Program Support: Perspectives on Technical Planning and Execution

Dave Castellano

Deputy Director, Systems Engineering

DEFENSE SYSTEMS
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Top Five Systems Engineering Issues*

- Lack of awareness of the importance, value, timing, accountability, and organizational structure of SE on programs
- Adequate, qualified resources are generally not available within government and industry for allocation on major programs
- Insufficient SE tools and environments to effectively execute SE on programs
- Requirements definition, development, and management is not applied consistently and effectively
- Poor initial program formulation

* Based on an NDIA Study in January 2003

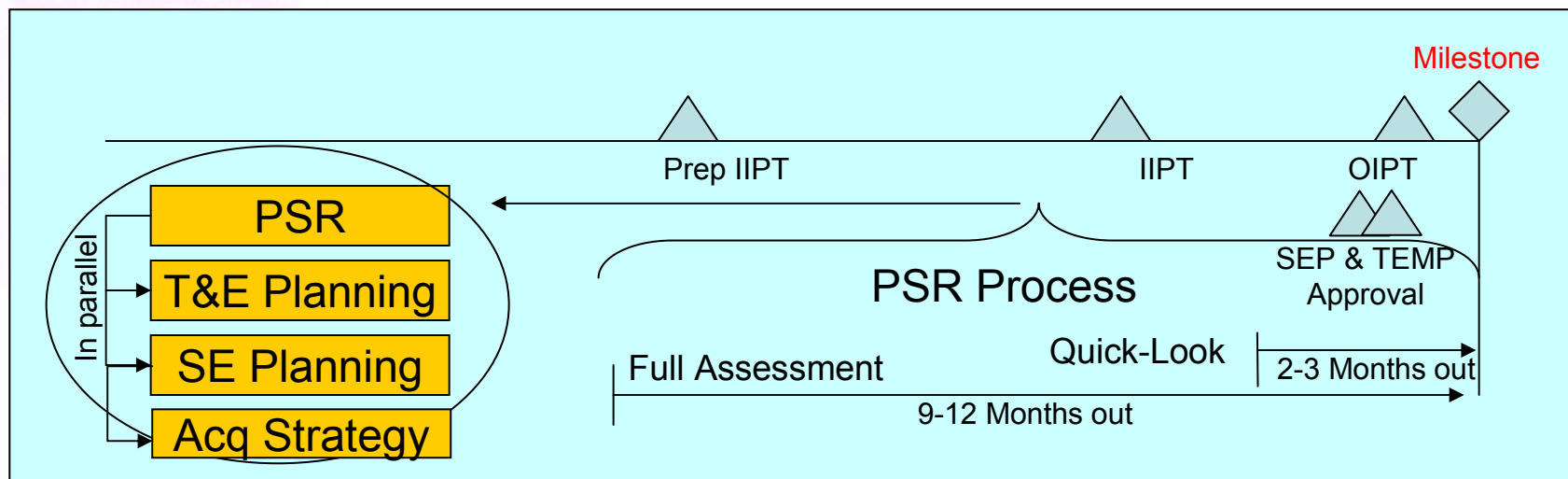# Recap: What We Have Done To Revitalize Systems Engineering

- Issued Systems Engineering (SE) policy
- Issued guidance on SE and Test & Evaluation (T&E)
- Integrating Developmental T&E with SE policy and assessment functions – focused on effective, early engagement of both
- Instituted system-level assessments in support of OSD major acquisition program oversight role
- Established SE Forum – senior-level focus within DoD
- Working with Defense Acquisition University to revise SE, T&E, and enabling career fields curricula
- Leveraging close working relationships with industry and academia

Necessary but not sufficient!

General Approach: Program Outreach Review Products

- Full reviews conducted 9-12 months before Milestone
  - Detailed findings, risks & actionable recommendations
  - Conducted in "PM support" vice "OSD oversight" mode
- "Quick-Look" reviews conducted 2-3 months before Milestone
  - Same form and formats as full assessment; conducted "for record" review
- Quarterly Defense Acquisition Executive Summary (DAES) assessments inputs
- Test & Evaluation Master Plan (TEMP) and Systems Engineering Plan (SEP) development and approval

In parallel:
- PSR
- T&E Planning
- SE Planning
- Acq Strategy

Prep IIPT — IIPT — OIPT — Milestone

PSR Process

SEP & TEMP Approval

Full Assessment — Quick-Look

9-12 Months out — 2-3 Months out

Systems Engineering Plans

DoD Systems Engineering Shortfalls*

- Common failures on acquisition programs include:
  - Inadequate understanding of requirements
  - Lack of systems engineering discipline, authority, and resources
  - Lack of technical planning and oversight
  - Stovepipe developments with late integration
  - Lack of subject matter expertise at the integration level
  - Availability of systems integration facilities
  - Incomplete, obsolete, or inflexible architectures
  - Low visibility of software risk
  - Technology maturity overestimated
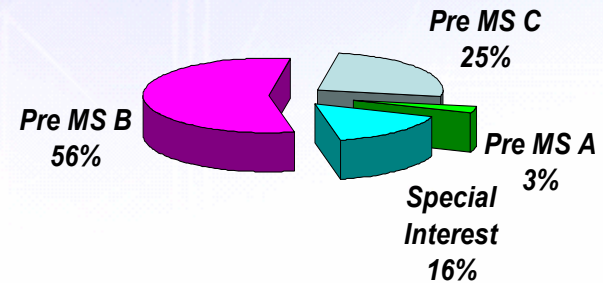
Major contributors to poor program performance

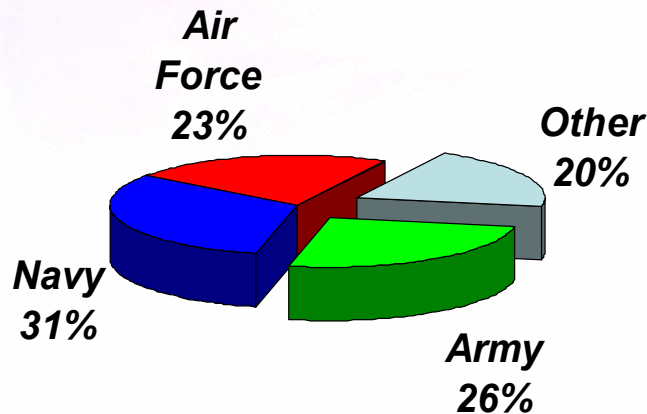* Findings from PSRs and DoD-directed Studies/Reviews

Systems Engineering Plan Activity
(since November 2004)

- Number of SEPs reviewed: 59

- Programs submitting SEPs: 36
  - Number of SEPs approved: 8
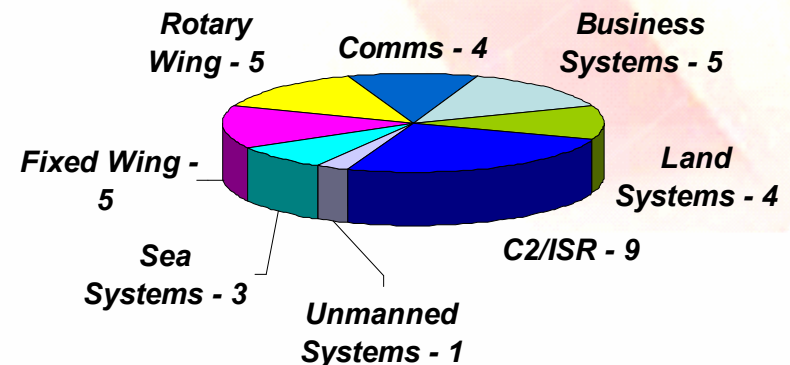 - Number of SEPs pending: 5

- Reviews planned for rest of FY06: 103

SEP Program Milestones

- Pre MS C 25%
- Pre MS B 56%
- Pre MS A 3%
- Special Interest 16%

Component-Managed Acquisitions

- Air Force 23%
- Other 20%
- Navy 31%
- Army 26%

Programs by Product Line

- Rotary Wing - 5
- Comms - 4
- Business Systems - 5
- Fixed Wing - 5
- Land Systems - 4
- Sea Systems - 3
- Unmanned Systems - 1
- C2/ISR - 9

Emerging SEP Comments**
(not systemic across all programs)

Integration with Overall Management of Program 23%

Program Requirements 18%

Technical Staffing and Organizational Planning 18%

Technical Baseline Management Planning 17%

Technical Review Planning 24%
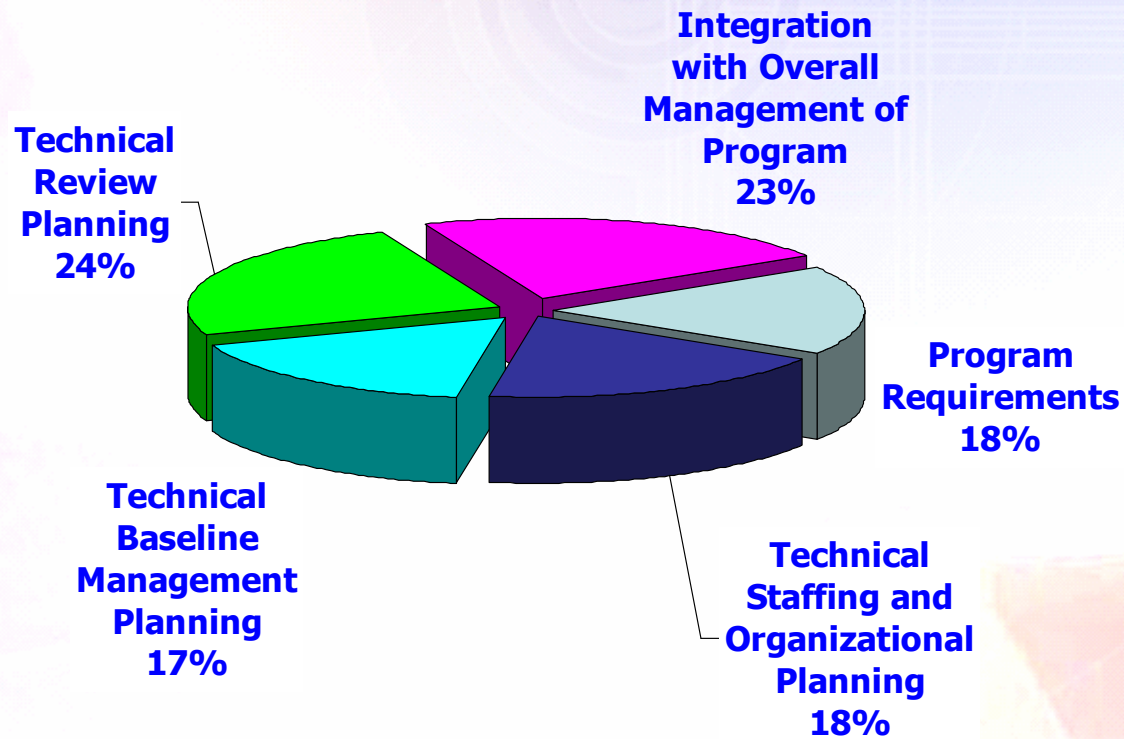
**BASED ON ANALYSIS OF 27 OUT OF 39 PROGRAMS

Program Support

General Review Areas

ASSESSMENT METHODOLOGY FOR PRE-MILESTONE C

1.0	Mission Capabilities/Requirements Assessment Area	4
	Sub-Area 1.1 – Operational Requirements	4
2.0		
3.0		
4.0		
5.0		
6.0		

ASSESSMENT METHODOLOGY FOR PRE-MILESTONE B

1.0	Mission Capabilities/Requirements Assessment Area	4
	Sub-Area 1.1 – Operational Requirements	4
2.0		
3.0		
4.0		
5.0		
6.0		

ASSESSMENT METHODOLOGY FOR PRE-MILESTONE A

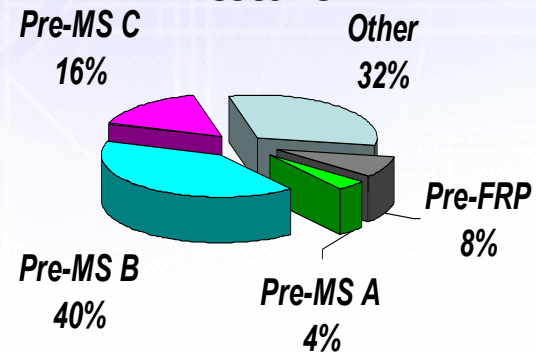|		
1.0	Mission Capabilities/Requirements Assessment Area	4
	Sub-Area 1.1 – Operational Requirements	4
2.0	Resources Assessment Area	9
	Sub-Area 2.1 – Program Planning and Allocation	9
	Sub-Area 2.2 – Personnel	10
	Sub-Area 2.3 – Facilities	12
	Sub-Area 2.4 – Engineering Tools	13
3.0	Management Assessment Area	16
	Sub-Area 3.1 – Acquisition Strategy/Process	16
	Sub-Area 3.2 – Project Planning	19
	Sub-Area 3.3 – Program and Project Management	21
	Sub-Area 3.4 – Contracting and Subcontracting	26
	Sub-Area 3.5 – Communication	28
4.0	Technical Process Assessment Area	30
	Sub-Area 4.1 – Technology Assessment and Transition	30
	Sub-Area 4.2 – Requirements Development	31
	Sub-Area 4.3 – Functional Analysis & Allocation	32
	Sub-Area 4.4 – Design Synthesis	33
	Sub-Area 4.5 – System Integration, Test and Verification	35
	Sub-Area 4.6 – Transition to Deployment	37
	Sub-Area 4.7 – Process Improvement	38
5.0	Technical Product Assessment Area	38
	Sub-Area 5.1 – System Description	38
	Sub-Area 5.2 – System Performance	42
	Sub-Area 5.3 – System Attributes	43
6.0	Environment Assessment Area	44
	Sub-Area 6.1 – Statutory and Regulatory Environment	45

http://www.acq.osd.mil/ds/se

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Program Support Review Activity
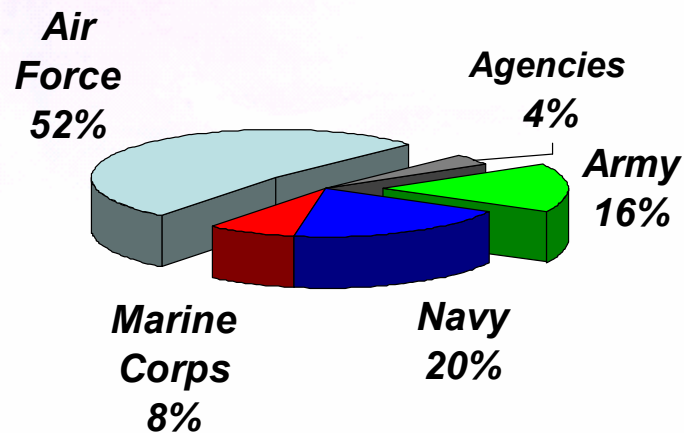## (since March 2004)

- Number of PSRs completed: 25
- Number of AOTRs completed: 4

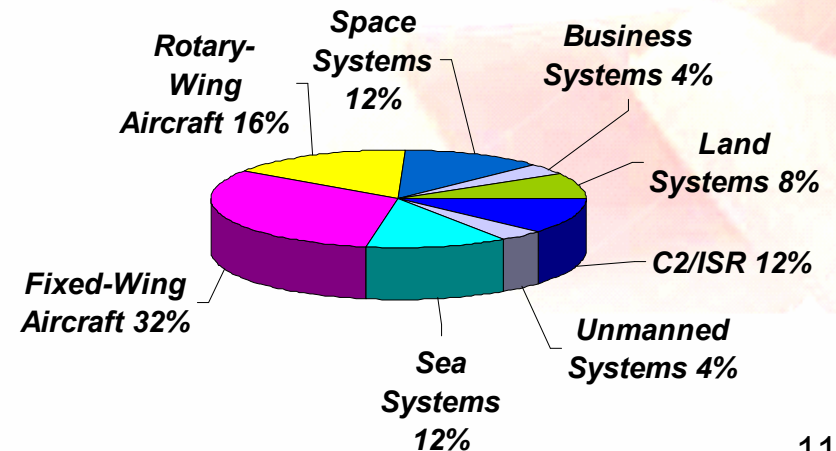- Reviews planned for rest of FY06
  - PSRs: at least 24
  - AOTRs: 2

Reviews Conducted Prior to Each Milestone

- Pre-MS C 16%
- Other 32%
- Pre-FRP 8%
- Pre-MS A 4%
- Pre-MS B 40%

Service-Managed Acquisitions

- Air Force 52%
- Agencies 4%
- Army 16%
- Navy 20%
- Marine Corps 8%

Programs by Product Line

- Rotary-Wing Aircraft 16%
- Space Systems 12%
- Business Systems 4%
- Land Systems 8%
- C2/ISR 12%
- Unmanned Systems 4%
- Sea Systems 12%
- Fixed-Wing Aircraft 32%

- Experienced and dedicated program office teams
- Strong teaming between prime contractors, sub-contractors, program offices and engineering support
- Use of well defined and disciplined SE processes
- Proactive use of independent review teams
- Successful management of external interfaces
- Corporate commitment to process improvement
- Appropriate focus on performance-based logistics
- Notable manufacturing processes
- Focus on DoD initiatives
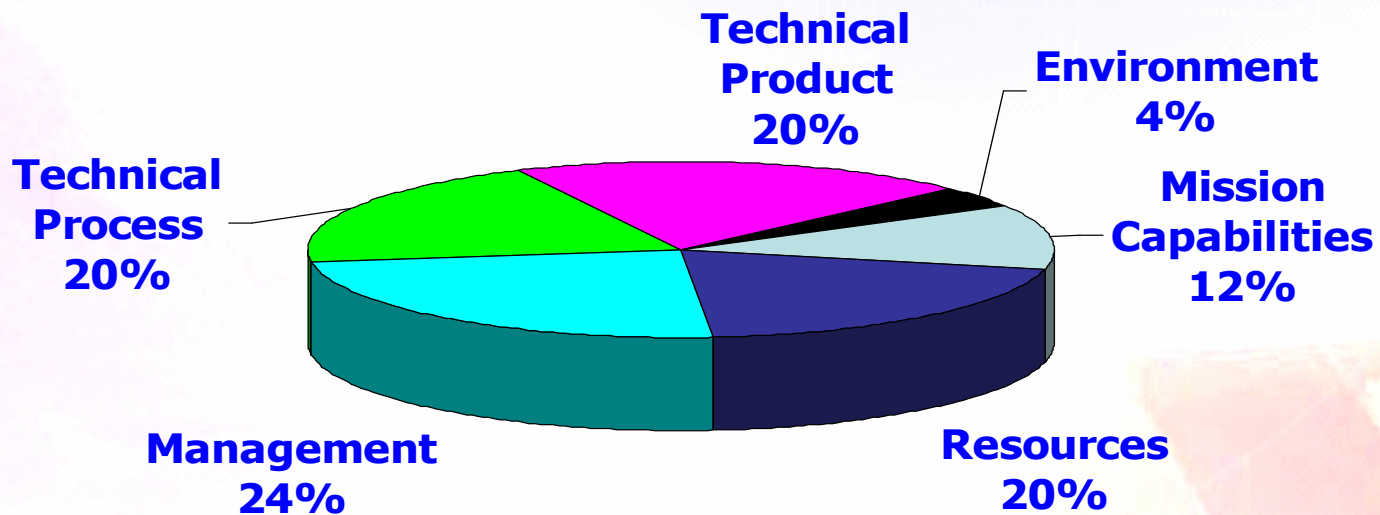- Excellent risk management practices

But not on all Programs…

Emerging Program Support Findings**
(not systemic across all programs)

- Findings across the 6 general review areas…
  (based on assessment methodology areas)

Technical Product 20%

Environment 4%

Technical Process 20%

Mission Capabilities 12%

Management 24%

Resources 20%

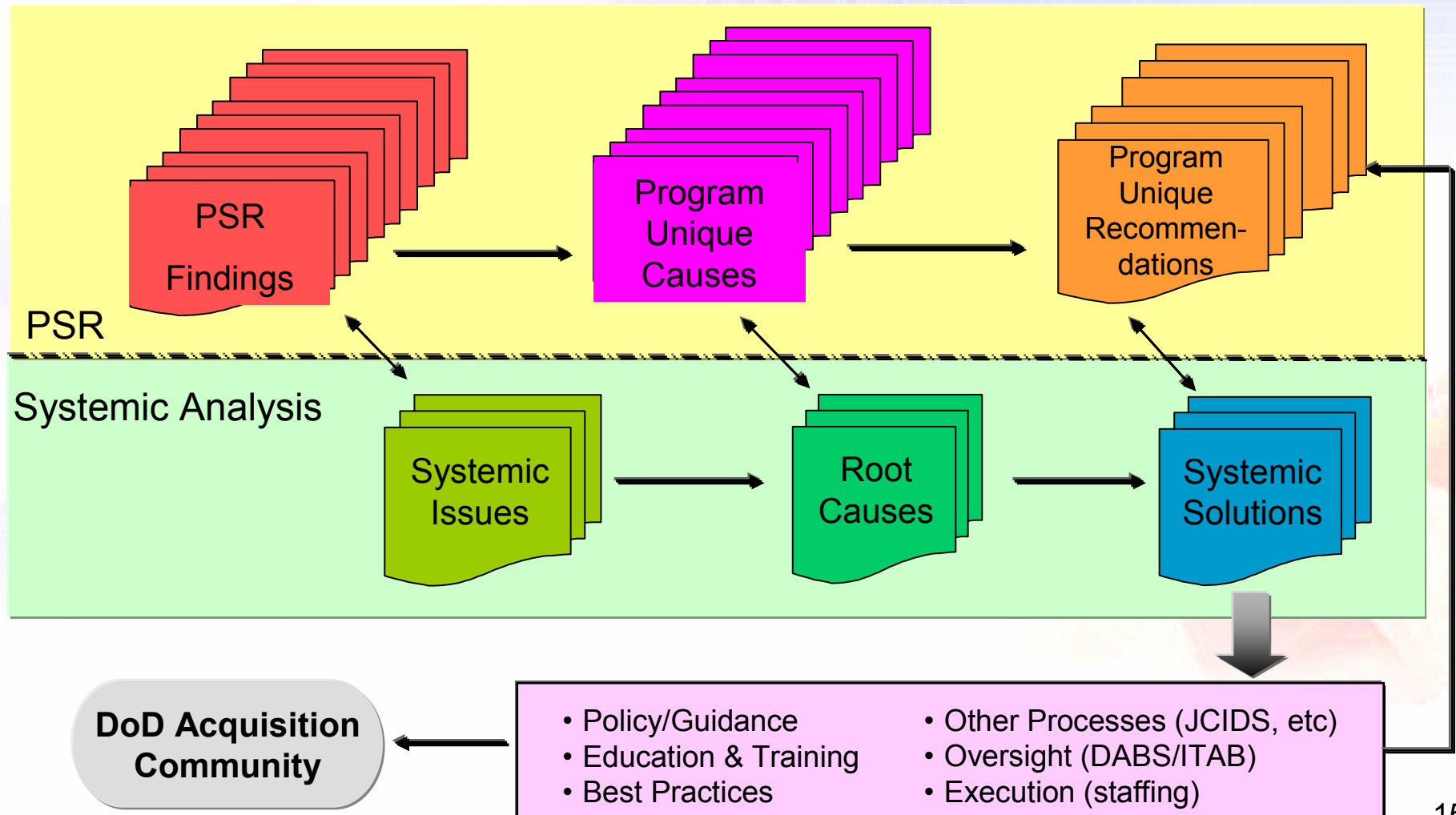**BASED ON ANALYSIS OF 14 OUT OF 22 REVIEWS

- Mission Capabilities - Requirements
  - User requirements not fully defined and/or in flux
  - ☑ Established requirements management plan with all stake holders, including proactive plan for Net-Ready KPP
- Resources - Personnel
  - Experienced, dedicated PM office staff, but stretched too thin
  - ☑ Expanded, empowered WIPT to bring in technical authority SMEs, users, and DCMA
- Management - Schedule Adequacy
  - Technical review planning demonstrated schedule was high risk
  - ☑ Lengthen schedule to include full suite of SE technical reviews, supported by adjusted program funding
- Technical Process - Test & Evaluation
  - Insufficient reliability growth program to meet user requirements by IOT&E
  - ☑ Increased the number of test articles and added sub-system level test events
- Technical Product - Supportability/Maintainability
  - Logistics demonstration plan just prior to IOT&E
  - ☑ Demonstration re-scheduled prior to MS C

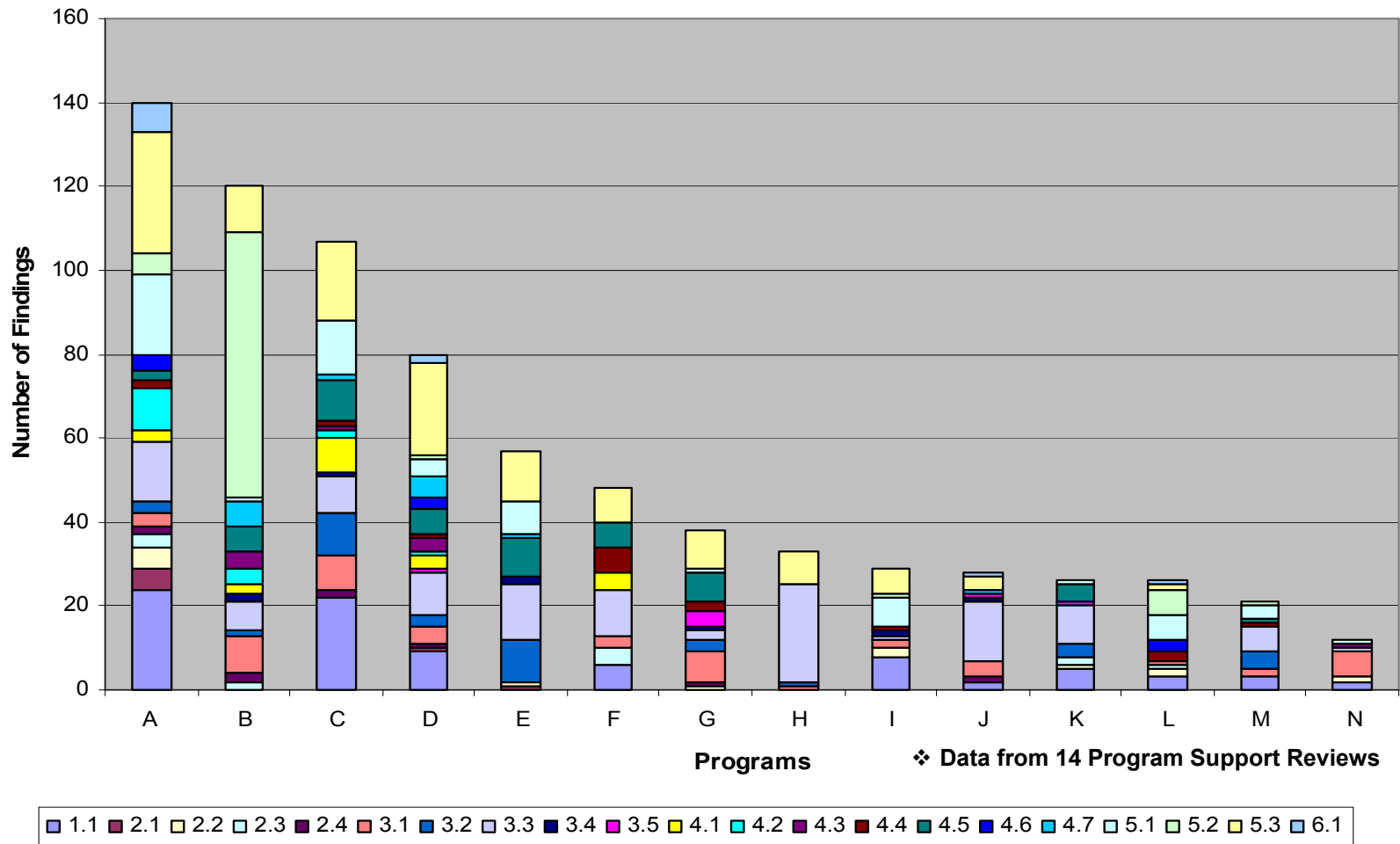**Better than 90% acceptance of recommendations**

Systemic Analysis Perspective

"How do we find solutions to the systemic problems?"

PSR

- PSR Findings → Program Unique Causes → Program Unique Recommendations

Systemic Analysis

- Systemic Issues → Root Causes → Systemic Solutions

DoD Acquisition Community

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

Numbers represent sections of the PSR Metholodgy

Systemic Analysis Perspective

"What are the systemic problem areas?"

Number of Programs Where Issue Was Prevalent

Legend: Pre-MS B, Pre-MS C, Pre-FRP
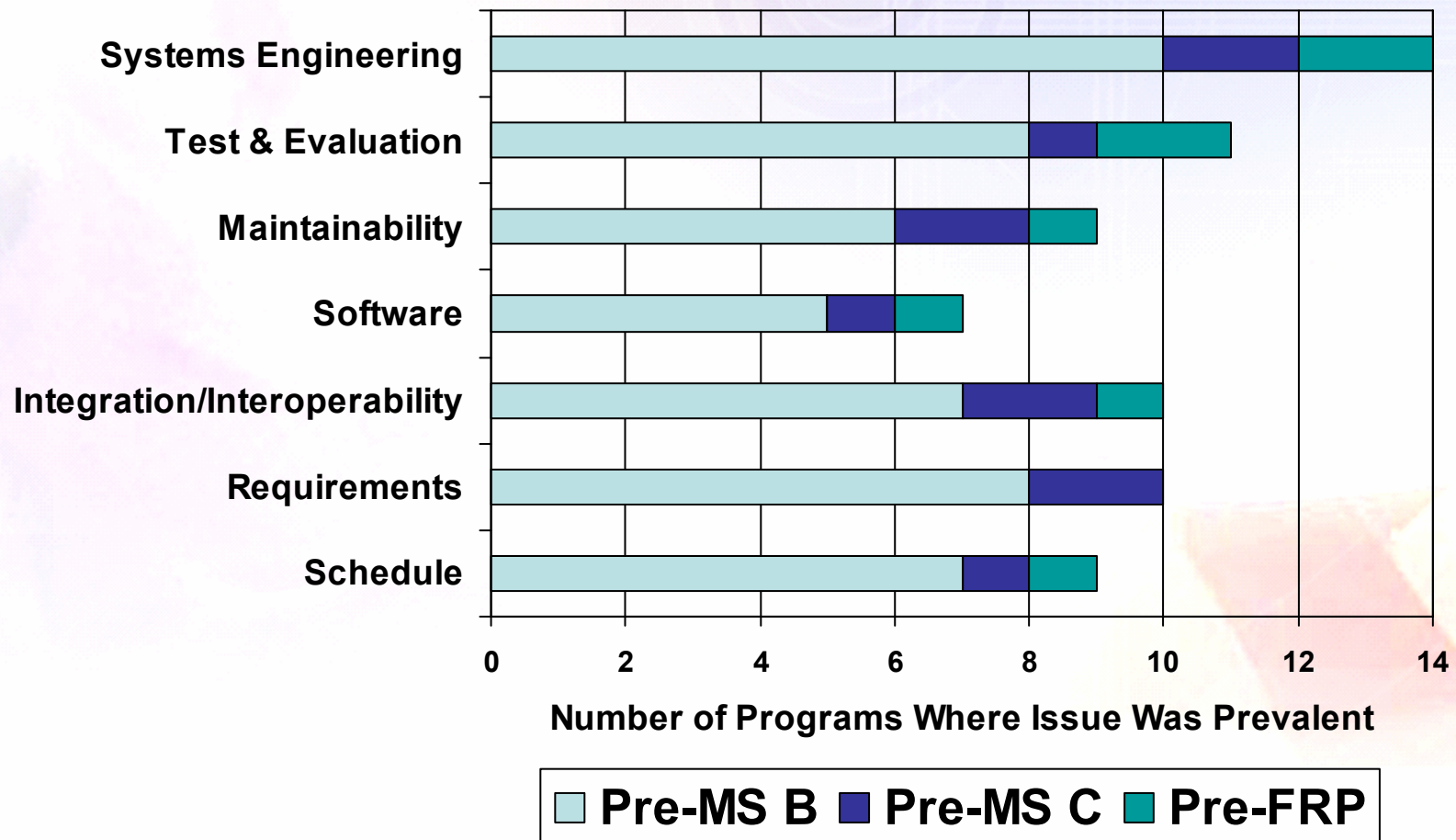
- **Representative Issues for _Schedule_**
  - Schedules too aggressive
  - Detailed schedules missing key components
  - Schedule concurrency (e.g. T&E activities)

- **Representative Issues for _Requirements_**
  - Requirements don't support planned modifications, increasing capacity
  - Requirements changed without consideration or coordination with PM/PO and dependent programs
  - "Shortsighted" requirements, i.e. safety critical, bandwidth to support future capabilities

- **Representative Issues for _Integration/Interoperability_**
  - Integration plans lacking key components
  - Multi-platform, scalable design benefits not realized due to low hw/sw commonality
  - Interoperability with Joint Forces not adequately addressed

- **Representative Issues for _Software_**
  - Software processes not institutionalized
  - Software development planning doesn't adequately capture lessons learned to incorporate into successive builds
  - Systems and spiral software requirements undefined
  - Software architecture immature
  - Software reuse strategies are inconsistent across programs
  - Software support plan missing

- **Representative Issues for _Maintainability_**
  - Maintainability requirements incomplete or missing
  - Diagnostic effectiveness measures are either too ambiguous or missing
  - Tailoring out of criticality calculations translates to inability to monitor the maintainability status of reliability critical items

- **Representative Issues for _Test and Evaluation_**
  - No reliability details (hours, profile, exit criteria, confidence level, OC curve)
  - Lack metrics
  - Basis for some threat-based requirements not fully explained or rationalized

- **Representative Issues for _Systems Engineering_**
  - Lack of disciplined SE process, metrics, etc
  - PO not conducting PRR prior to LRIP
  - Missing Joint CONOPs
  - Missing System Functional Review (SFR) and PDR during SDD

Summary

- We are working to meet the Under Secretary's imperatives in support of transformation by:
  - Providing a context for decisions
  - Putting credibility into the acquisition process
  - Driving systems engineering back into programs

- Our ultimate goal in conducting PSRs is to help all programs achieve mission success through:
  - Early and persistent application of SE
  - Event-driven technical reviews and test programs