



Observations from AT&L/PARCA's Root Cause Analyses

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Root Cause Analysis Functions

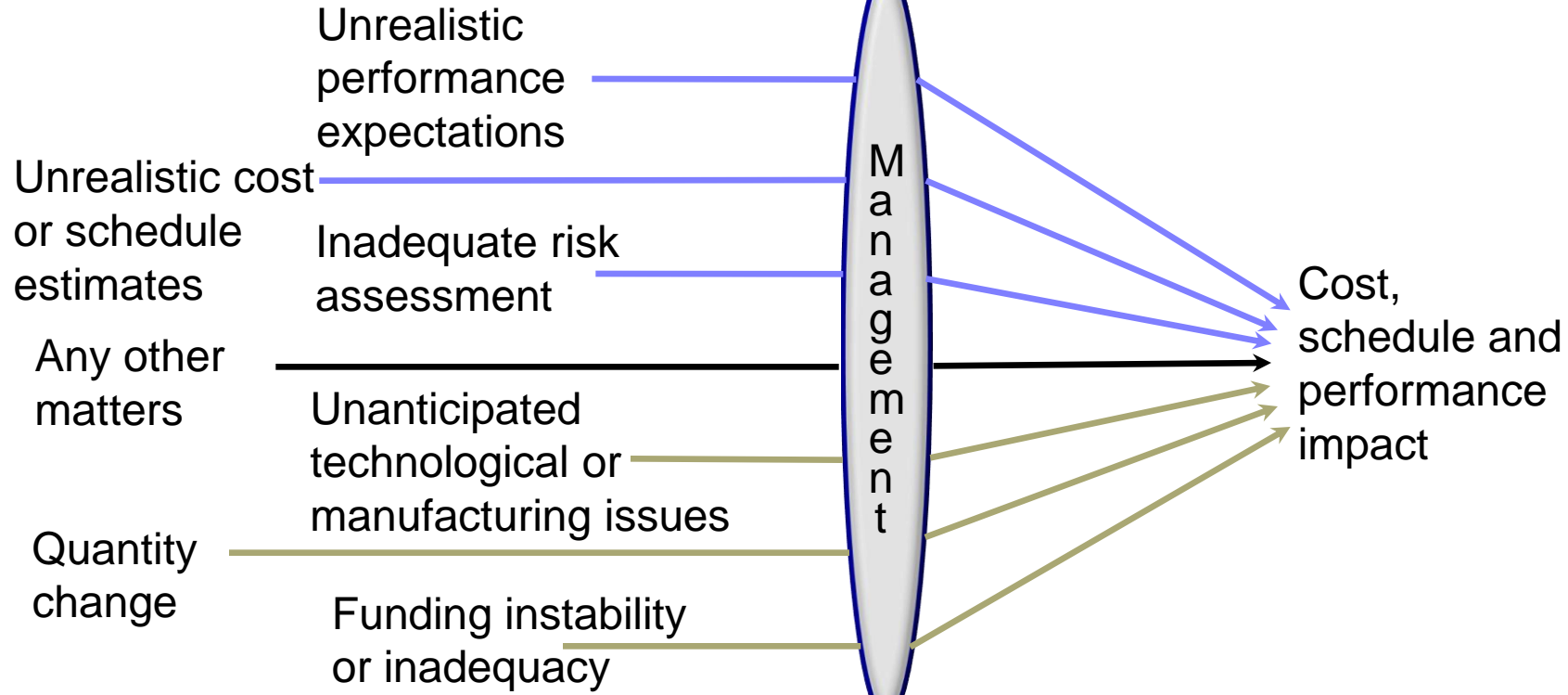
- ▶ Statutory duties defined in WSARA 09
 - Conduct root cause analyses for major defense acquisition programs.
 - As part of the Nunn-McCurdy breach certification process.
 - WSARA 09 states that the Secretary of Defense shall*
 - (1) determine the root cause or causes of the critical cost growth*
 - (2) If program is not terminated, restructure the program in a manner that addresses root cause or causes of the critical cost growth*
 - Issue policies, procedures, and guidance governing the conduct of root cause analyses.
- ▶ Identification of lessons learned for the benefit of acquisition community.



Analytical Framework

INCEPTION

INCENTIVES



EXECUTION

Problems will occur: why they occur and our response to them are crucial subjects for root cause analysis.



Preliminary Trends

	Programs											
Inception Issues	A	B	C	D	E	F	G	H	I	J	K	L
Unrealistic cost or schedule estimates			X	X					X	X	X	
Immature technology, excessive manufacturing, integration risk												
Unrealistic performance expectations		X										
Other									X			
Execution Issues												
Change in procurement quantity			X	X				X				
Inadequate funding/funding instability												
Unanticipated design, engineering, manufacturing or technology issues	X											
Poor performance			X			X	X		X		X	X
Other												

Root causes must be true AND relevant.



Overview

- ▶ **Unrealistic Estimates**
- ▶ **Changes in Quantity**
- ▶ **Performance**

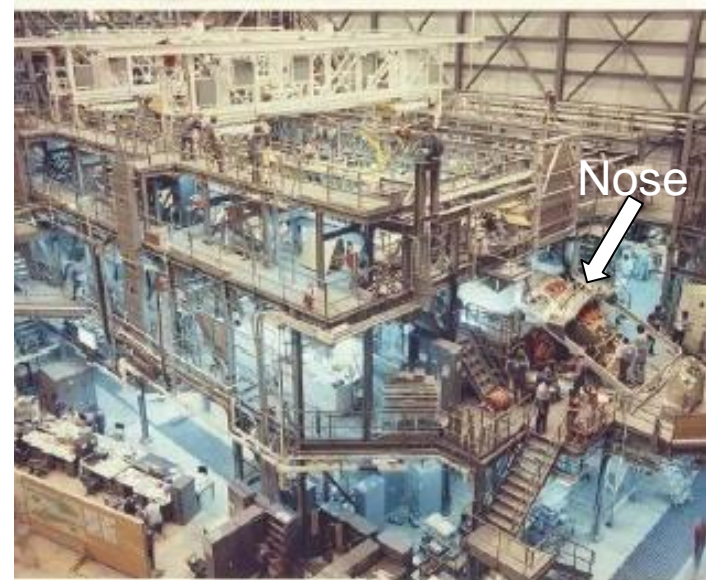


Why are Estimates Unrealistic?

- ▶ Unrealistic estimates are generally caused by the invalidity of major assumptions NOT methodological errors.



Orbiter Processing Facility Concept (1974)



Actual Orbiter Processing Facility

- ▶ The cost estimating community can and should challenge assumptions but the acquisition community formulates them.
- ▶ Consideration of this has led to “framing assumptions”



Estimating Assumptions Flow from Framing Assumptions

Framing Assumptions

Design is mature
(Prototype design is close to Production-Ready)

Consequences

Production and development can be concurrent

Weight (critical for vertical lift) is known

Design can now be refined for affordability

Estimating Assumptions

Schedule will be more compact than historical experience

Weight will not grow as usual for tactical aircraft

Affordability initiatives will reduce production cost

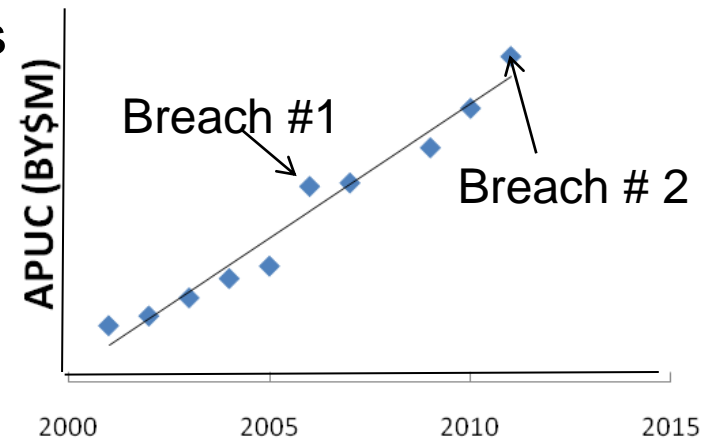
Responsible Communities:
Requirements, Technical, & Program Management
Cost Estimators

Cost and Schedule Estimates



Role in N-M Breaches

- ▶ When an invalid framing assumption is embraced:
 - Evidence of problems will accumulate
 - Cost and schedule estimates will need to be changed
 - But, the amount of growth will depend on
 - How promptly management recognizes the issues
 - How effectively management responds
- ▶ Further cost growth if the full implications of the invalid framing assumption are not addressed.



“It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so.” - Mark Twain



Correlation When Framing Assumption is Invalid

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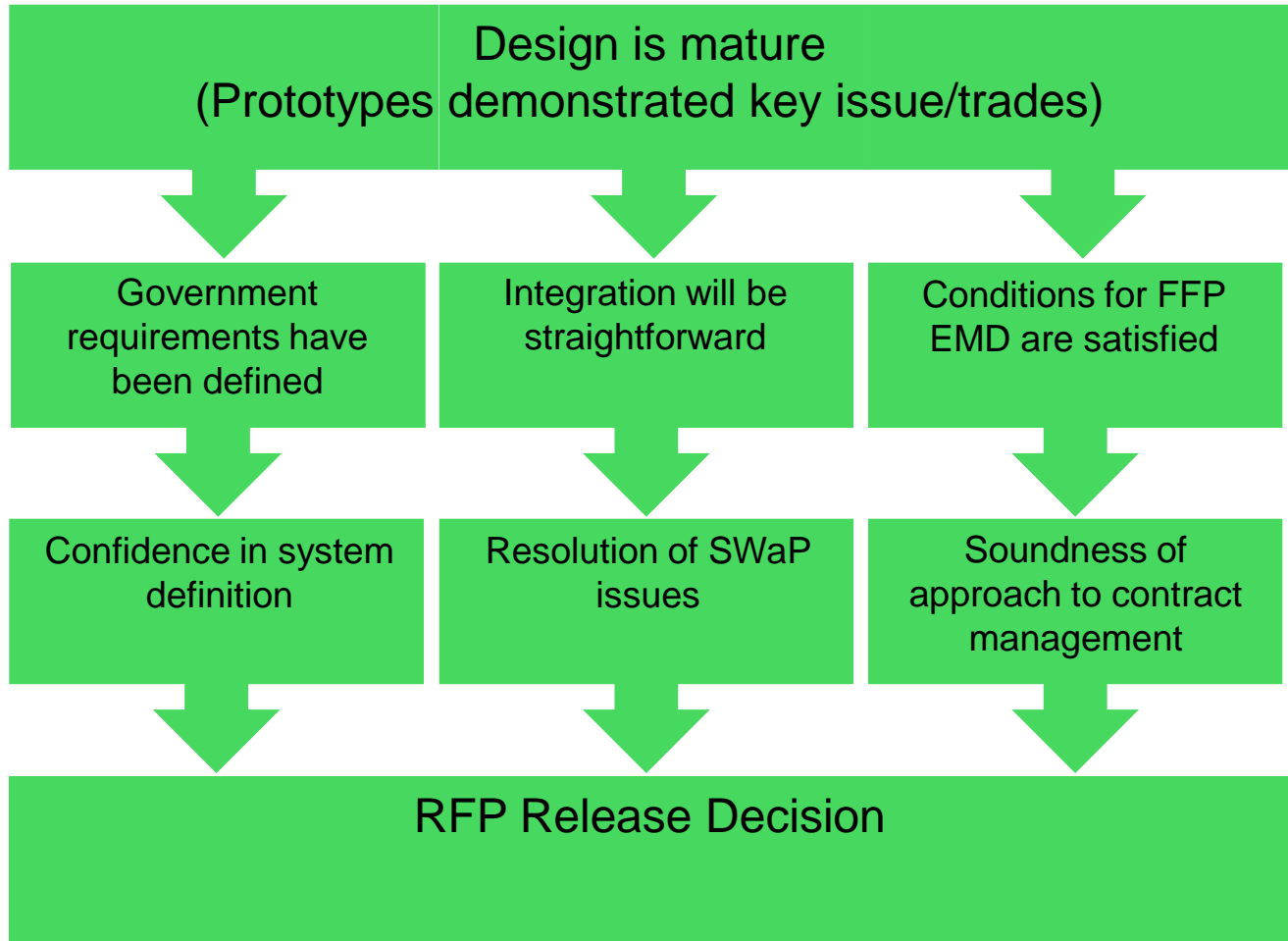
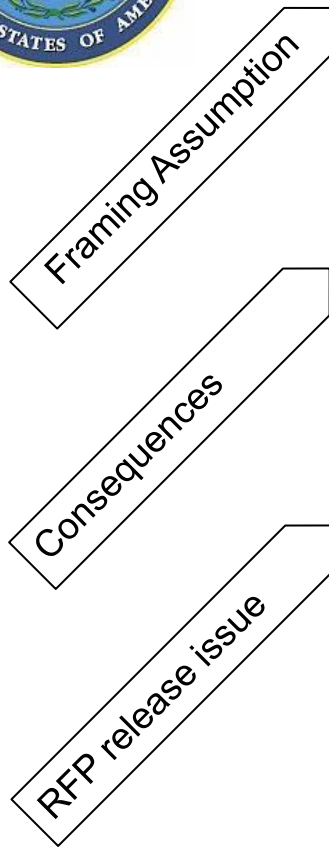


Framing Assumptions and Decision-Making

- ▶ Issues now are formed by “advocates” of particular subject areas:
 - Each subject area has particular metrics
 - Relationship of these to *overall* program success is never questioned
- ▶ Intent is to raise the key issues for the program irrespective of whether they are controversial
 - **First step:** Identify the right issues and know how they contribute to program success.
 - **Second step:** Establish what metrics are relevant to the issue’s contribution to program success.
 - **Third step:** Present the data to date for and against, including relevant historical programs that are capable of discriminating outcomes.
 - **Fourth step:** Generate baseline forecasts of how the data will evolve if the thesis is correct . . . And vice versa. Track data and report.



Constant set of Assumptions for a Variety of Decisions



Concept will be piloted this year



Overview

- ▶ **Unrealistic Estimates**
- ▶ **Changes in Quantity**
- ▶ **Performance**



Quantity Changes

- ▶ To consider a quantity change to be a root cause, PARCA has defined two conditions:
 - The reason for the change was outside the control of the acquisition community.
 - Doctrinal or threat change
 - “Pure” fiscal constraints
 - Other cost growth would not have caused a breach without the quantity change.
- ▶ To date, PARCA has observed that quantity changes were due to factors within the control of the acquisition community in about half of the cases.

but NOT

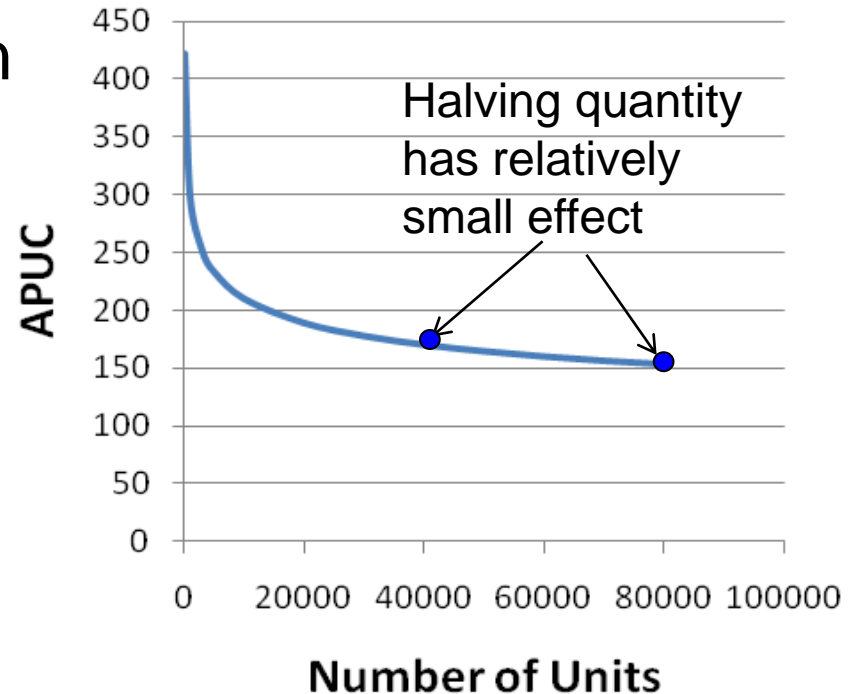
- Escalating unit costs
- Schedule slips

The reason for the quantity change is crucial to management.



The Impact of Changing Quantity Depends on Other Decisions

- ▶ Quantity change in isolation mainly impacts PAUC.
 - RDT&E amortized over fewer units.
 - Modest learning effects on APUC.
- ▶ Two separate decisions often affect unit costs as much as the quantity change itself.
 - Reduce annual buy or curtail program.
 - The mix of systems can change (or confuse) unit costs.





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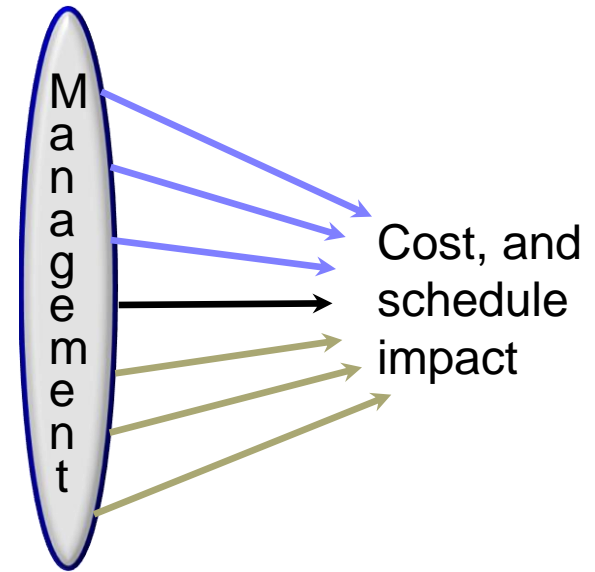
Poor Management Performance

➤ Management performance is the lens through which all program issues are addressed.

- Contractor
- Program Office
- PEO
- OSD

➤ PARCA has found issues in three broad areas.

- Systems engineering
- Contractual incentives
- Organizational awareness and response



A critical but difficult area to assess.



Systems Engineering

- ▶ General observations.
 - High potential as a significant or a root cause because systems engineering critical for complex systems.
 - Process definition required but can dominate substance.
 - “Strong in process but weak in integration” – PMO assessment
 - Recognizing poor systems engineering early a challenge.
 - “Systems Engineering” too broad for actionable root causes.
- ▶ Areas where problems have been observed include:
 - Requirements management
 - Ambiguities in combining requirements documents.
 - Funding program to include all requirements.
 - Interface and environment management
 - Holistic performance attributes e.g. reliability, weight
 - Risk assessment



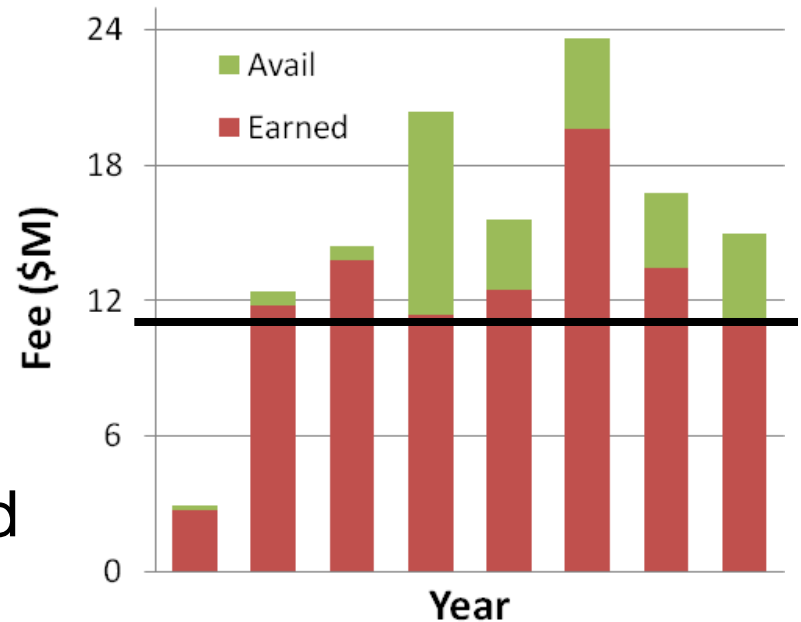
Effective Contracting Strategy

▶ Incentive evaluation

- Aligned with program goals and challenges
- Demanding yet achievable
- Sufficient to motivate
- No perverse effects
- Correct signal sent and received

▶ Incentive strategy

- Conditions for strategy satisfied?
- Consistent with corporate goals and position
- Consistent with policy

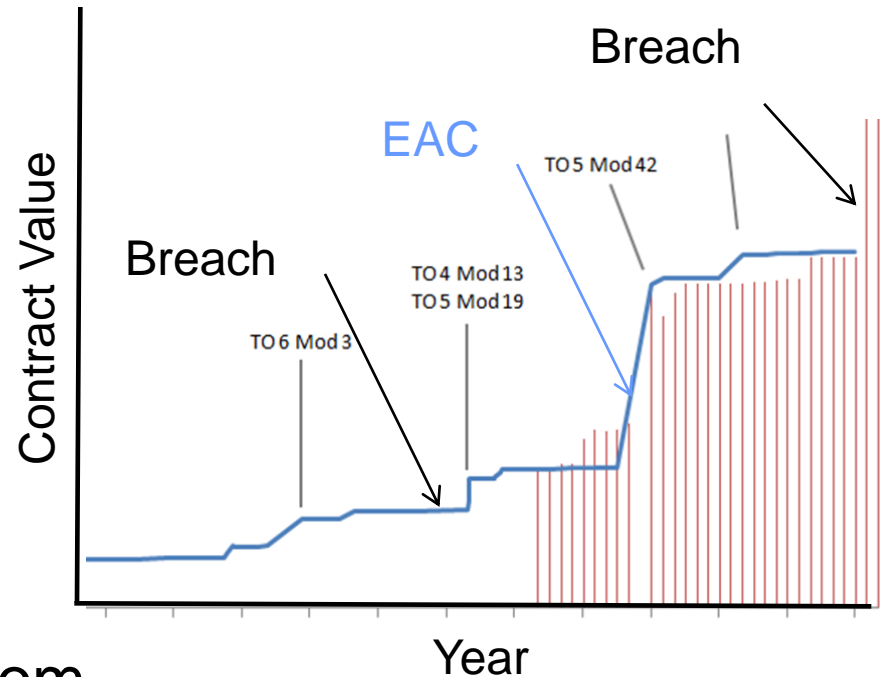


Government goals but contractor's perspective



Situational Awareness – Contract Performance v Program Performance

- ▶ Several cases where program content evolves
 - Work not understood
 - “Unfunded” requirement
 - Spiral development (almost by definition)
- ▶ Consequences require management
 - Contract performance differs from program performance
 - Discipline in program content
 - Budgetary pressure





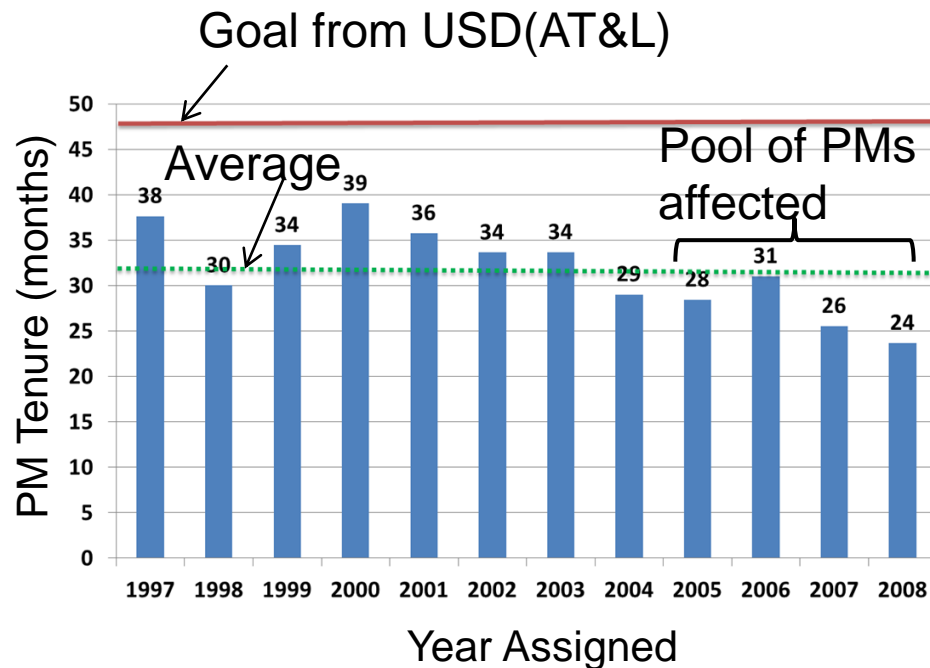
Organizational Response

► Direction

- Policy is a significant source of program postulates
- Implementation not assured e.g. PM tenure, ADMs

► Organizational performance issues appear to persist

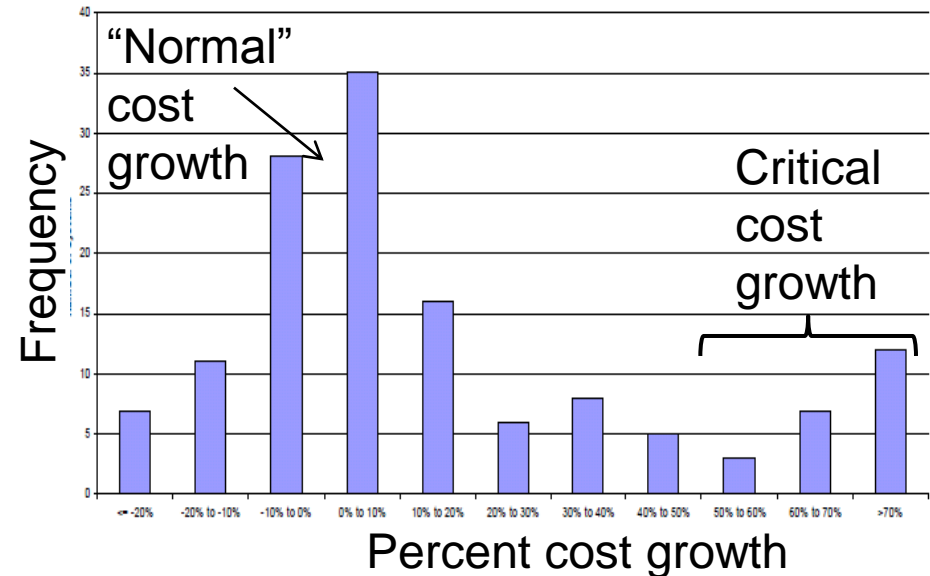
- Organizational problems identified at first breach ...
 - “Management and systems engineering processes were not in place”
 - Contractor “did not effectively tap ... expertise resident within team.”
 - “Concurrent activities increased program execution complexity.”
- ... are often still present at second.





Closing Comments

- ▶ PARCA's role in N-M process is to help identify program root causes so that we don't have more growth
- ▶ The broader issue is – can the breach be avoided altogether?
- ▶ PARCA's observations
 - Problem cost growth comes both from inception and execution issues
 - Inception issues are primarily due to invalid postulates
 - In execution, DoD does not always recognize all the implications of postulate invalidity and finds it difficult to identify and respond to evidence of invalid postulates and organizational issues.



Recognizing problems is the first step to solving them.