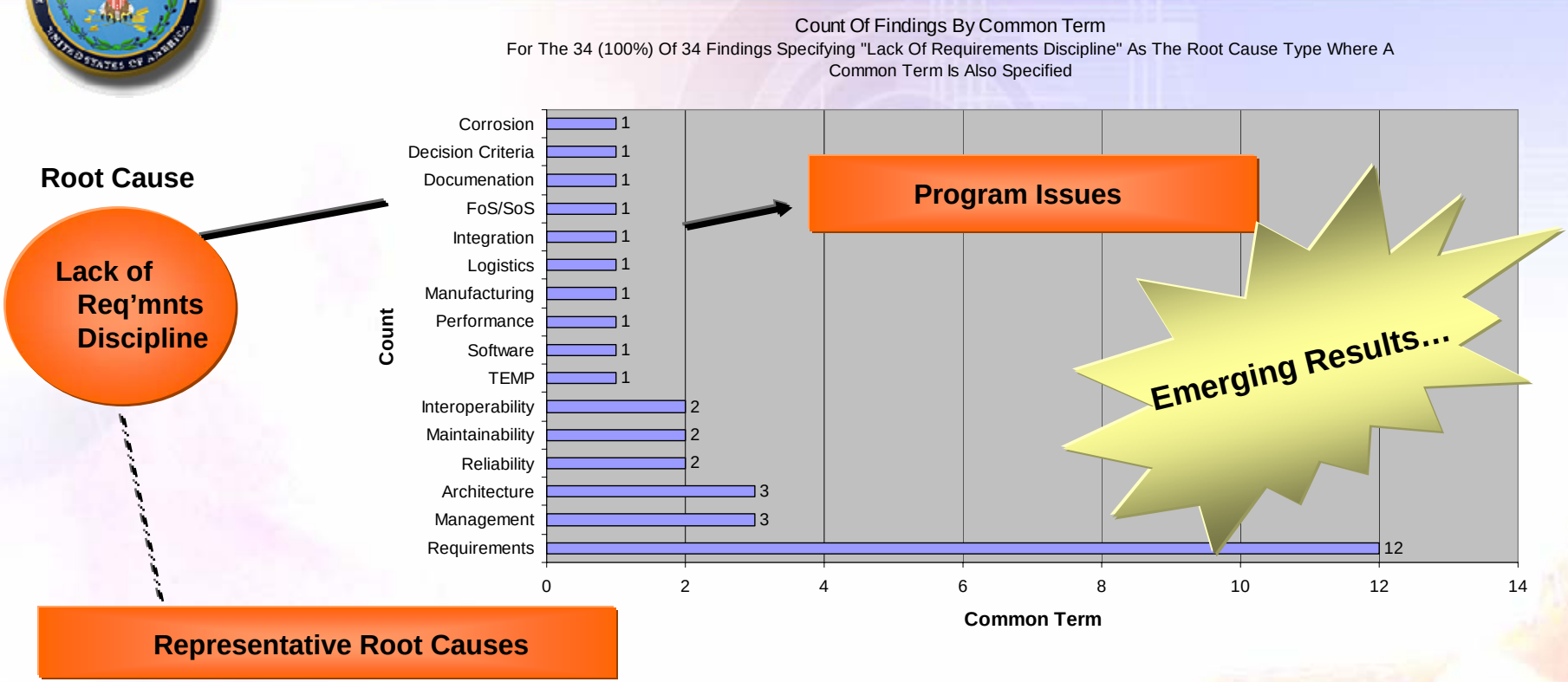
Program Issues

Emerging Results…

Representative Root Causes

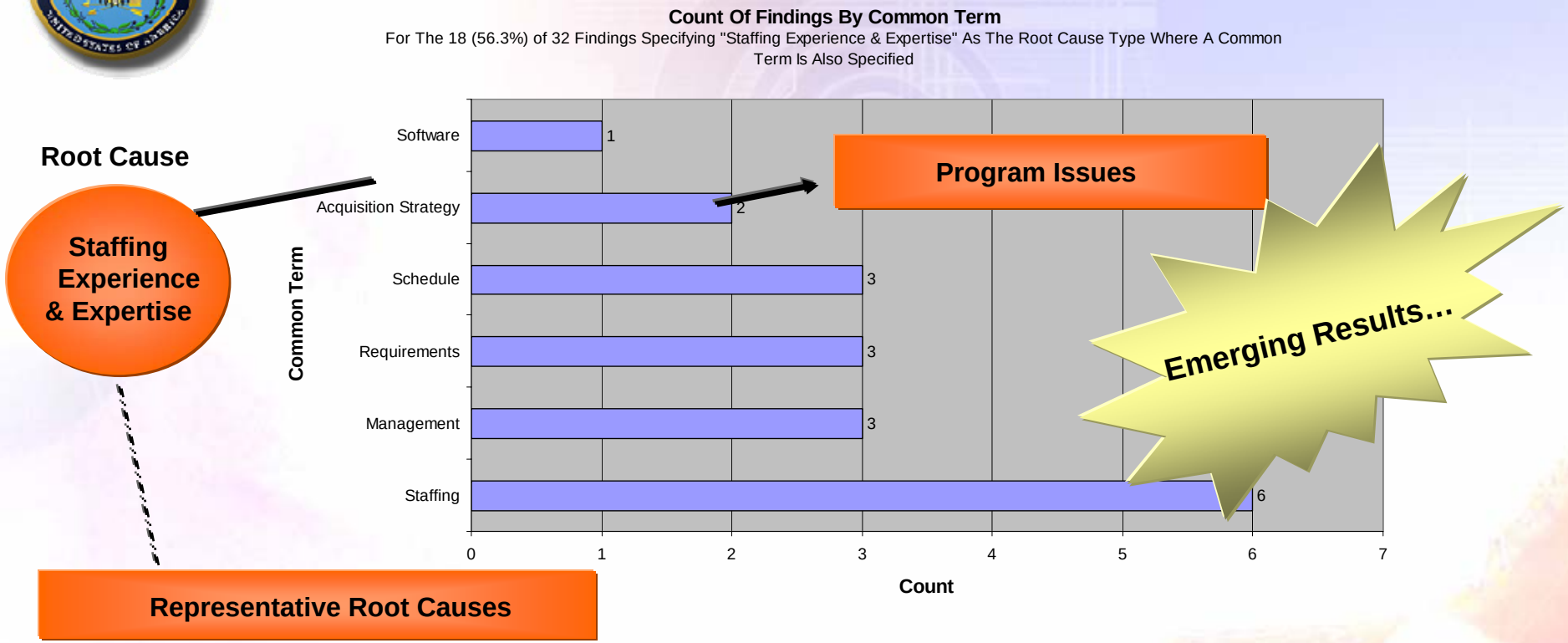
- Lack of a rigorous SE approach
- Lack of emphasis on software architecture when defining software requirements
- Failure to identify and address risk of program dependencies tied to requirements
- Risk management not delegated down to IPTs and sub contractor levels
- Inadequate test environments, program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

Root Cause: Requirements Discipline



- **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



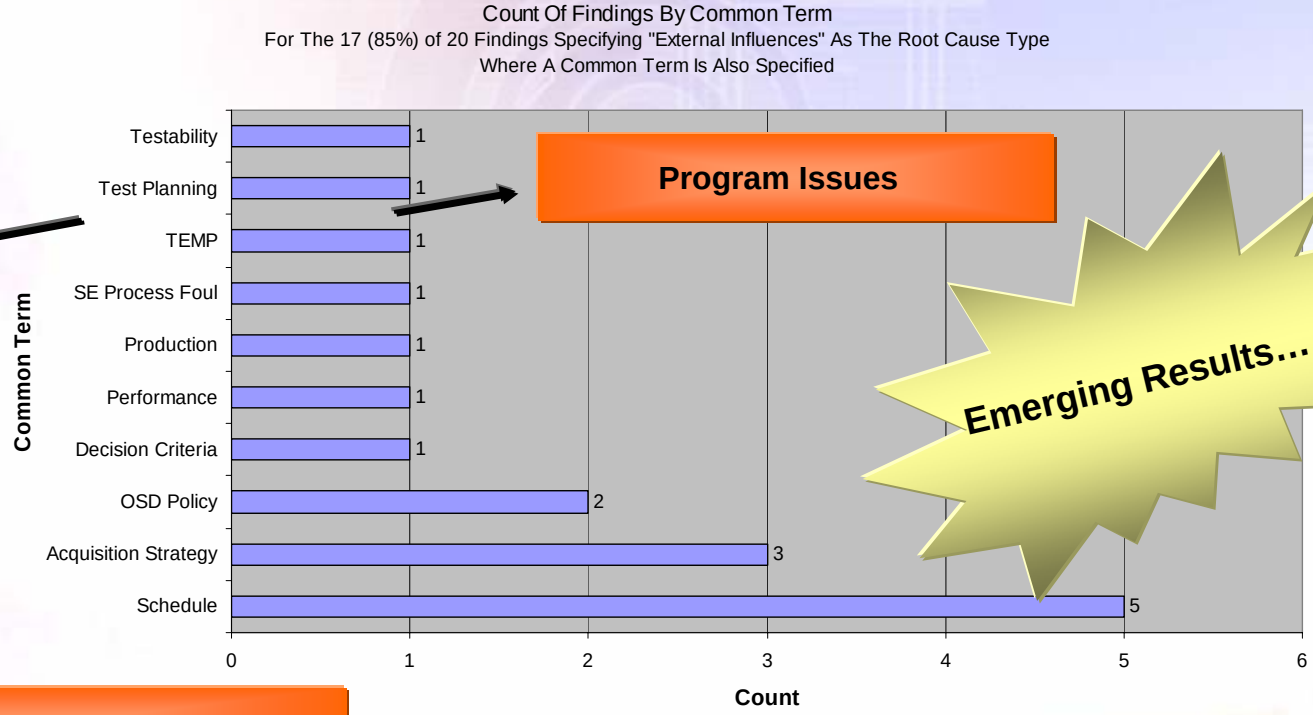
- PEO living within constrained personnel allocation system
- Failure to recognize value of cross-functional IPTs and gov't matrix support
- PM's over-reliance on Industry to define technical solutions, often proprietary/NDI
- Lack of appreciation for, and value added of technical reviews
- Limited staff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

Root Cause: External Influences

Root Cause

External Influences

Representative Root Causes

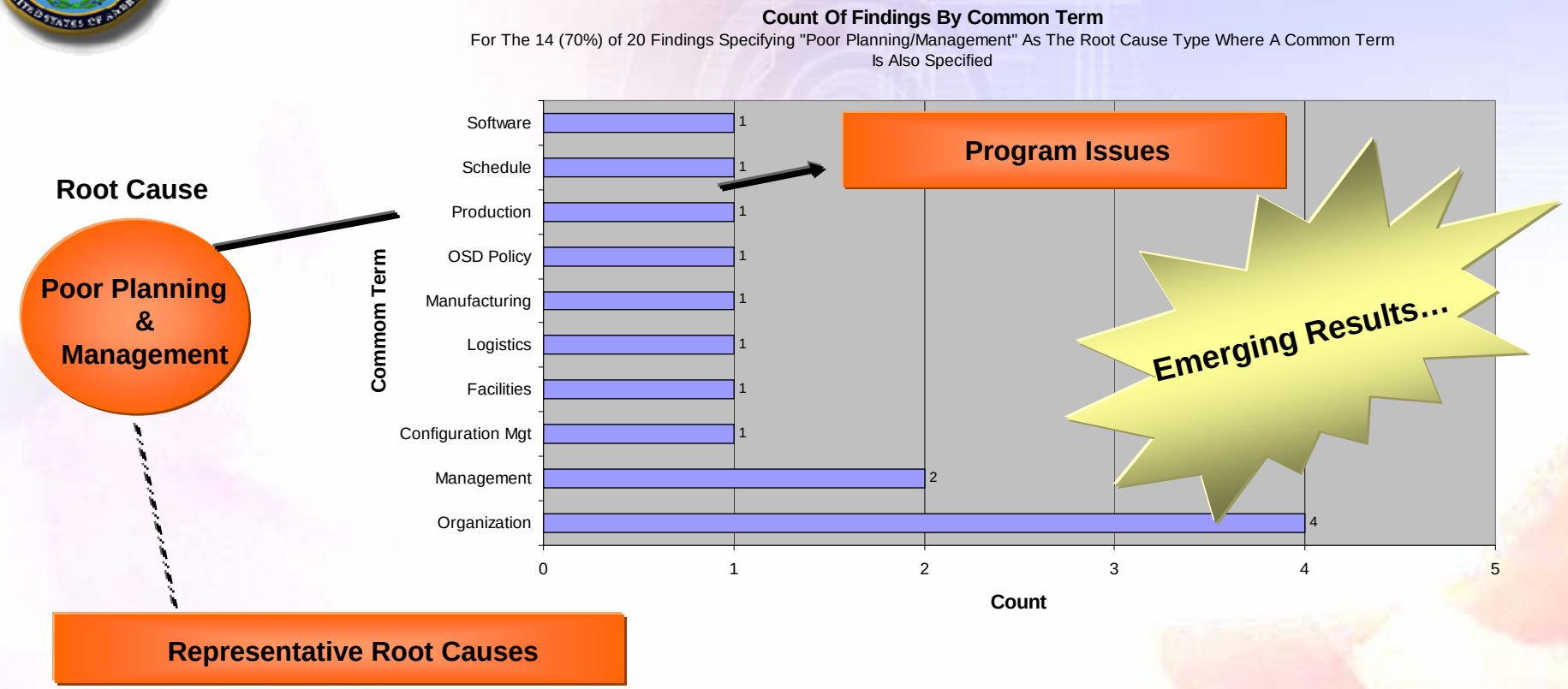


Program Issues

Emerging Results…

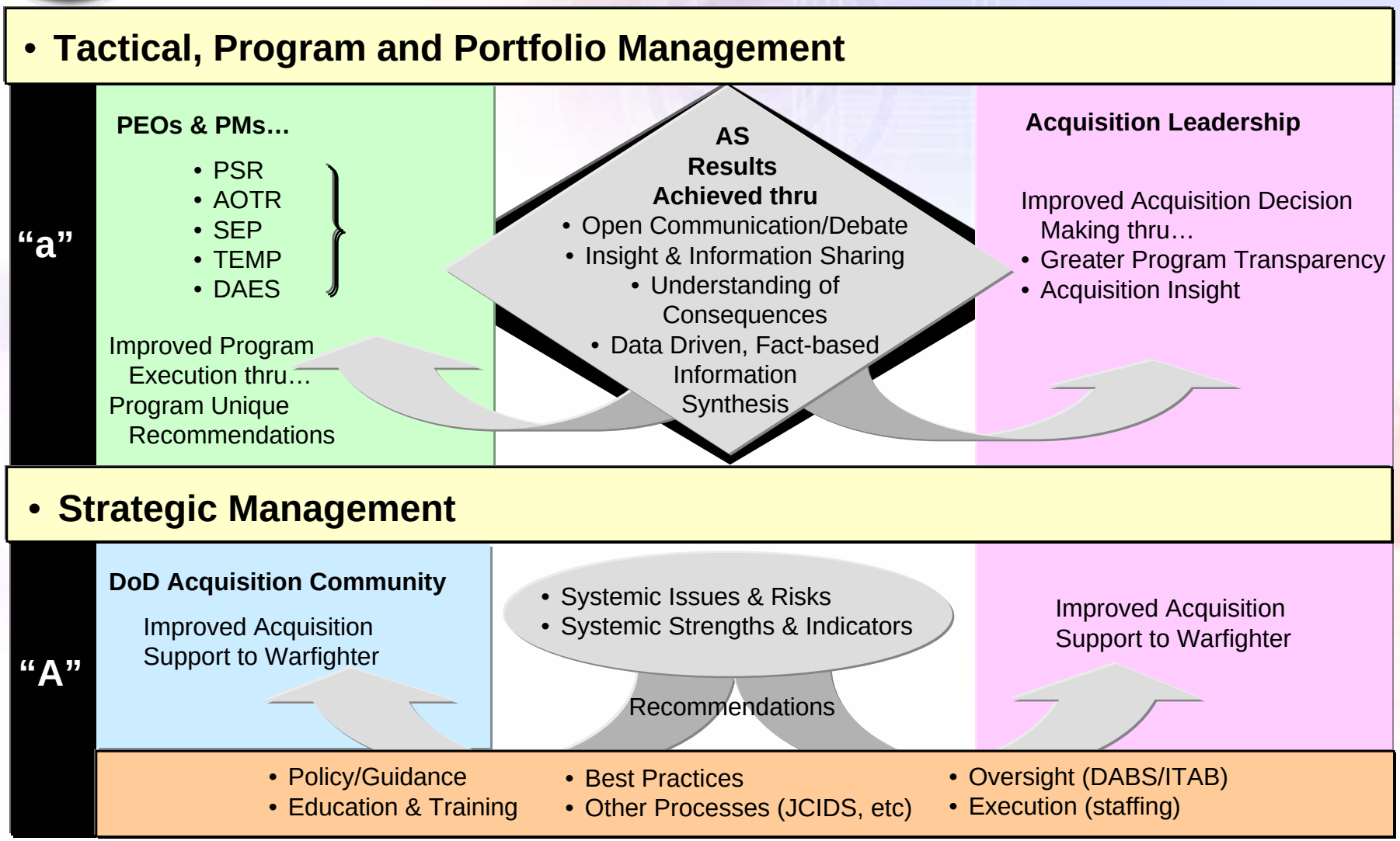
- End date dictated by customer need, driving unrealistic schedules
- Commercial use of “band systems” takes priority over military use due to profitability
- Urgency to replace aging equipment by procuring short-term NDI solution at expense of long-term requirements

Root Cause: Poor Planning/Management

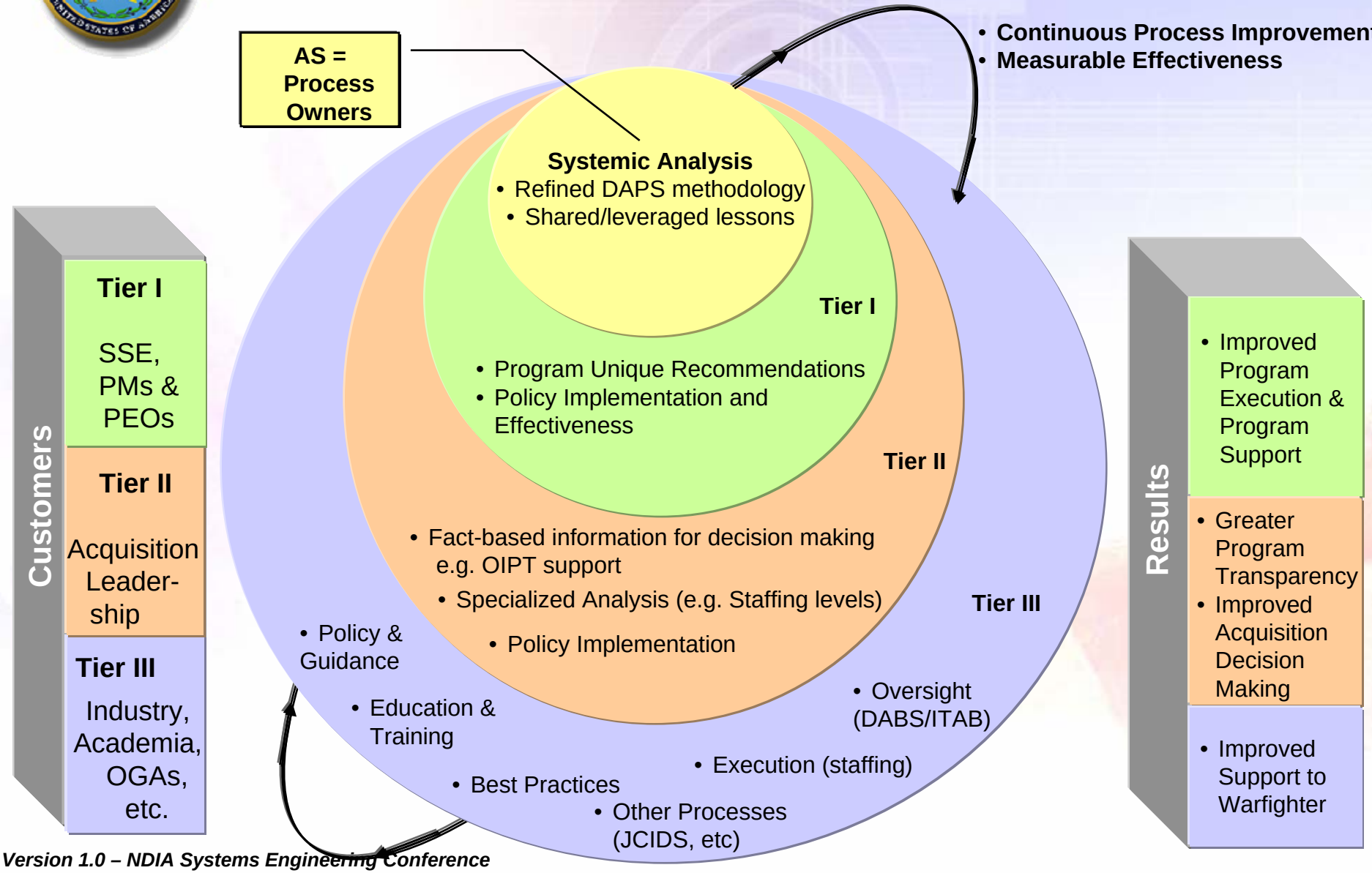


- **Absence of critical path analysis**
- **Erroneous assumption that prime would do pre-award integration**
- **IPT Charters are low priority due to staffing and time constraints**
- **Lack of trust, collaboration and communication: unwillingness to share information**
- **Contractor proprietary info**

Providing Value Added Oversight & Support



Systemic Analysis – Customer Model



Emerging Customer Products…

Assessments & Support

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 "got

Continuous Improve
&
Measurable Effectiv

- Improved DAPS Methodology
- Earlier support to programs
- Metrics and performance tracking
- Lean/Six Sigma application
- Customer feedback
  - ❑ PM Survey
  - ❑ % Recommendations Accepted

External

Tier III: Acq Commu-nity

- Risk Management Guide
- CLM on Tech Reviews
- Contracting for SE Guid
- Mandator sions

ole flow down to
ACAT IC and below
r Force st to pilot

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

Work In Progress

Questions/Discussion

Contact Information:

Dave Castellano
ODUSD(A&T) Systems & Software Engineering
Deputy Director, Assessments and Support
David.Castellano@osd.mil

Laura Dwinnell
SSE/AS Support
Systemic Analysis Team Lead
LDwinnell@fasi.com