Enablers and Impediments to Systems Engineering Implementation

Mr. Peter Nolte

Deputy Director, Major Program Support

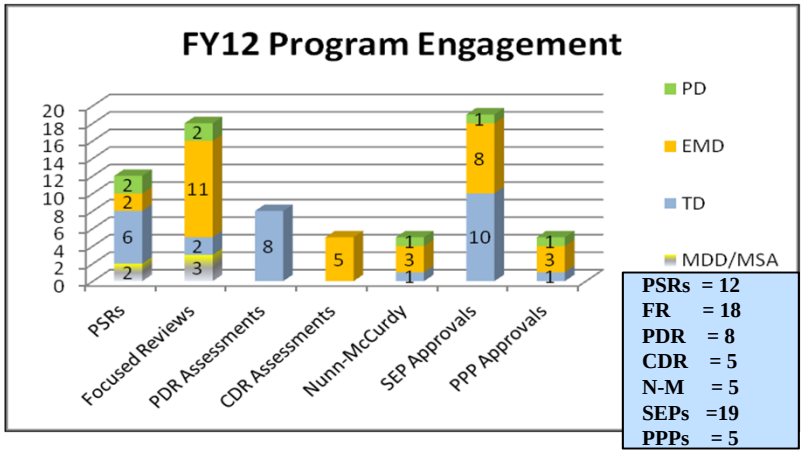
Office of the Deputy Assistant Secretary of Defense for Systems Engineering

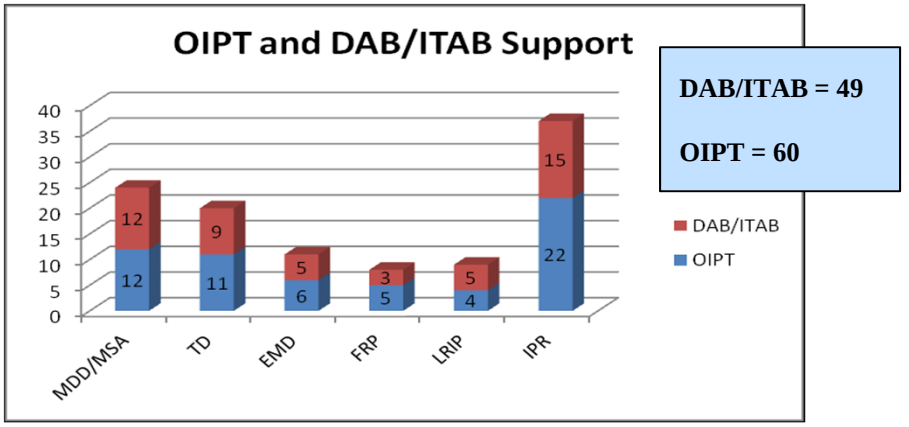
Systems Engineering Forum
December 11, 2012

Overview

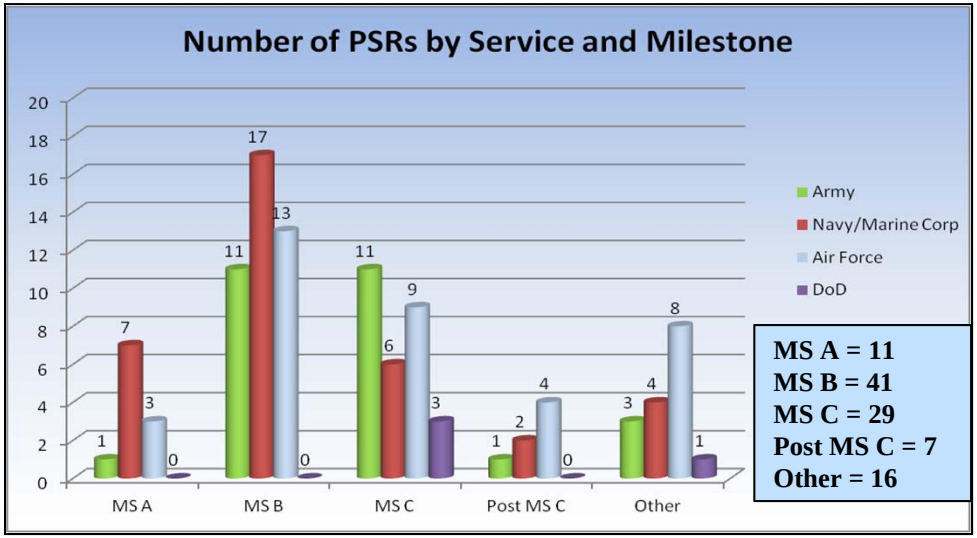
- **Discuss insights from DASD(SE) program engagements**
  - Systemic Root Cause Analysis from Program Support Reviews
  - Implementation of WSARA
    - Systems Engineering Plans
    - PDR/CDR Assessments
    - Metrics and Benchmarking
  - Schedule, Software and Integration Enablers

Program Engagements

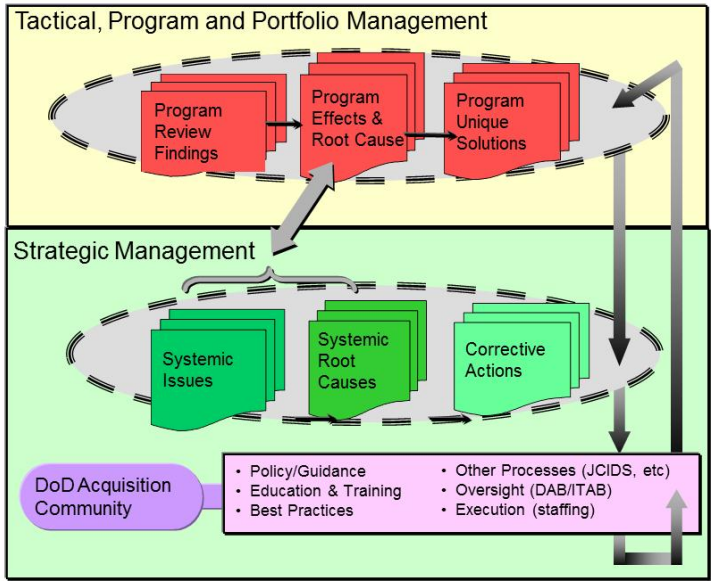




104 Program Support Reviews have been planned, initiated or completed since 2003



Systemic Root Cause Analysis Data Model



Positive Observations
- Enablers -

Systemic Positive Findings

2012 Positive Systemic Findings	% Pgm Rvws
PMO and contractor are staffed with experienced and knowledgeable personnel	21%
Evidence of strong communication and teamwork between PMO and contractor	20%
Program is using a low risk, acceptable, acquisition strategy	13%
Good SE practices are in place and followed	13%
Risk management process is effective in capturing, tracking, and managing system level risks	12%
Risk management process is well defined and well documented	12%
Contractor demonstrated willingness to have an open dialog and share information with the PSR team.	11%
Through the comprehensive and robust usage of earned value, the program continually addresses cost and schedule risk	11%
Requirements process is adequately documented and requirements are traceable to the top level	11%
T&E has been consistently well planned and executed	11%

Notable practices (not Systemic)

- Contractors identify problematic requirements and cost / schedule drivers early in TD phase
- Early Requirements Knowledge Point process collaboration between Materiel and Users
  - Use of Knowledge Point process to conduct trade studies & mature CDD/specification
  - Provides early SE feedback to mature the CDD and spec with low risk, achievable requirements
- TD phase RFP solicits Integration Plan, IMS through prototype delivery, CAD drawings, mature technologies, and SIL
- Defined contractor shakedown periods with success criteria prior to Gov't test
- Use of capabilities IPT to develop roadmaps
- Early negotiation of prices for production assets and spares
- Systems Engineering Plan is included with RFP; SEMP is delivered with proposals

Indicators of Good Programs
- Enablers -

- Mission Capabilities/Requirements
  - ❑ Ensure user requirements are reasonable, measurable and testable
  - ❑ Ensure approved CONOPS informs requirements generation process
  - ❑ Maintain stable requirements
  - ❑ Conduct cost/performance trades with stakeholders
  - ❑ Push **high risk requirements to the next increment**
  - ❑ Conduct SRR in Technology Development phase
  - ❑ **Understand COTS/GOTS limitations**
  - ❑ Be aware of critical dependence on external programs
  - ❑ Establish space/weight/power/cooling margins
- Resources
  - ❑ Ensure funding is phased and adequate to support SE activities
  - ❑ **Adequately staff the program with qualified personnel**
  - ❑ Ensure early selection of M&S and plan to VV&A planning
  - ❑ **Management reserve** consistent with program risks and overall acquisition strategy
- Management
  - ❑ Balance requirements, resources and acquisition strategy
  - ❑ Plan to demonstrate key functionality in Engineering & Manufacturing Dev. phase
  - ❑ Maintain **event driven schedules**; establish entry/exit criteria
  - ❑ Use earned value management as a vehicle for planning, executing, and controlling the program
  - ❑ Employ a **robust risk management process** and resource mitigation activities that is integrated with other management efforts (e.g. EVM, IMS)
  - ❑ Ensure **communication among user, acquirer and supplier**
- Management (continued)
  - ❑ Define IPT roles, responsibilities, authority and conflict resolution process
  - ❑ **Manage external interfaces; issue resolution process**
  - ❑ **Avoid urgency of need outweighing good engineering and program management**
  - ❑ Ensure consistency in program documentation
  - ❑ Be aware of new policies, Congressional language, and certifications
- Technical Process
  - ❑ Ensure translation of operational requirements into contractual language
  - ❑ Ensure adequate requirements flow-down/ traceability/ decomposition
  - ❑ Use **mature technologies and open architecture**
  - ❑ Assess COTS/GOTS form factor changes and integration challenges
  - ❑ Use established SE processes
    - Full suite of SE technical reviews
    - Independent chairman and SMEs
    - **Adequate time between technical reviews**/EMD events
    - Maintain technical baselines
    - Process compliance
  - ❑ **Plan to design-in reliability and maintainability**
  - ❑ Assess supportability in the EMD phase
  - ❑ Use realistic software size, productivity, and reuse estimates
  - ❑ Comprehensive contractual verification (section 4 of spec) of meeting requirements (section 3 of spec)
  - ❑ Put emphasis on test and verification approach
  - ❑ Test **schedule reflects time for corrective actions**
  - ❑ Provide early focus on production planning

2012 Negative Systemic Findings*
- Impediments -

Category	2012 Systemic Finding	% All
CONOPS	Current employment CONOPs are incomplete	13%
Capabilities	Requirements are not measurable nor testable	13%
Budget	Current program budget is not sufficient.	29%
	Program suffers from a lack of funding stability	14%
Staffing	Marginal program office and contractor staffing levels	38%
	Program offices have a lack of acquisition or specialized expertise	21%
	Program office has suffered from instability in key positions	11%
	Difficult to retain and bring in high quality personnel	10%
Acquisition Strategy	Acquisition Strategy supports a decision to proceed before key testing is completed	23%
	Acquisition strategy needs to be restructured or updated	
	Proposed LRIP quantities exceed ten percent	
Knowledge Based Decisions	Key documents are incomplete	16%
	Decision criteria are not established	15%
Schedule	Program is unlikely to achieve schedule	32%
	Program has an aggressive schedule	19%
	POs have inadequate system engineering processes	18%
	Program is schedule driven, not event driven	14%
	No program level Integrated Master Plan (IMP)	19%
	Program does not have a current IMS or even an IMS	15%
Mgmt Structure & Commun	Progress is impeded by lack of good communications between Government and contractor	24%
	Incomplete or missing a Systems Engineering Plan (SEP)	13%
	Roles, responsibilities and lines of authority are not clear	15%
	Inadequate baseline management	10%
	Prime contractors lack insight into subcontractor`s status	
	IPTs are neither chartered nor implemented	
Mgmt Methods, Metrics,	Risk management tools and methodology are not sufficient	24%
	Management metrics are not collected, or are not collected frequently enough, or used to monitor program health	13%
	Programs do not have adequate risk mitigation plans	14%
	EVMS does not provide required insight nor reflect work being done	10%

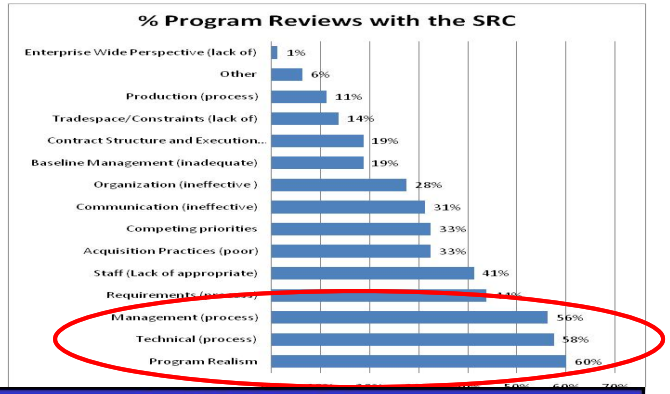
Category	2012 Systemic Finding	% All
Contracting	Prime and PMO have not reached consensus on the scope of work	11%
	Contractor has not demonstrated significant control of subs/suppliers	12%
Design Considerations	Architecture appears overly complex or does not exist	11%
	Program lacks a formal or current Corrosion Prevention & Control (CPC) Program	13%
	PESHE document is incomplete and does not accurately describe the ESOH risk management effort	
Requirements Development	Requirements creep or requirements are vague, poorly stated, or even not defined	24%
	Program failed to establish a process for flowing down requirements	11%
Software	A Software Development Plans do not exist, lacking needed information, or are outdated	13%
	There is significant variation in software development estimates	16%
	Software requirements are ambiguous, not fully specified, not fully developed and not managed adequately	13%
	Lack of metrics prevent accurate awareness of software activities	12%
Design Verification	Testing is incomplete or inadequate	23%
	Test schedule is aggressive/success-oriented/ and highly concurrent	21%
	Scope of testing is not defined	16%
Reliability	A reliability growth program is not in place	16%
	Reliability is not progressing as planned or has failed to achieve requirements	20%
	A reliability test program is needed	12%
Maintainability	System has not demonstrated maintainability requirements	
Production	Poor quality (production) processes	15%
	Production planning is immature or incomplete	10%

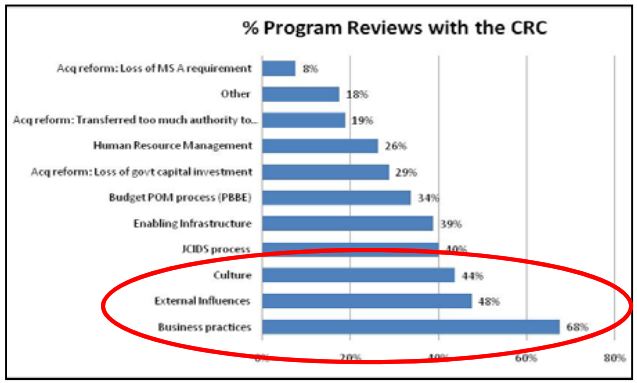
*** Based on 2004-2012 PSR Findings**

Systemic Root Cause Analysis
- Impediments -

Systemic Root Cause – Within the Program Manager's Control

Systemic Root Causes	Amplifying Description
Baseline Management	Baselines not stable or incomplete
Communication	Inadequate external information flow between government and contractor, or internal information flow at the IPT level
Competing priorities	Need vs. Schedule vs. Cost vs. Performance vs. Technical/Integration level of effort
Contract Structure and Execution	Deliverables/Data required not specified / Insufficient Contract Content and Structure
Management	Inadequate Planning / Oversight / EVM / Cost Accounting / Risk mgmt / Supplier mgmt / Accountability / Definition of Enterprise / Tools
Organization	Inappropriate/Not defined / Roles and responsibilities / Responsibility w/o Authority
Other	Other
Acquisition Practices	Poor Acquisition practices / Fundamentally flawed application of practices
Production	Flow / Capacity / Process Control / Process Capability / Quality
Program Realism	Unrealistic expectations / Risk accepta and alignment / Inadequate Capital inv
Requirements	Ambiguity / Stability / JCIDS / No SE i
Staff	Qualifications / Skill Availability / Expe
Technical	Poor SE / Requirements decompositic Inadequate Modeling & Simulation / L Cycle Planning
Trade Space/Constraints	Excessive Requirements / Insufficient
Unknown	Unknown





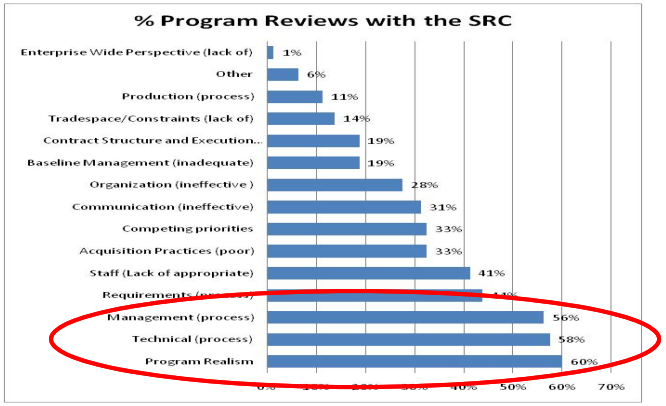
Core Root Causes	Amplifying Description
Acq reform: Loss of Gov't capital investment	Inadequate resources (e.g., people, facilities, test assets)
Acq reform: Loss of MS A requirement	Programs entering late and with less maturity into acquisition system
Acq Reform: Transferred Authority	Gov't transferred too much authority to contractor / Gov't doesn't provide enough guidance to contractor
Budget POM process (PBBE)	Inadequate funding and/or phasing to support program
Culture	Govt. / Industry do not understand each other / have different motives
Enabling Infrastructure	Conditions/Constraints affecting programmatic and technical effort
External Influences	Program forced to make decisions about cost, schedule, and performance based on leadership/external influences
JCIDS process	Capabilities and/or Requirements not tangible, measurable, or reasonable
Human Resource Management	Pool of clearable skilled people; Gov't. / Industry lack qualified, cleared staff to support effort (e.g. software programmers); Rotations / continuity - loss of continuity and knowledge base
Business Practices	Govt. / Industry not following best practices / Not using published guides to facilitate program and technical management
Other	Other
Unknown	Unknown

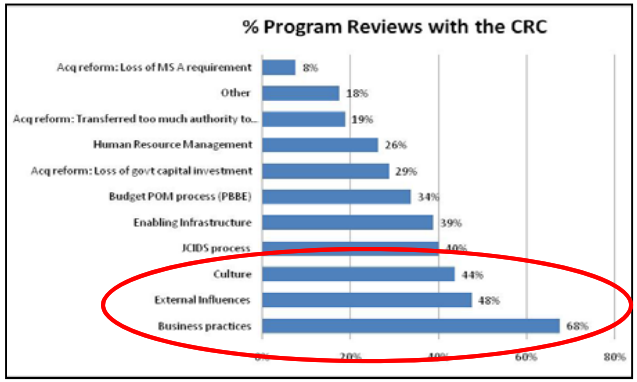
Core Root Cause – Outside the Program Manager's Control

Systemic Root Cause Analysis
- Impediments -

Systemic Root Cause – Within the Program Manager's Control

Systemic Root Causes	Amplifying Description
Baseline Management	Baselines not stable or incomplete
Communication	Inadequate external information flow between government and contractor, or internal information flow at the IPT level
Competing priorities	Need vs. Schedule vs. Cost vs. Performance vs. Technical/Integration level of effort
Contract Structure and Execution	Deliverables/Data required not specified / Insufficient Contract Content and Structure
Management	Inadequate Planning / Oversight / EVM / Cost Accounting / Risk mgmt / Supplier mgmt / Accountability / Definition of Enterprise / Tools
Organization	Inappropriate/Not defined / Roles and responsibilities / Responsibility w/o Authority
Other	Other
Acquisition Practices	Poor Acquisition practices / Fundamentally flawed application of practices
Production	Flow / Capacity / Process Control / Process Capability / Quality
Program Realism	Unrealistic expectations / Risk acceptance/ Funding, Budget, and Schedule constraints and alignment / Inadequate Capital investment / Poor assumptions- COTS, TRL, etc
Requirements	Ambiguity / Stability / JCIDS / No SE in Requirements process / CONOPS incomplete
Staff	Qualifications / Skill Availability / Experience level / Continuity / Workload / Slots / Training
Technical	Poor SE / Requirements decomposition / V&V / Inadequate system integration / Inadequate Modeling & Simulation / Logistics/Sustainment late to need in SDD/ Poor Life Cycle Planning
Trade Space/Constraints	Excessive Requirements / Insufficient Resources / Insufficient Stakeholder involvement
Unknown	Unknown





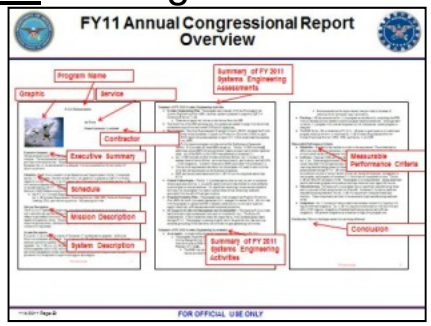
	Amplifying Description
	te resources (e.g., people, facilities, test assets)
	s entering late and with less maturity into acquisition system
	nsferred too much authority to contractor / Gov't doesn't provide enough to contractor
	te funding and/or phasing to support program
Culture	Govt. / Industry do not understand each other / have different motives
Enabling Infrastructure	Conditions/Constraints affecting programmatic and technical effort
External Influences	Program forced to make decisions about cost, schedule, and performance based on leadership/external influences
JCIDS process	Capabilities and/or Requirements not tangible, measurable, or reasonable
Human Resource Management	Pool of clearable skilled people; Gov't. / Industry lack qualified, cleared staff to support effort (e.g. software programmers); Rotations / continuity - loss of continuity and knowledge base
Business Practices	Govt. / Industry not following best practices / Not using published guides to facilitate program and technical management
Other	Other
Unknown	Unknown

Core Root Cause – Outside the Program Manager's Control

Weapon Systems Acquisition Reform Act

- **Weapon Systems Acquisition Reform Act (WSARA)**
  - Public Law 111-23-Signed by President May 22, 2009
  - Directive-Type Memorandum (DTM) 09-027, 4 Dec 2009, implements WSARA

- **Systems Engineering Changes Directed:**
  - ☑ DASD(SE) review and approval of SEPs for MDAPs
  - ☑ PDR Assessments prior to Milestone B
  - ☑ Early developmental planning engagement
  - ☑ Assessment of technological maturity and integration risk of critical technologies
  - ☑ Evaluate the cost, schedule, and performance of the program, relative to current metrics, performance requirements, and baseline parameters
  - ☑ Annual Report to Congress

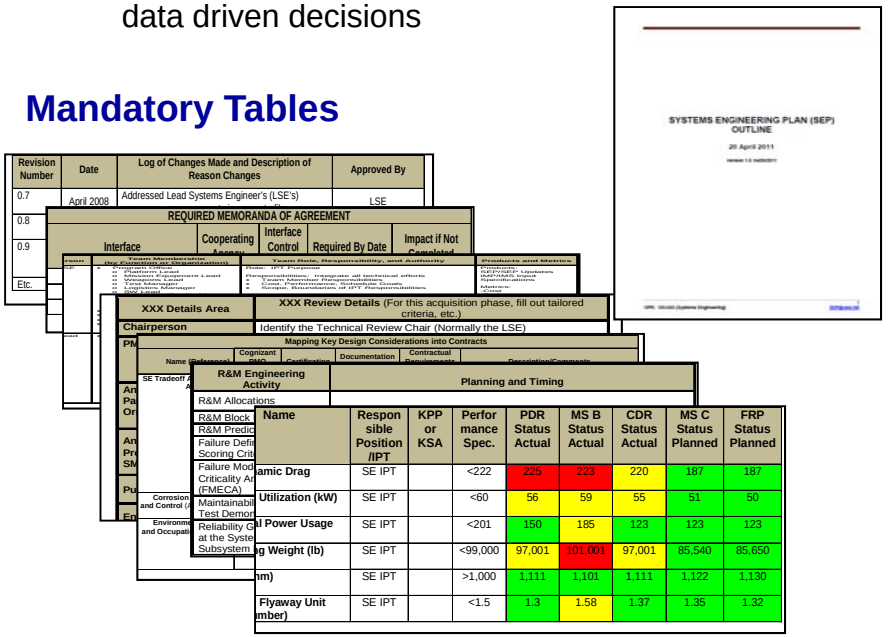


Systems Engineering Plans (1 of 2) - Enabler -

- **Provides means to develop, document and approve a program's technical strategy**
  - Basis for cost/schedule baselines at MS reviews
  - Development prior to RFP release ensures precludes program start-up issues
- **The Program's technical planning and management manual**
  - Blueprint for conduct, management, and control of program's technical aspects
  - Reflects both Government & contractor activities, roles, and responsibilities
  - Uses "plain speak" language to communicate what programs are doing
  - Answers the "who, what, why, when, and how" questions associated with technical processes and management activities
- **SEPs should be a "go to" technical planning and management manual**
  - Should be a "living document" and not "shelf-ware"
  - Be consistent with all program documentation
  - Hotlinks to key documents maintains SEP currency and reduce its size

- **2011 SEP outline intended to reduce confusion about expectations**
  - Reduce development, review and approval timelines
  - Mandatory tables replace extensive narratives
  - Development of metrics to monitor execution of engineering efforts inform risk mitigation efforts and data driven decisions

Mandatory Tables



SEP Outline: http://www.acq.osd.mil/se/pg/guidance.html

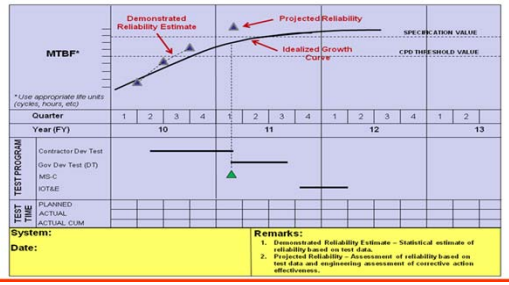
The approved SEP provides authority and empowers the Lead Systems Engineer/Chief Engineer to execute the program's technical planning

Systems Engineering Plans (2 of 2)
- Enabler -

What we see:

- Quantitative Planning
  - Reliability Growth Planning
  - Schedule Risk Assessments are not well understood
- Data Driven
  - Data-driven is a key aspect of our approach to SEPs and programs
  - Often missing objective or quantifiable assessments
    - SE technical reviews entry / exit criteria
  - TPMs not planned with interim values, may not clearly tie to KPPs
- Deferred Content
  - Linked Content (PPP, CPCP, IUID)
  - IMS, IMP and WBS

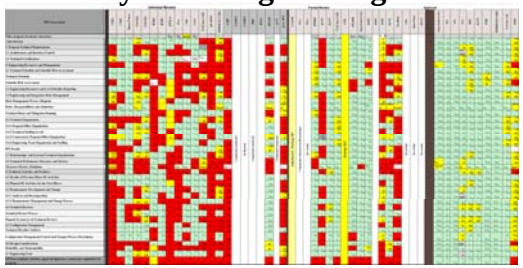
Reliability Growth Curve



What we could do better:

- Ensure that the Chief Engineer/Lead SE has responsibility for developing the SEP
  - Delegating the SEP and other key documents to the contractor post-award is not good. Neither is leaving the contractor in control of all baselines
- Have an approved SEP prior to the RFP release
  - Communicates the technical intent on the program and demonstrates sound thinking/planning that supports a quality RFP
- Prepare a post Milestone SEP update (Service Approved) that reflects the contractor(s) technical planning
- Conduct SE WIPTs on all programs to better assess performance to plan to inform risk mitigation activities

2012 Systems Engineering Plans



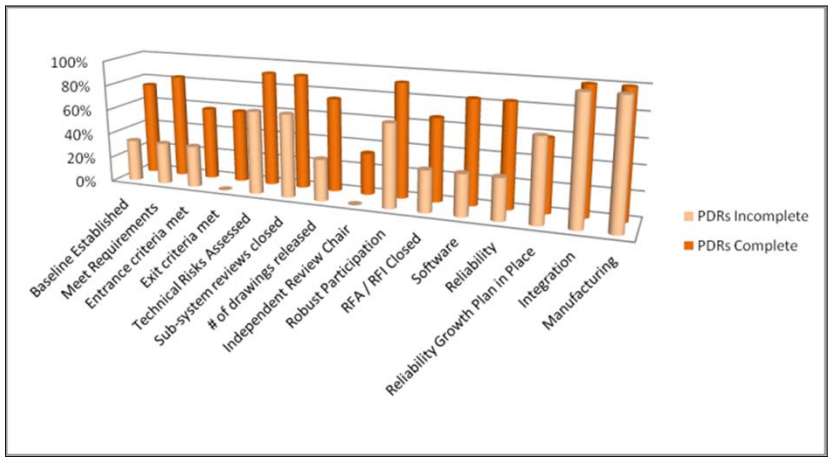
Preliminary/Critical Design Reviews (1 of 2)

What Have We Seen:

- DASD(SE) has conducted 15 PDR assessments and 15 CDR assessments since 2009
- Most programs are conducting good reviews
  - Three PDRs / four CDRs found incomplete, requiring additional actions or Delta reviews
  - Incomplete reviews are rushing to completion
    - Only 14% met all entrance and exit criteria
    - Only 25% completed all key subsystem reviews, established baselines
- Common Risks / Issues
  - Reliability
    - 25% tracking reliability risks or were projected to miss thresholds
    - Only 54% of programs have a reliability growth plan in place
  - 75% have integration risks / 33% have interdependency risks
  - Schedule: 42% of CDRs identified risks in meeting IOT&E schedule
  - Software: 30% tracking risks to software development or plan
  - Certifications - 30% tracking risks to system certifications

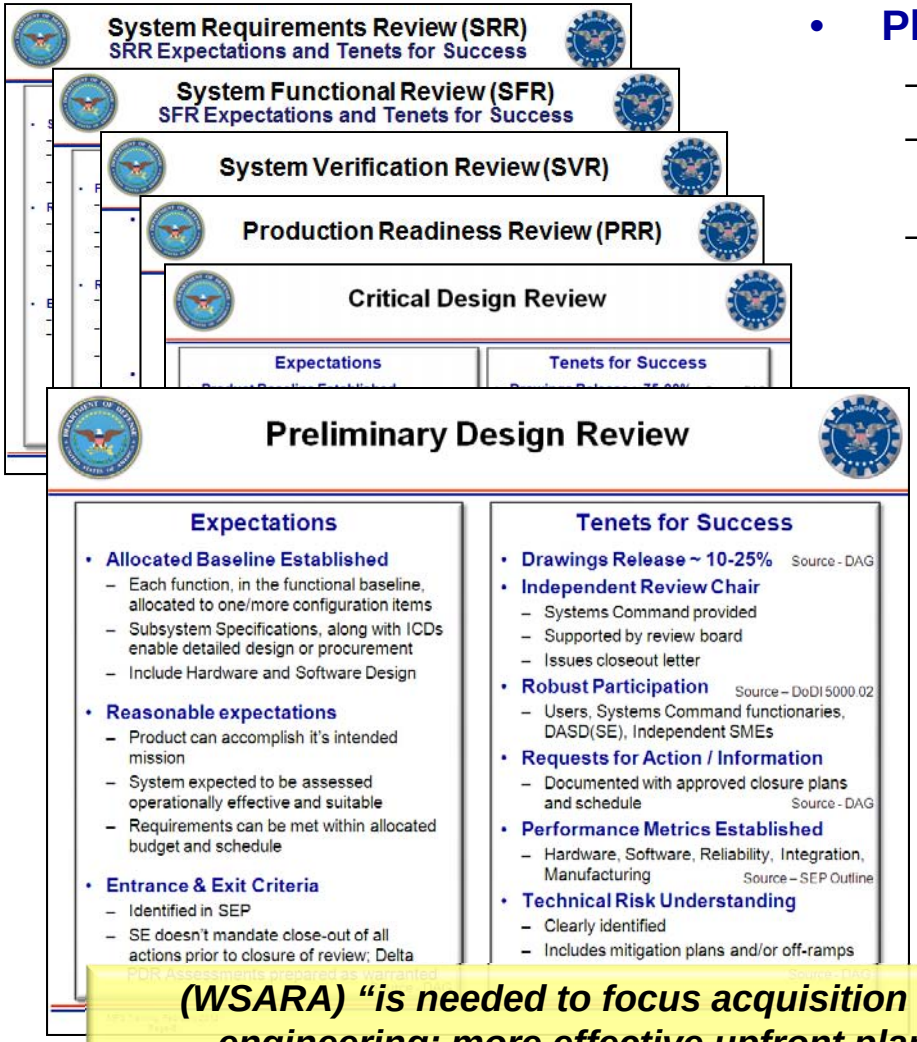
WSARA: … "has received a PDR report and conducted a formal post-PDR assessment, and certifies the program demonstrates a high likelihood of accomplishing its intended mission"

PDR Incomplete Areas

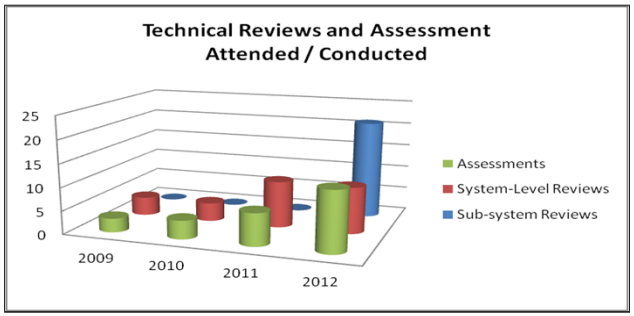


"The key to successful acquisition programs is getting things right from the start with sound systems engineering, cost-estimating, and developmental testing early in the program cycle." -Senator Carl Levin (D-MI), Chairman, SASC

Preliminary/Critical Design Reviews (2 of 2)



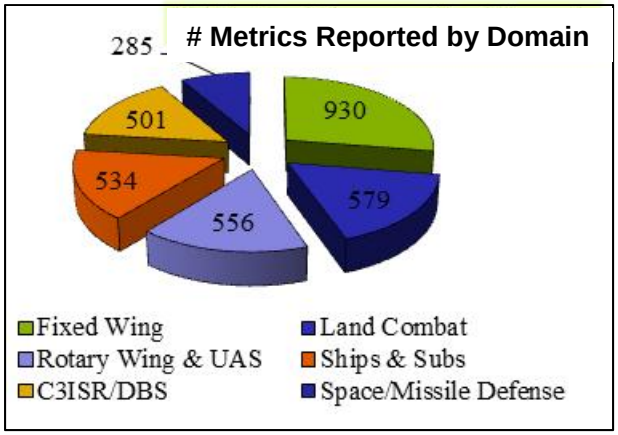
- **Plan to meet Technical Review expectations**
  - Conduct the full suite of SE technical reviews
  - Base the phasing of technical reviews on historical programs
  - Document Entry/Exit criteria in the SEP
    - Recommend Draft PDR report be an entrance criteria for the system level PDR
    - Place additional emphasis on: reliability, staffing, schedule, software, integration and external dependencies
    - Be event driven. Don't close the review with excessive liens

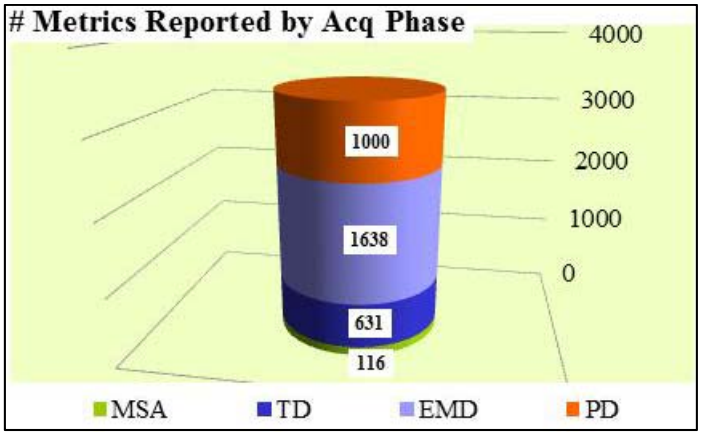


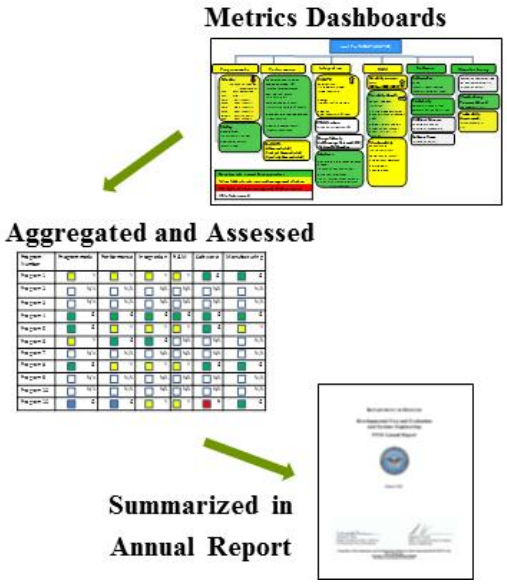
(WSARA) "is needed to focus acquisition and procurement on emphasizing systems engineering; more effective upfront planning and management of technology risk." - Senator John McCain (R-AZ), Ranking Member, Senate Armed Services Committee

FY12 Metrics Highlights

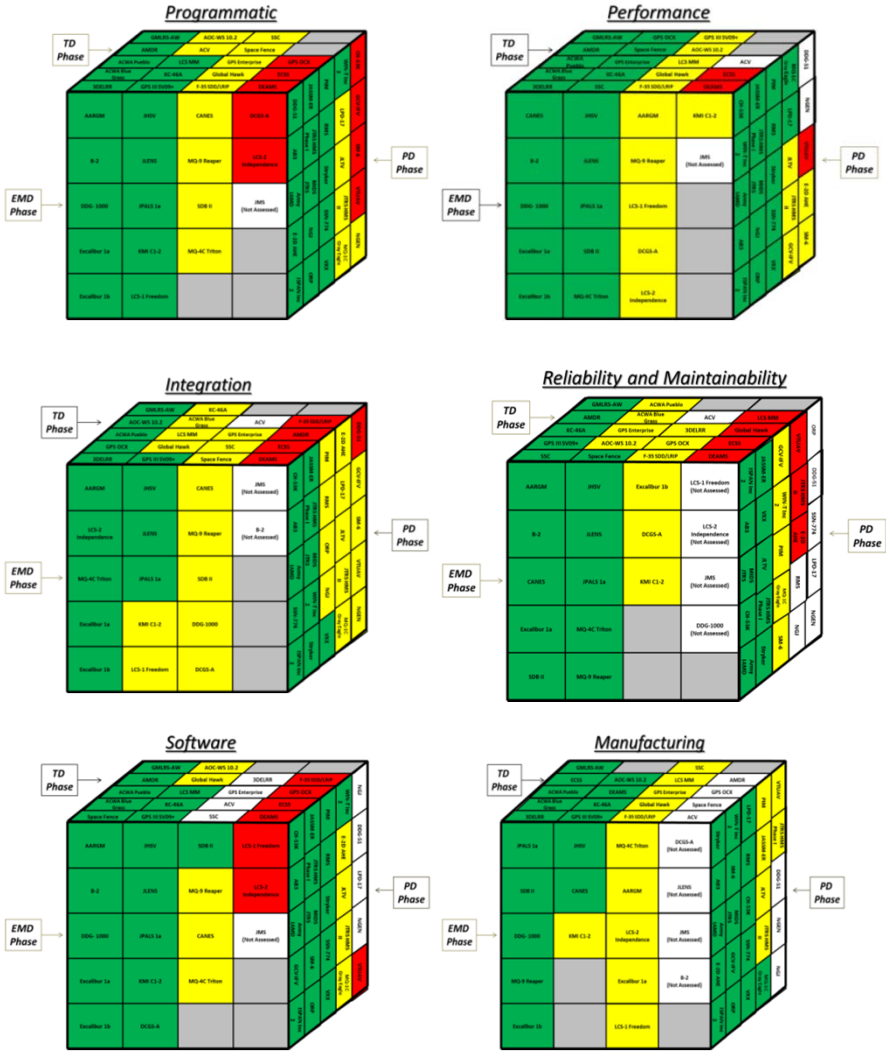
- **PMs determine tailored set of metrics and Technical Performance Measures (TPMs) to be utilized – Document metrics in the SEP**
  - Per 2009 WSARA – Detailed measurable performance criteria shall be established
  - In accordance with April 2011 Systems Engineering Plan outline – Metrics and Technical Performance Measures (TPMs) will be developed
  - Metrics and TPMs are utilized to assess whether programs are "executing to plan"
- **Accomplishments**
  - Built and implemented the framework for the MPS metrics program. Designed a database to capture Systems Engineering (SE) metrics and technical performance measures (TPMs) data. This data will, over time, support trend analysis and reporting.
  - Tracking 3,385 SE metrics and TPMs for 73 MDAPs
  - Merging with DAMIR database







Metrics Initiative



What We Want to See:

- **Base requirements on similar systems**
  - Don't overpromise and under-deliver
  - Mature requirements based on trade studies and verification activities
  - Refine requirements via Knowledge Point reviews and Configuration Steering Boards
- **Don't constrain metrics in Acquisition Program Baseline to KPPs**
- **Assess execution to plan progress via SE WIPTs to assess risks**
  - Document reasons for deviations in SEP and Selected Acquisition Report
  - Document & share lessons learned to improve the state of the practice
  - Provide access to Integrated Data Environments

DoD SE Program Health in a Snapshot

Schedule Planning

What we have seen:

- Missing artifacts such as Work Breakdown Structures (WBS), Integrated Master Plans (IMP), Integrated Master Schedules (IMS) needed to adequately baseline a schedule and track Earned Value Management
- In programs with WBS, IMP and IMS, the artifacts aren't regularly updated and/or lack detail needed to conduct Schedule Risk Analysis
- Lack of most likely, optimistic, pessimistic analysis taking into account the probability of occurrence
- Impact of risks aren't quantified
- External pressures from senior leaders place unrealistic demands on the time it will take for the program to reach milestones
- Schedules not realistic or based on historical norms for similar systems, instead schedule is based on wishes

What we want to see:

- Programs develop and integrate their work products, schedule and risk activities using the WBS, IMP, IMS, Risk Register and RMP to track program progress
- Regularly update IMS to better manage risk and gain confidence in the schedule
  - Conduct better planning by checking the quality and traceability of each artifact
  - Identify the critical path and the impact of its delay
- Justify that time allocated between major activities is realistic and supported with historical evidence
- Avoid excessive schedule concurrency:
  - Ensure financial decisions will be supported by demonstrated performance
  - Competitive prototyping is representative of the end product and reduces technology/integration risks
  - Ensure competitive prototyping and TRA informs the PDR which informs the Requirements Document

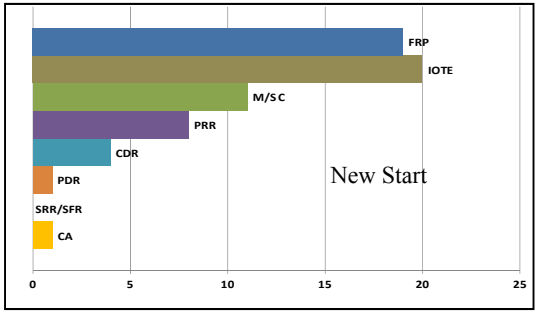
Review of 45+ System Engineering Plans identified over 225 schedule, risk and EVM deficiencies

DASD(SE) performing schedule health checks on programs to pinpoint schedule strengths and weaknesses. – Goal is to conduct 30 Schedule Risk Assessments in FY13

Schedule
- FY12 Benchmarking Effort – (1 of 2)

- **Review of 109 MDAPs' planned program schedules show:**
  - Planned schedule are overly optimistic; as the median actual time to execute exceeds planned time by 6 (for new starts) to 8 months (modifications)
  - Unrealistic schedule planning can lead to cost growth and does not allow adequate time to fix problems that arise
- **Benchmarks developed using historical data can assist in planning more realistic schedules during development; assure a more executable schedule and reduce risk**
- **As programs approach production, planning slips are longer**
- **Proper phasing of funding with a low risk schedule is critical**
- **Some Caveats:**
  - RDT&E expenditures assumed to be expended uniformly over time Expenditures are allocated to key SE events
  - The data in the schedule database is less well populated prior to PDR

Average Key Event Slippage (in months)



Approximate Cumulative % RDT&E Expenditures to Key SE Events

Domain	PDR	CDR	MS C	FRP
Land Combat	18%	38%	67%	100%
Fixed Wing Aircraft	13%	26%	81%	100%
C4ISR	19%	35%	92%	100%
Missiles	40%	59%	81%	100%
Rotary Wing	25%	34%	70%	100%
Space & Missile Def	24%	40%	69%	100%
Unmanned Aircraft	28%	40%	87%	100%
ALL DOMAINS	24%	39%	78%	100%

CA	– Contract Award
SRR	– System Requirements Review
SFR	– System Functional Review
PDR	– Preliminary Design Review
CDR	– Critical Design Review
PRR	– Production Readiness Review
M\SC	– Milestone C
IOT&E	– Initial Operational Test and Evaluation
FRP	– Full Rate Production

Average Key Event Slippage (in months)

MDAPs	PDR	CDR	PRR	M/S C	IOTE	FRP
New Start	1	4	8	11	20	19
Mod	1	6	4	7	11	16

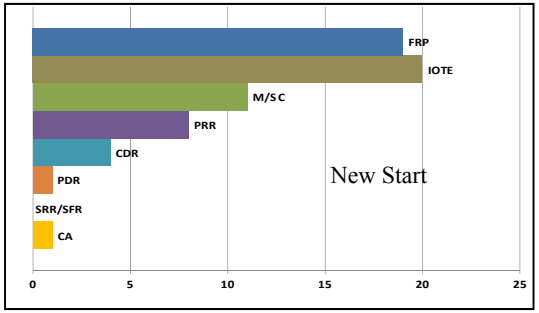
Average Key Event Slippage For Services (in months)

Component	PDR	CDR	PRR	M/S C	IOTE	FRP
Army	1	5	18	12	13	20
Navy	0	6	3	8	12	13
Air Force	1	7		21	29	34
DoD	1	4	6	7	19	18

Schedule
- FY12 Benchmarking Effort – (1 of 2)

- **Review of 109 MDAPs' planned program schedules show:**
  - Planned schedule are overly optimistic; as the median actual time to execute exceeds planned time by 6 (for new starts) to 8 months (modifications)
  - Unrealistic schedule planning can lead to cost growth and does not allow adequate time to fix problems that arise
- **Benchmarks developed using historical data can assist in planning more realistic schedules during development; assure a more executable schedule and reduce risk**
- **As programs approach production, planning slips are longer**
- **Proper phasing of funding with a low risk schedule is critical**
- **Some Caveats:**
  - RDT&E expenditures assumed to be expended uniformly over time Expenditures are allocated to key SE events
  - The data in the schedule database is less well populated prior to PDR

Average Key Event Slippage (in months)



Approximate Cumulative % RDT&E Expenditures to Key SE Events

Domain	PDR	CDR	MS C	FRP
Land Combat	18%	38%	67%	100%
Fixed Wing Aircraft	13%	26%	81%	100%
C4ISR	19%	35%	92%	100%
Missiles	40%	59%	81%	100%
Rotary Wing	25%	34%	70%	100%
Space & Missile Def	24%	40%	69%	100%
Unmanned Aircraft	28%	40%	87%	100%
ALL DOMAINS	24%	39%	78%	100%

CA	– Contract Award
SRR	– System Requirements Review
SFR	– System Functional Review
PDR	– Preliminary Design Review
CDR	– Critical Design Review
PRR	– Production Readiness Review
M\SC	– Milestone C
IOT&E	– Initial Operational Test and Evaluation
FRP	– Full Rate Production

Average Key Event Slippage (in months)

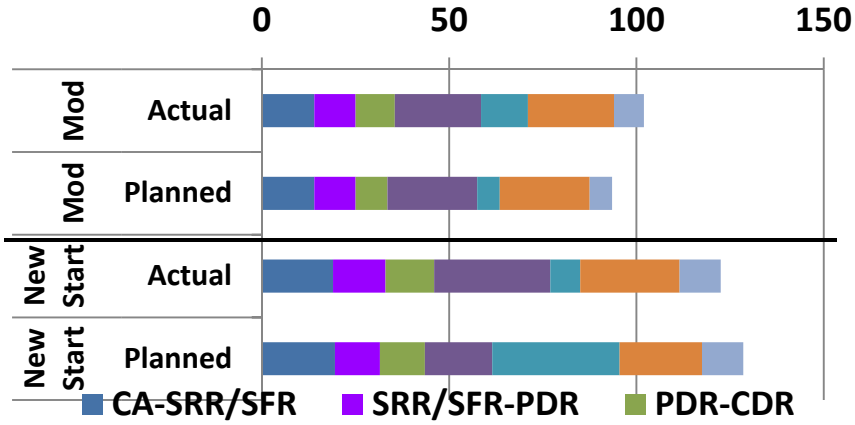
MDAPs	PDR	CDR	PRR	M/S C	IOTE	FRP
New Start	1	4	8	11	20	19
Mod	1	6	4	7	11	16

Average Key Event Slippage For Services (in months)

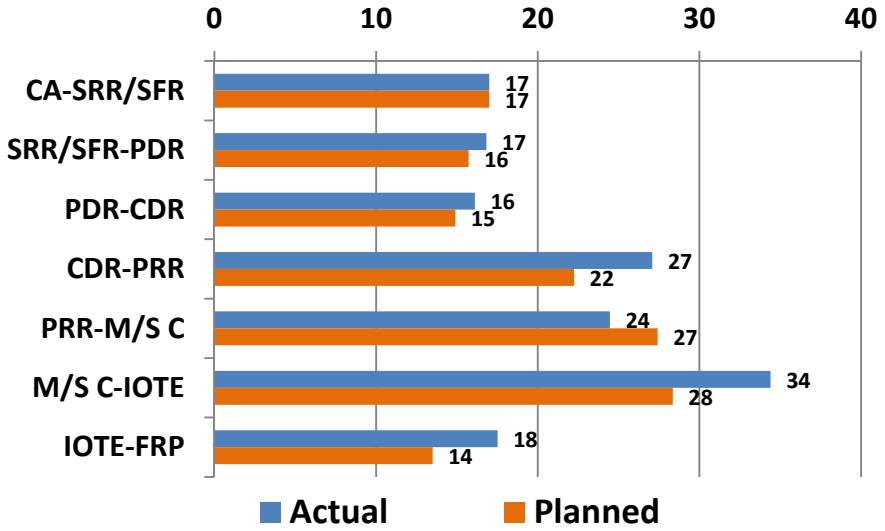
Component	PDR	CDR	PRR	M/S C	IOTE	FRP
Army	1	5	18	12	13	20
Navy	0	6	3	8	12	13
Air Force	1	7		21	29	34
DoD	1	4	6	7	19	18

Schedule Planning
- FY12 Benchmarking Effort - (2 of 2)

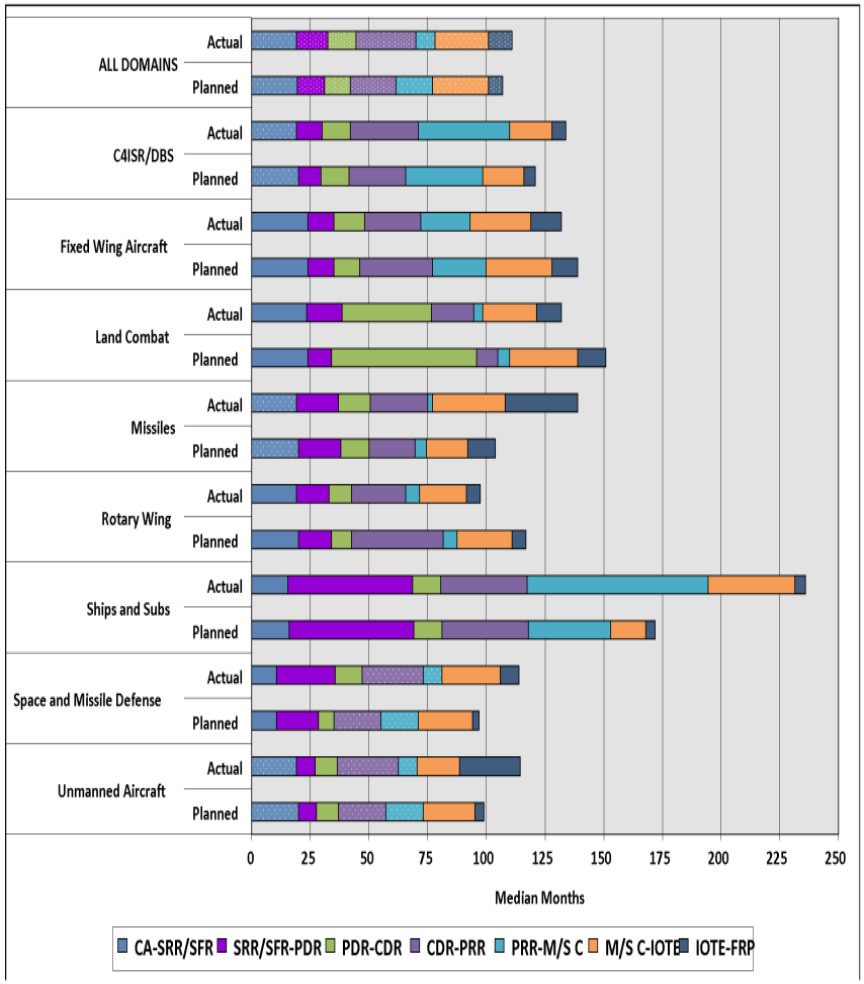
Comparison of Planned vs. Actual Technical reviews



Average Months Between Technical Reviews



Planned vs. Actual Technical Reviews by Domain



Software Engineering Impediments
- Among 20 MDAP/MAIS Reviews in FY12 -

Impediments among 20 MDAP/MAIS reviewed in FY12

- Lack of sufficient predictive software metrics and quantitative management
  - e.g.. size, schedule, LOE, staffing, and defects; emphasis on SW delivery targets (schedule-driven) vices estimates
- Low software schedule realism
  - 70% of DASD(SE) parametric analyses conducted found optimistic schedules
- Software staffing issues
  - Insufficient government oversight, understaffing (at PM, prime, and/or subs), or aggressive staffing leading to late-cycle effort/cost growth
- Low software process maturity (below CMM-I level 3 behavior) and robust software quality assurance program
  - e.g. low/no acceptance process or criteria; supplier quality issues
- Fielding immature software
  - Fielded defects and workarounds result in increased sustainment and decreased usability
- Insufficient software requirements engineering and management
  - Lack of connection to system requirements, lack of bidirectional traceability
- Software integration issues
  - Lack of focus on end-to-end performance, and insufficient/incomplete integration testing

Enablers of SW & SE Success

- Ensure bidirectional **traceability** between CONOPS/mission-threads & SW requirements, architecture, design and V&V
- Build & manage a robust **software IMS**
- Build & track detailed **SW build plan/schedule**
- Connect SW to program **schedule risk analysis**
- Enable insight into development **progress and SW maturity**
  - Establish, contractually require, and closely monitor quantitative measures of progress, quality
- **Reassess PMO staffing plans to** ensure adequate, qualified personnel

DASD(SE) SW & SE Initiatives

- Continuous **program engagement**
- Development planning and **early acquisition** lifecycle support
- Promote/track use of **software metrics**
  - Eensure use of metrics planned in Acquisition Documents (e.g., SEP, SDP, RFP, SEMP)
  - Use parametric analysis to quantitatively assess execution and maturity at touch-points
  - Maintaining a SW metrics database to enable trend analysis & benchmarking across AT&L/warfare domains

Continue finding systemic software development risks and issues in DoD's SW intensive programs

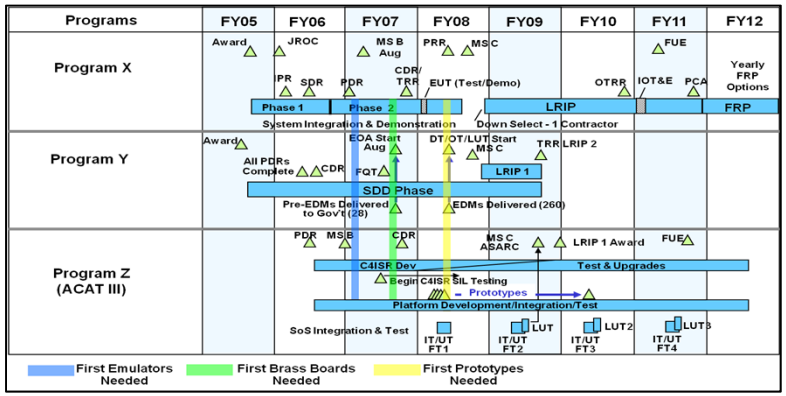
Integration Process Challenge
- Putting the pieces together -

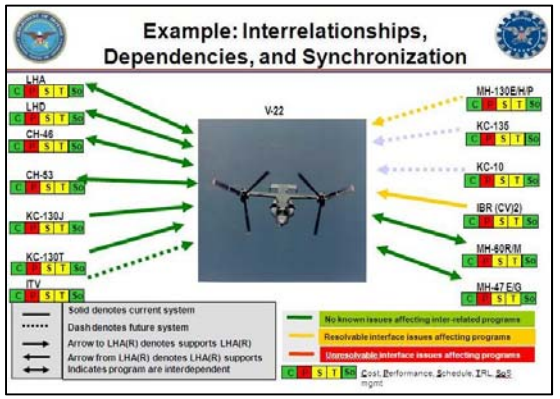
What we are seeing - common integration threads:

- Inadequate resources for integration / planning for integration
- Underestimated difficulty of software integration
- Lack of compliance with Memorandums of Agreement
- Lack of growth margins to accommodate the integration of additional capabilities
- Asynchronous schedules / Differing priorities from external programs leads to delays in establishing capabilities
  - No issues resolution process
  - Difference perspectives about health of linkages
  - Insufficient time for integration and test

What we want to see

- Development of an Integration Plan and execute in a transparent manner
- Involve Government stakeholders, especially the PM and the Chief Engineer – use MOAs
- Exploit contractor and government corporate memory (SMEs) to identify and avoid risks
- Establish Growth Requirements (SWaP-C)
- Plan for schedule, performance margin to accommodate integration issues
- Improved management of external dependencies
  - Quantitative reporting of program health metrics





Questions?

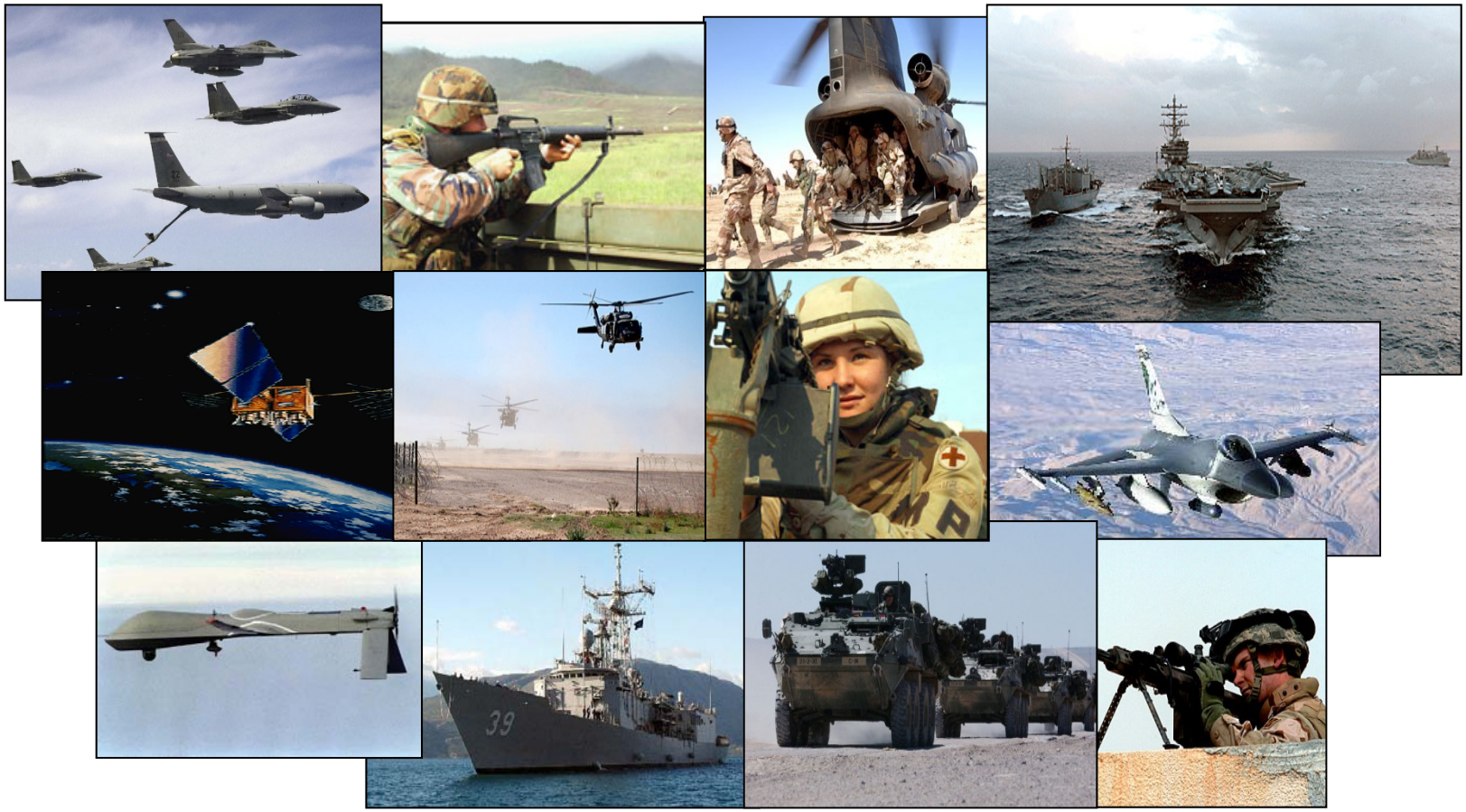
Mr. Peter Nolte
Peter.Nolte@osd.mil
571-372-6150

Mr. John Quackenbush
John.Quackenbush.ctr@osd.mil
571-372-6037

Links:
For SEP Outline, How to build a SEP brief, PDR Report Template, SE WIPT Charter, and Defense Acquisition Program Support (DAPS) Methodology

http://www.acq.osd.mil/se/pg/guidance.html

Systems Engineering: Critical to Program Success



Innovation, Speed, and Agility

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