

Digging Out the Root Causes of Nunn-McCurdy Breaches

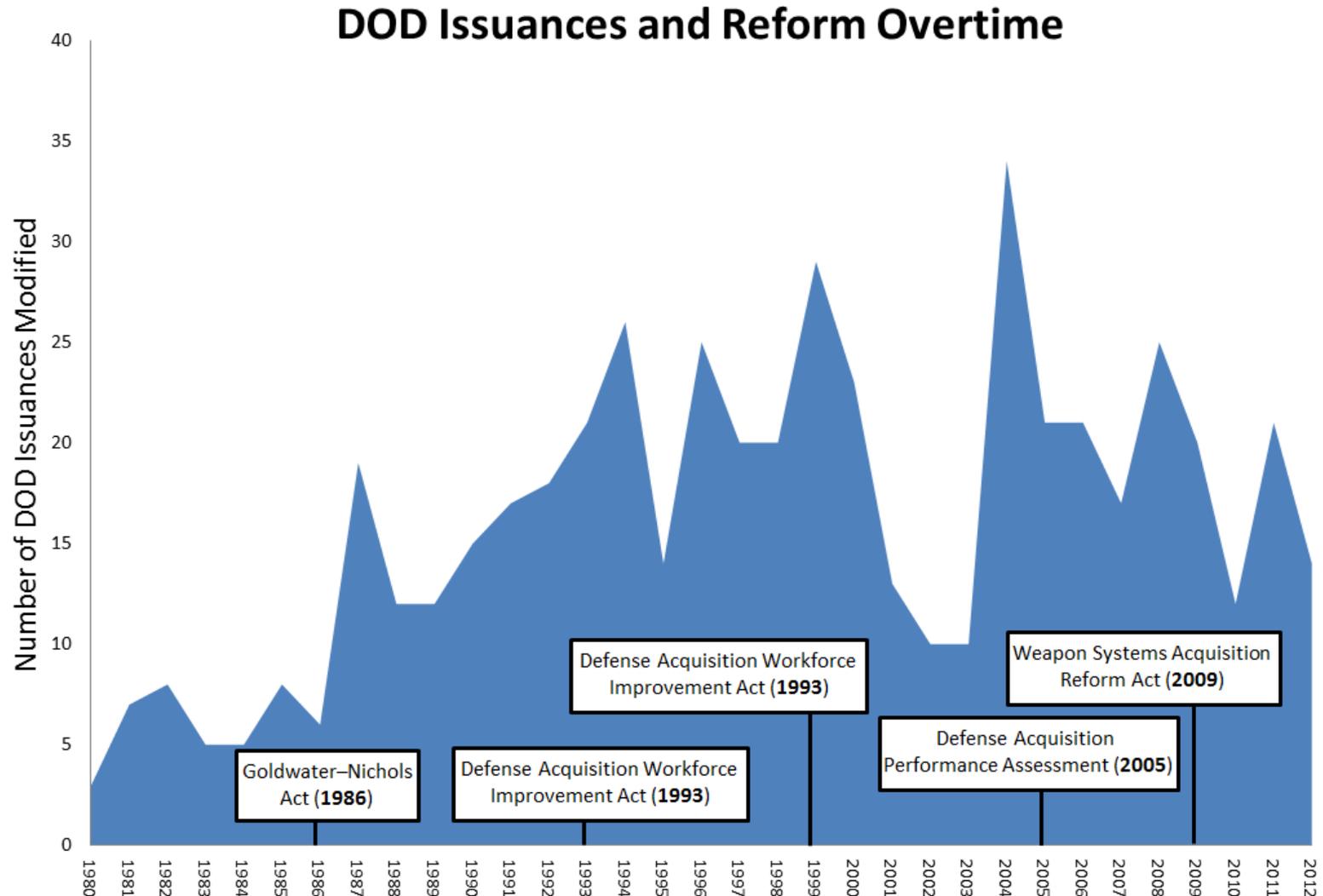
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Congress Has Increased Focus on Cost Overruns



1982 Nunn-McCurdy Legislation Focused on Two Types of Cost

$$\text{Program Acquisition Unit Cost (PAUC)} = \frac{\text{Development Funding + Procurement Funding}}{\text{Total \# of Units Procured}}$$

$$\text{Average Procurement Unit Cost (APUC)} = \frac{\text{Procurement Funding}}{\text{Total \# of Units Procured}}$$

2009 WSARA Defined Two Types of Nunn-McCurdy Breaches

Congressional notification by the military department is required if any of these thresholds are exceeded

Significant

Unit Cost	Current Budget	Original Budget
PAUC	15%	30%
APUC	15%	30%

Critical*

Unit Cost	Current Budget	Original Budget
PAUC	25%	50%
APUC	25%	50%

* Assumes termination unless Secretary of Defense certifies:

- Program is essential, necessary for national security, and no lesser cost alternative exists
- New total program cost estimates are reasonable
- Management structure is adequate to control costs

2009 WSARA Also Established PARCA in OSD

- Set up to do **P**erformance **A**ssessments **R**oot **C**ause **A**nalyses of major acquisition programs
- Small office and tight reporting deadlines (45-60 days for RCAs) meant PARCA needed help—primarily FFRDCs
- To date RAND has analyzed 9 programs and studied several management topics for PARCA

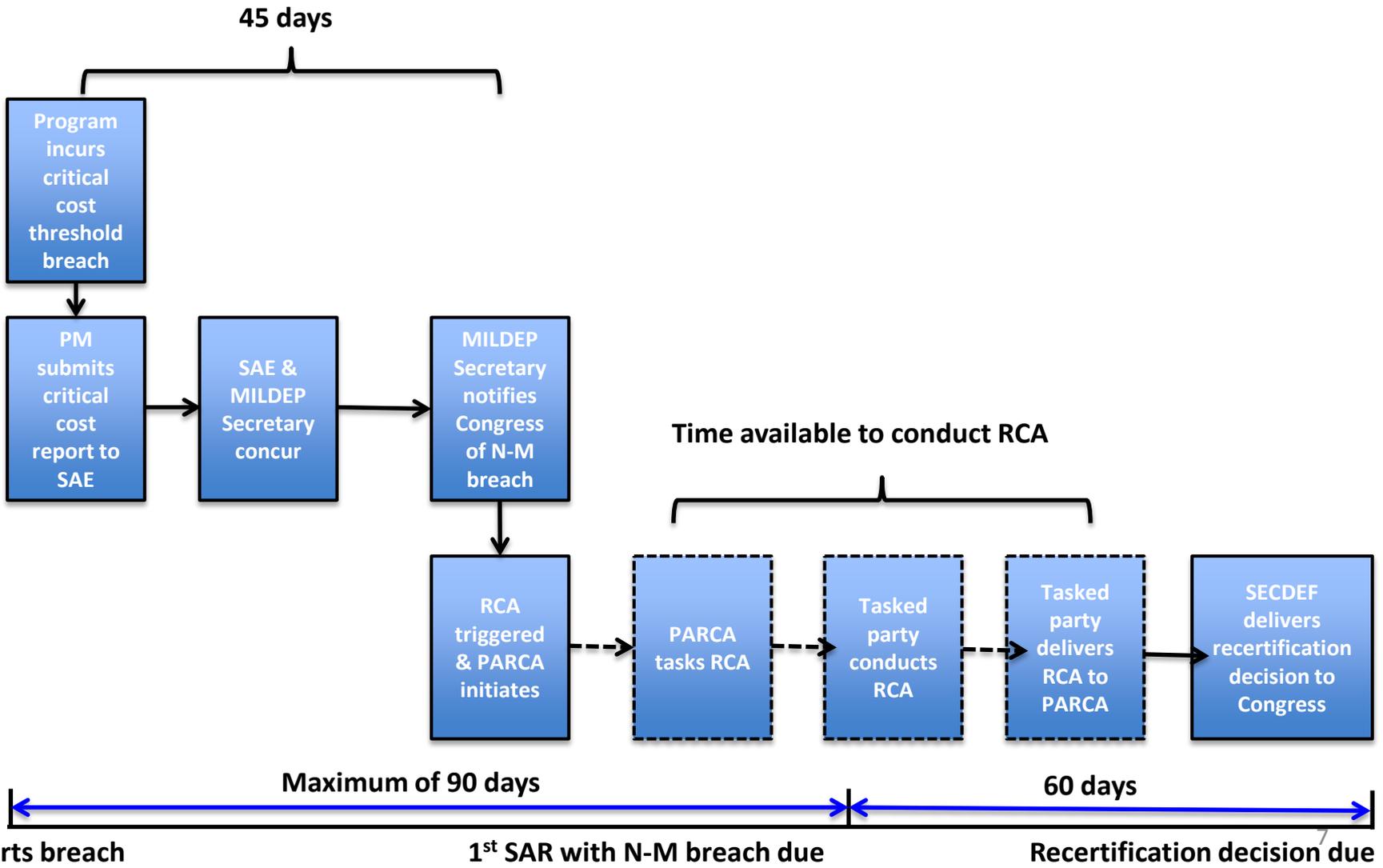
Outline

- **RCA methodology**

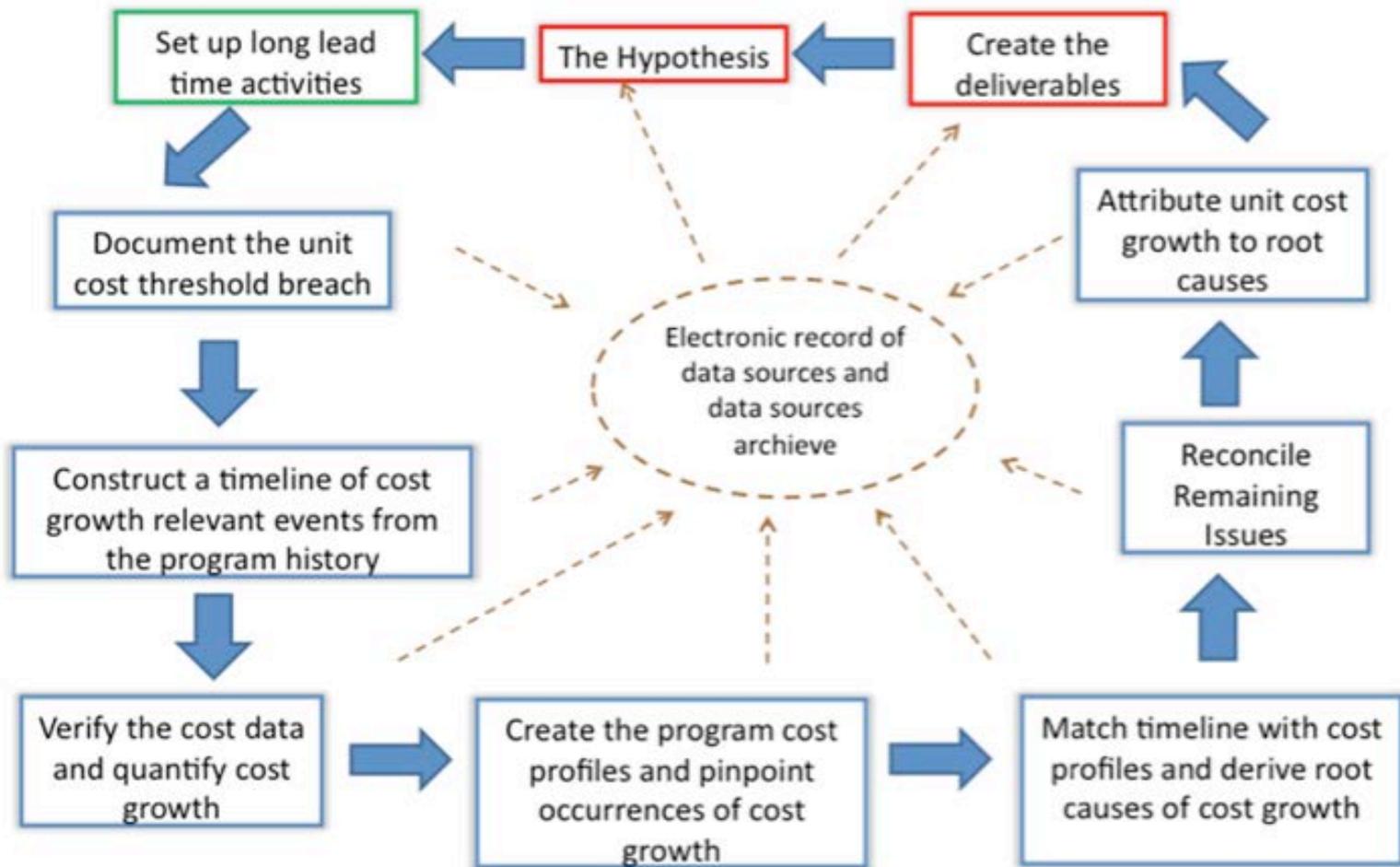
- Wideband Global Satellite Example

- Common trends in RCAs

Time Available for RCAs Is Short



RAND Has Developed an RCA Methodology That Meets Timelines



Understanding Framing Assumptions Helps RCAs

- **A Framing Assumption (FA) is any supposition central to shaping cost, schedule, or performance expectations**
- **FAs have these characteristics:**
 - **Critical: Significantly affects program expectations**
 - **No work-arounds: Consequences are not easily mitigated**
 - **Fundamental: Not derivative of other assumptions**
 - **Program Specific: Not generically applicable to all programs**

Source: Husband, OSD/AT&L/PARCA, Sep 13

Outline

- RCA methodology

- **Wideband Global Satellite Example**

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Wideband Global Satellite Meets Military Need for Military SATCOM

- **Consists of three “blocks”**
 - **Block I is 3 satellites (now in orbit)**
 - **Block II is also 3, but one is for Australia**
 - **Block II_f is 2 satellites**
- **Total buy is planned for 12 satellites**
- **A procurement gap occurred between blocks I and II and between II and II_f**

WGS Costs Increased Substantially and Incurred N-M Breach

- Block II was about 50 % more expensive than Block I
- Block II was about 50 % more expensive than Block I—breach occurred here

Source: Secretary of the Air Force briefing charts

	Original Budget	Current Budget	Current Estimate (Dec 09 SAR)	% Change Current Budget	% Change Original Estimate
PAUC	\$326M	\$358M	\$424M	18	<30
APUC	\$268M	\$294M	\$374M	27	40

Significant breach

Critical breach

Significant breach

Source: WGS SAR, December 2009

Why Did the Program Breach?

	Component of Increase	Block IIf Cost
1	Boeing price (BY 2007\$)	\$355M (Block II cost)
2	3% Cost overrun	\$11M
3	Actual unit costs (BY 2007\$)	\$366M
4	Four years' inflation at 3.5% per year	\$54M
5	Expected unit cost ~ 2011	\$420M
6	Extra tests	\$2M
7	Higher component prices for 3 items	\$35M
8	Higher component prices overall	\$25M
9	Subtotal	\$482M
10	15% risk premium	\$555M

First level WGS overrun

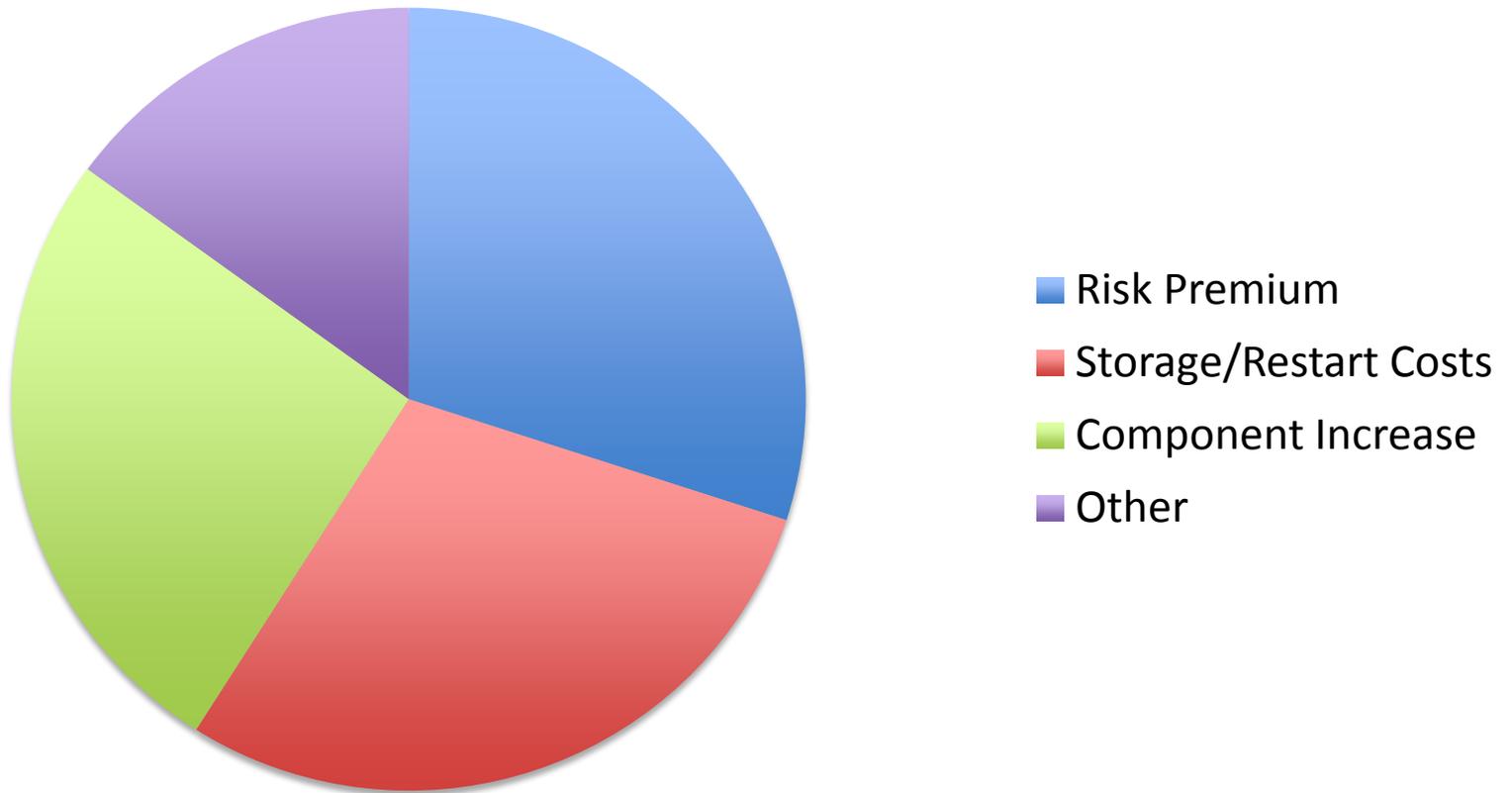
Historic experience (component & manufacturing)

Components at risk in the supply chain

Difference between Block II target cost and Block IIf ceiling cost

Risk Premium Was Largest Contributor to the Breach

% of Breach



Key Conclusions from WGS Breach

- **Storage and re-start costs go up when the commercial market no longer supplies components**
- **Acquisition costs of components also go up when not available in the commercial market**
- **Root causes of the breach are changes in the commercial market without corresponding changes in the WGS design and procurement, and obsolescence**

FA: Commercial market would support military technology needs and economies of scale

Outline

- RCA methodology
- Wideband Global Satellite Example
- **Common trends in RCAs**

Based on Past Research We Divided Root Causes into Three Categories

This category...	Includes these issues...
Planning	Baseline cost estimates, ambitious schedules, poor contract incentives, contract delays, not enough RDT&E, poor manufacturing processes, unrealistic performance expectations
Changes in Economy	Increases in component and labor costs, decreased private sector demand (component or technology), quantity changes (+/-), inflation, production delays
Program management	Unforeseen design, manufacturing, technology integration issues, poor government oversight or contractor performance, inadequate or unstable funding, accounting artifacts

Root Causes Spread Across the Six Programs Evaluated

Category	Root Causes	Significant Root Causes
Planning	21	3
Change in Economy	18	5
Program Management	11	2
	50	10

Root and Significant causes by program:

1. Wideband global satellite - 11
2. Apache - 9
3. DDG-1000 - 14
4. Joint Strike Fighter - 13
5. Excalibur – 5
6. Navy ERP - 8

Significant Root Causes:

- Poor contractor incentives (1)
- Immature technologies (2)
- Increase in component costs (1)
- Production delays (2)
- Quantity changes (2)
- Unanticipated design, manufacturing, integration (2)

Key Takeaways

- Programs reveal some common characteristics, BUT also important differences—policymakers need to understand causes do not stem from common source
- Quantity changes happen a lot, but they are *rarely* the root cause of a breach; typically reflects some other cause
 - All six programs analyzed had quantity changes
 - Typically, quantity change was a symptom, not a cause
- DoD should:
 - Understand early testing regimes and number of test articles required
 - Stipulate cost methodologies that rely on commercial production
 - When a program depends on product improvements, ensure clear understand of time in inventory, ongoing R&D, and periodic program upgrades

Questions?

Root Cause Analysis

Published Reports

- **Root Cause Analyses Completed & Published**
 - **RAND 1171.1 –OSD Report**
 - **AB3; Longbow Apache**
 - **DDG-1000; Zumwalt-Class Destroyer**
 - **Joint Strike Fighter (with Univ. Tenn. & IDA)**
 - **Wideband Global Satellite**
 - **RAND 1171.2 –OSD Report**
 - **Navy ERP (Root Cause-like)**
 - **Excalibur**
 - **Analyzing program Risk and Complexity**
 - **Root Cause Analysis Procedures Technical Report TR1248-OSD**

Root Cause Analysis cont'd

Published Reports

- **RAND 1171.3 – OSD Report (FOUO)**
 - **JTRS GMR**
 - **P8 (Root Cause-like)**
 - **Global Hawk MOD (Root Cause-like)**

- **RAND 1171./4 OSD-Management Perspectives Pertaining to Root Cause Analyses of Nunn-McCurdy Breaches**
 - **PM Tenure**
 - **Oversight of ACAT II Programs**
 - **Framing Assumptions**

- **EELV- PR-659 – OSD; FOUO and Propin**

Root Cause Analyses Cont'd

Underway or Recently Published

- RAND 1171.5-OSD Report; Comparing Army and Commercial Advanced Waveform Developments and Analyzing Acquisition Programs with Multiple Nunn-McCurdy Breaches;**
- RAND 1171.6-OSD Report ; Management Perspectives Pertaining to Root Cause Analysis of Nunn-McCurdy Breaches, Volume 6: Contractor Motivations and Anticipating Breaches; in publication**
- Identifying Acquisition Framing Assumptions through Structured Deliberation; in publication**
- Acquisition of Space Systems, Volume 7: Past Problems and Future Challenges**

Root Cause Analyses Underway cont'd

Underway or in Review

- Portfolio Analyses; Jennifer Kavanagh et al
- PR-796-OSD; Workforce Productivity; Enabling the Defense Acquisition Workforce to Meet the National Security Needs of the Future Workforce (McInnis et al)
- EVM: (Yardley et al)
- Knowledge Management System (McKernan)
- New Nunn-McCurdy breach analyses as directed
 - JPALS

Common Root Causes

Category	Root Cause of Nunn-McCurdy Breach	WGS	Apache	DDG - 1000	JSF	Excalibur	Navy ERP
Planning	Underestimate of baseline cost	✓	✓	✓	✓		✓
	Ambitious scheduling estimates			✓	✓		✓
	Poorly constructed contractual incentives	✓✓			✓		✓
	Immature technologies		✓✓	✓	✓✓		
	Ill-conceived manufacturing process			✓			
	Unrealistic performance expectations			✓		✓	✓
	Delay in awarding contract			✓			✓
	Insufficient RDT&E	✓	✓	✓	✓		
Changes in economy	Increase in component costs	✓✓	✓	✓	✓	✓	
	Increase in labor costs		✓		✓	✓	
	Discontinued/decreased production of components	✓					
	Decreased demand for similar technology in private sector (economies of scale)	✓					
	Inflation	✓	✓	✓	✓		
	Production delays	✓✓		✓	✓✓		
	Change in procurement quantities						
	Increase	✓	✓✓				✓
	Decrease			✓✓	✓	✓	
Program management	Unanticipated design, manufacturing, and technology integration issues		✓✓	✓	✓✓		✓
	Lack of government oversight or poor performance by contractor personnel			✓	✓		
	Inadequate or unstable program funding	✓	✓	✓	✓	✓	✓
	Accounting artifact	✓					

Note: ✓—Root cause, ✓✓—Significant root cause