



OBSERVATIONS FROM ROOT CAUSE ANALYSIS

RAND in Support of PARCA

May 2012

**Charles Nemfakos
NPS Acquisition Symposium**

Performing Root Cause Analysis

- **Others have/will cover the enabling legislation, PARCA duties and responsibilities and relationships**
- **Characteristics of effort**
 - **Be factual**
 - **Be concise**
 - **Be timely**
- **Requires a multi-disciplinary approach**

Analytical Approaches

- Sodium pentothal



- Torture



- What did people say happened (anecdotal)



- Facts from various sources

Just the facts, mam.
Just the facts.



**Consistent with the Express Direction From
PARCA We Went with Facts.**

“Just the Facts”

- **Voluminous amount of material**
 - **Acquisition databases**
 - **Budgetary exhibits and justification material**
 - **Congressional testimony**
 - **Open sources**
 - **Interviews**
- **Mix of classified, proprietary, business sensitive and other data**
- **Reconciliation is sometimes required.**

Analyses Performed

- **Root Cause Analyses (both Nunn-McCurdy breaches and others)**
 - **AB3; Longbow Apache**
 - **DDG-1000; Zumwalt-Class Destroyer**
 - **Joint Strike Fighter (with Univ. Tenn. & IDA)**
 - **Wideband Global Satellite**
 - **Navy ERP**
 - **Excalibur**
 - **JTRS-GMR**
 - **P8 Aircraft**
 - **EELV**
- **Over twenty professional staff applied to this group of program analyses**

Root Cause Related

- **Examination of Management Issues**
 - **Nunn-McCurdy Repeaters**
 - **Nunn-McCurdy Predictions**
 - **Program Manager Tenure**
 - **WSARA Law related to Mil Departments**
 - **Root Cause Knowledge Management**
 - **Root Cause Global Hawk Modifications**
 - **Root Cause Framing**

Our Perspectives Are Informed By Both

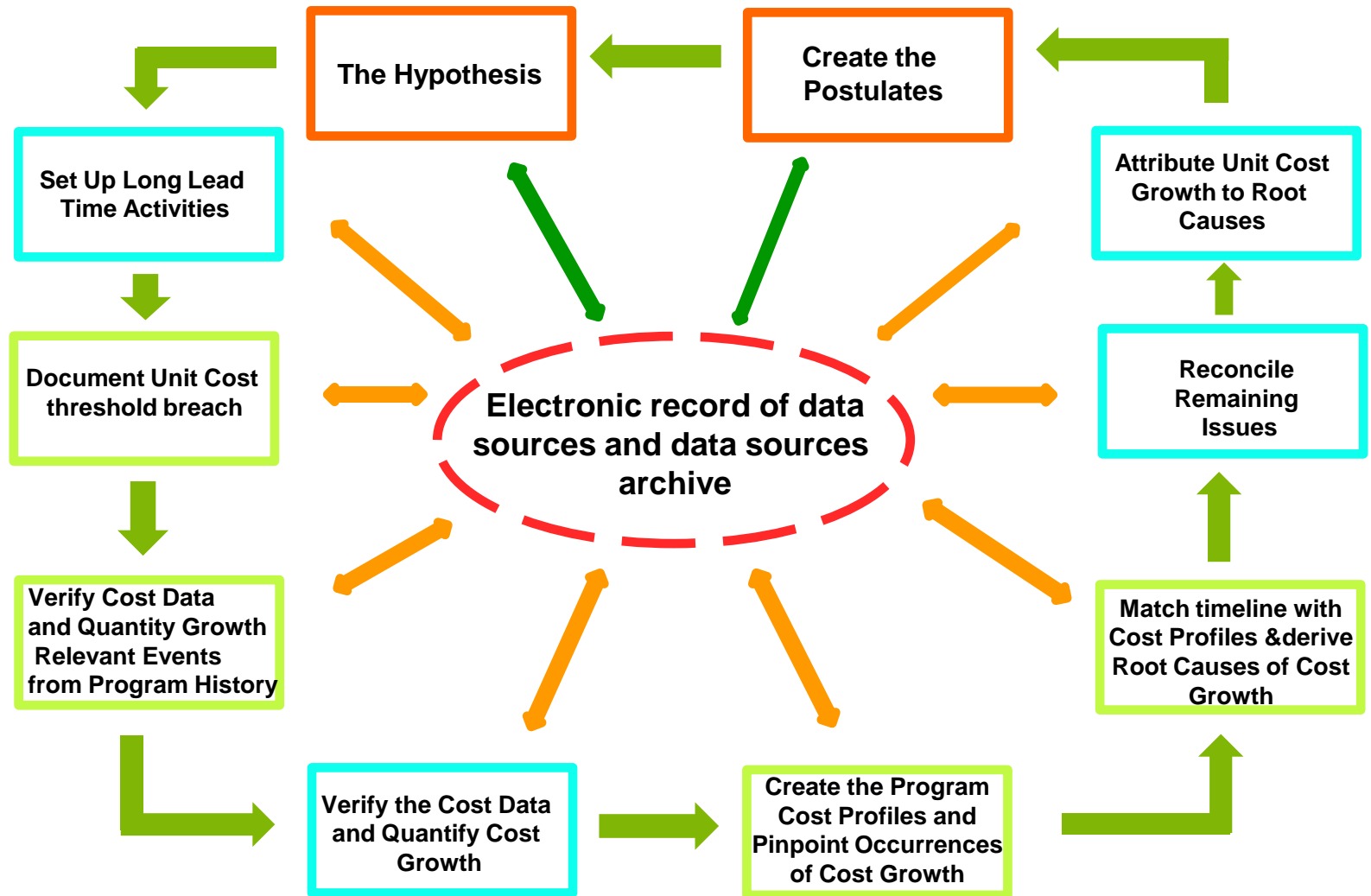
Program Differences

- Each of the programs analyzed was different (Kendall's point on program structure)
- But some common issues pertain

Category	Root Cause of Nunn-McCurdy Breach	Apache	DDG-1000	ERP	Excalibur	JSF	WGS	JTRS GMR
Planning	Underestimate of baseline cost	✓	✓	✓✓		✓	✓	
	Ambitious scheduling estimates		✓	✓	✓	✓		✓
	Poorly constructed contractual incentives			✓✓		✓	✓✓	
	Immature technologies	✓✓	✓		✓	✓✓		✓✓
	Ill-conceived manufacturing processes		✓					
	Unrealistic performance expectations		✓	✓				✓✓
	Delay in awarding contract		✓					
	Insufficient RDT&E	✓	✓			✓	✓	
Within DoD Control	Production delays		✓		✓	✓✓	✓✓	✓
	Change in procurement quantities							
	Increase	✓✓					✓	
	Decrease		✓✓	✓	✓✓	✓		✓✓
	Program Oversight	Unanticipated design, manufacturing, or technology integration issues	✓✓	✓	✓	✓✓	✓✓	
Lack of government oversight and/or poor performance by contractor			✓		✓	✓		

- Approach has to be flexible to cover the differing program characteristics and issues involved

RAND Uses an Iterative Approach to Root Cause Analysis (RCA)



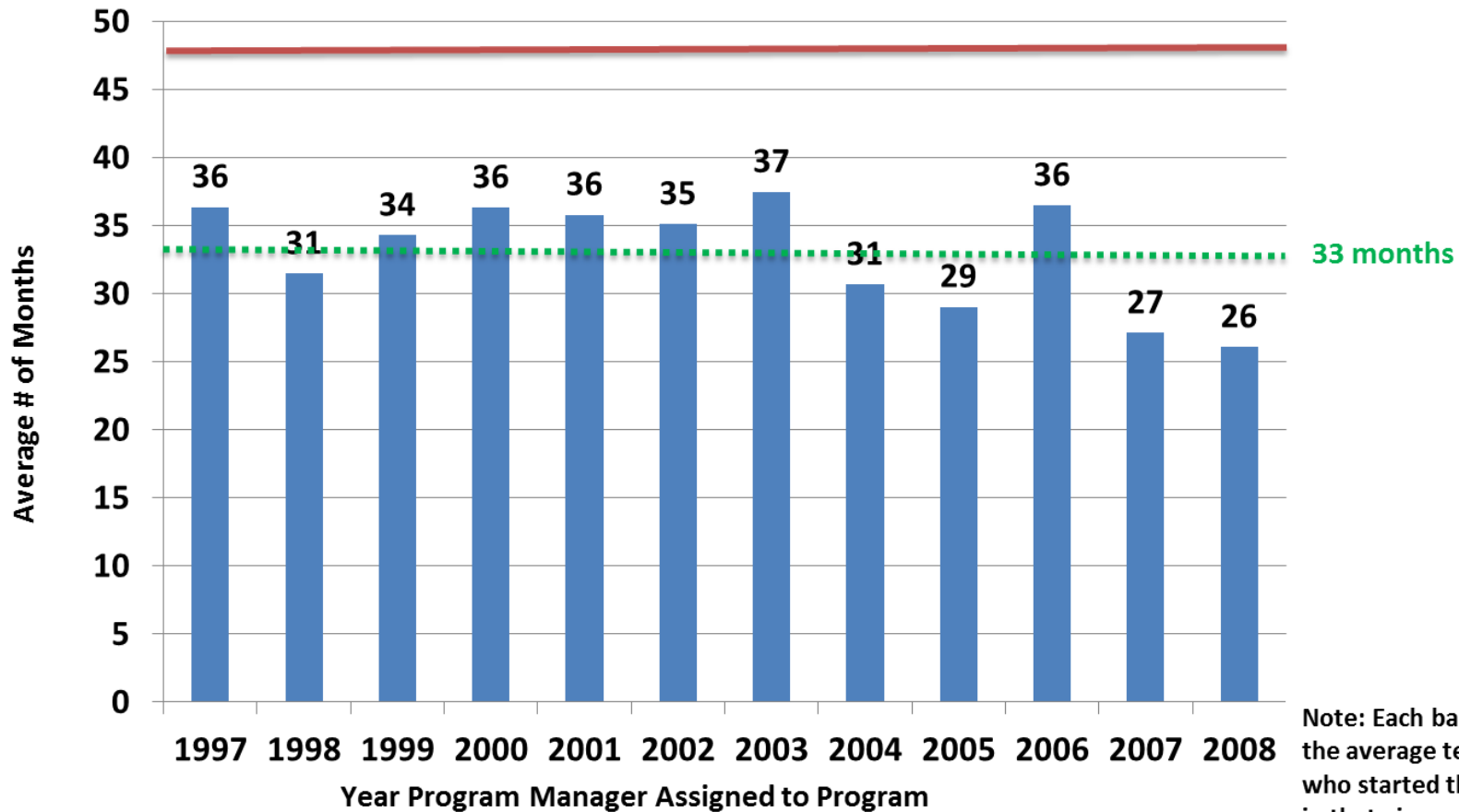
RAND Important Perspectives From RCA

- **Several lessons stand out**
 - **Need to understand the interrelationship of major modernization programs (FCS)**
 - **Revolving program management is the antithesis of program stability (F-35)**
 - **If a program depends upon a commercial base, keep an eye on that base (WGS)**
 - **For ERPs, distinguish between IT software and business re-engineering as an IT program**
- **Need to go beyond metrics used generally in acquisition program oversight**

Interesting Issues Identified in the Process of Both RCA and Management Questions

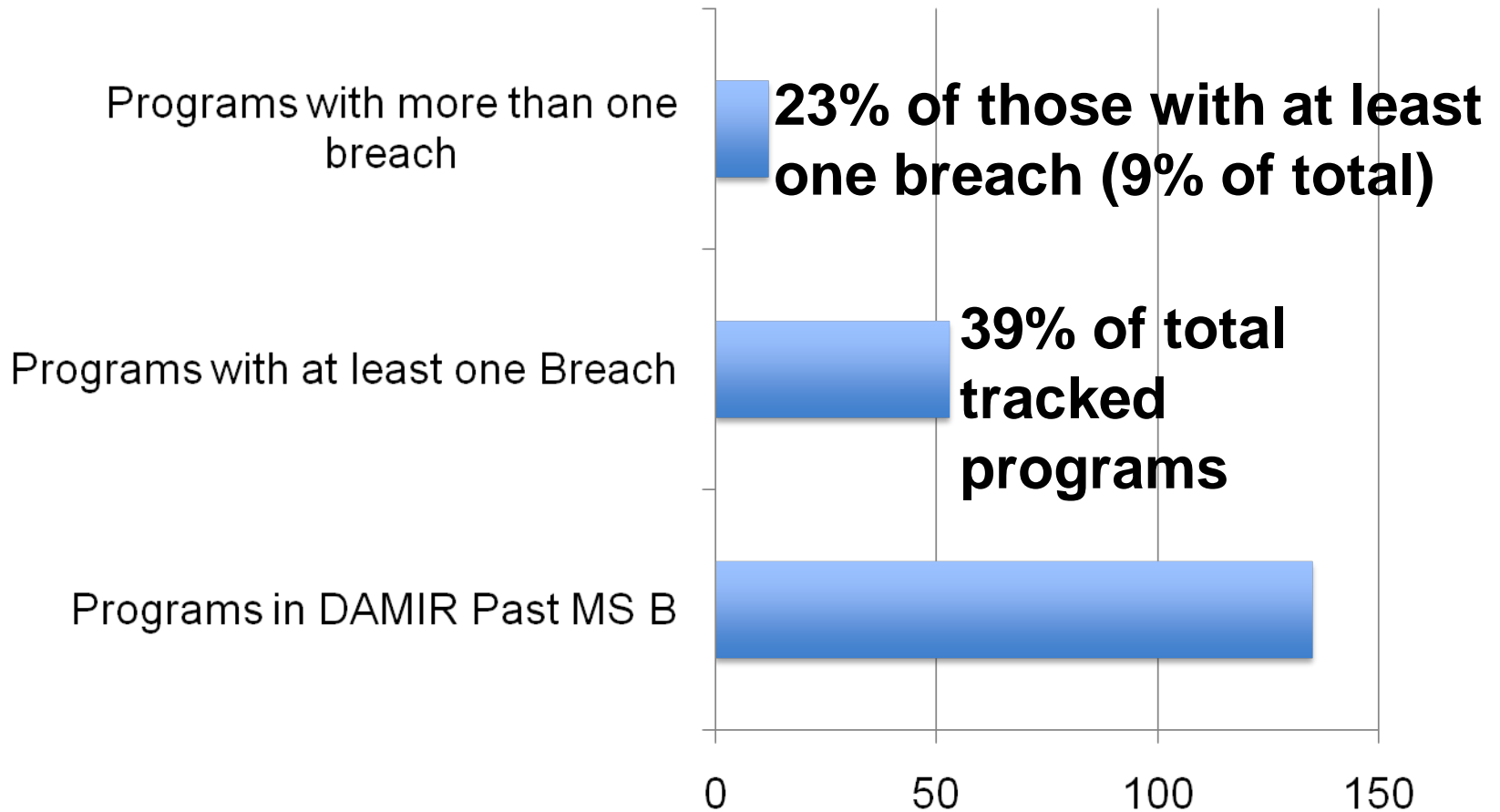
- **PM Tenure**
 - Not identified as a Root Cause
 - An examination across all MDAPs suggest an average of close to 3 years
 - Average tenure is sensitive to calculation methodology
- **Financial Stability**
 - For major programs resource decisions were driven, not driving
- **Multiple Breaches**
 - No single reason between programs and across individual program multiple breaches
- **Framing Assumptions (Examples)**
 - Understanding risk
 - COTS/commercial base
 - Use of simulation

Program Manager Tenure



Note: Each bar represents the average tenure of PMs who started their assignment in that given year.

Populations Demographics (based on DAMIR since 1997)



Definition and Examples of “Framing Assumptions”

- Framing assumption definition: *Any explicit or implicit assumptions that are central in shaping cost, schedule, and/or performance expectations*
- Unique to a program; not universal to all programs

A framing assumption is...	A framing assumption is not...
A unique aspect of contracting strategy (e.g., competitive prototyping)	The contractor will perform well
Weapon system to be replaced will last until a specified time	Program characteristic (e.g., family of systems)
Use of COTS / GOTS will save money	Program is affordable

Back up



Identified Framing Assumptions of Past RCAs

Technical	Management/Program Structures	Mission Requirements
Reliance on commercial technology increases likelihood of achieving technical program goals. (P-8A, WGS, ERP)	Reliance on commercial initiative/standards insulates the program from risk. (P-8A, WGS, ERP)	Low possibility for emergence of a substitute good. (JTRS)
Successful sub-system testing predicts overall technical program success. (JSF, Excalibur, AB3, DDG1000)	Threats to program funding are an incentive to manage program risk. (ERP, DG1000, JSF).	Constancy with joint capability requirements (JSF)
Simulations can substitute for or reduce full scale testing. (JTRS, JSF)	Management changes do not detract from program outlook. (JTRS, JSF)	Reliance on commercial technology shields program allows program to adapt quicker to changing operational requirements. (P-8A)
New testing/manufacturing approaches can reduce historic number of test articles (JTRS, JSF, P-8A)	Program sub-component/integration risks not a geometric risk function (JSF, AB3, DDG1000, JTRS, Excalibur)	

Apache Breach Root Cause

- **Root Cause**
 - **Quantity increase**
 - **58 new build aircraft (100% new) added to retrofit program (30% new)**
 - **Buy new fuselages; unavailability of airframes**
- **Major Contributors**
 - **Immature technologies**
 - **Incorporate 15 cutting edge technologies**
 - **Unanticipated design, manufacturing, or technology integration issues**
 - **Increase in non-recurring engineering costs to reflect post MS B knowledge & experience**



DDG-1000 Breach Root Cause

- **Root Cause**
 - **Quantity decrease**
 - **Reduction from 10 ships at MS B to 3 ships due to affordability issues**
- **Major Contributor**
 - **7 program planning issues contributed to cost growth**
 - **None were significant individually, but collectively may have been significant**
 - **Underestimation of baseline cost**
 - **Ambitious schedule**
 - **Immature technologies**
 - **Ill-conceived manufacturing process**



JSF Breach Root Cause

- **Root Cause:**
 - **Numerous Immature technologies**
 - **Complex integration**
 - **Reliance on unproven innovations to contain program costs**
 - **Prototype did not demonstrate new technologies**
- **Major Contributors:**
 - **Production delays**
 - **Aggressive and highly concurrent schedule**
 - **Affordability required fast ramp to high production rates**
 - **Unanticipated design, manufacturing, and technology integration issues, including weight growth and design issues**



Excalibur Breach Root Cause

- **Root Cause:**
 - **Quantity decrease**
 - **Reduction from 30K to 7K projectiles due to affordability and lack of customer demand**
- **Major Contributor:**
 - **Unanticipated design, manufacturing, or technology integration issues**
 - **Early program cost estimates highly inaccurate and insensitive to reductions in quantity**



WGS Breach Root Cause

- **Root Cause:**
 - **Production delays**
 - **2.5 year hiatus between Blocks II and III**
 - **Options allowed to expire; multi-year procurement breaks**
 - **Storage and restart costs**
- **Major Contributors:**
 - **Increase in component costs**
 - **Commercial marketplace no longer supports WGS systems which have not changed in 10 years**
 - **Poorly constructed contractual incentives**
 - **15% risk premium with limited evidence of risk**



JTRS GMR Breach Root Cause

- **Root Cause:**

- **Quantity fell from 86K to 10K radios**
 - **Cancellation of FCS**
 - **Performance issues which reduced the size of the WNW network**
 - **Emergence of lower cost, lower SWAP alternatives**



- **Major Contributors:**

- **Immature technologies & unrealistic performance expectations**
 - **“Mobile ad hoc networks” scalability up to 250 nodes assumed, but field experiments only achieved a 30 node network size**
- **Unanticipated design issues**
 - **Demonstrated limitations on network size required a redesign of the network architecture, which employed fewer GMRs**

Most of the Significant Root Causes Are Within DoD Control

- **Planning and program oversight issues – which are within DoD’s control – are significant root causes of cost growth**
 - **5 of 7 RAND analyses identify planning issues**
 - **All 7 RAND analyses identify program oversight issues**
- **Only one program (WGS) showed economic issues as a significant root cause of cost growth**
- **Related root causes can be collectively significant**
 - **7 planning issues in DDG case contributed to cost growth though no single planning issue was a significant root cause**

RAND Team

- **Mark Arena**
- **Irv Blickstein***
- **Mike Boito**
- **Abby Doll**
- **Jeff Drezner**
- **James Dryden**
- **Mel Eisman**
- **Dan Gonzales**
- **Chelsea Kaihoi**
- **James Kallimani**
- **Jennifer Lamping**
- **Martin Libicki**
- **Dan McCaffrey**
- **Brian McInnis**
- **Megan McKernan**
- **Mike McMahon**
- **Roger Molander**
- **Charlie Nemfakos***
- **Chad Ohlandt**
- **Jan Osburg**
- **Jessie Riposo**
- **Rena Rudavsky**
- **John Schank**
- **Jerry Sollinger**
- **Dan Tremblay**
- **Kathy Webb**
- **Carolyn Wong**
- **Erin York**
- **Stephanie Young**