



Scrutinizing an Organization's Project Planning Performance

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Some Powerful Quotes

“Whoever wishes to foresee the future must consult the past; for human events ever resemble those of preceding times.”

- Niccolo Machiavelli

“People don't care how much you know until they know how much you care.”

- Theodore Roosevelt

“Those that fail to learn from history, are doomed to repeat it.”

- Winston Churchill

“Can we fix it? Yes we can.”

- Bob the Builder

Why the Interest?

- O&S Phase of systems is a significant portion of the annual DoD budget
- Key factors to keep in mind:
 - Other O&M (~30% of total O&M) includes costs such as base operations, depot maintenance, spare parts, fuel, and transportation
 - Military and Civilian workforce make up an integral and significant portion of positions at a sustainment office and/or depot
- O&S Phase is not restricted to O&M appropriation
 - Procurement appropriation is often involved when surpassing O&M funding restrictions

Table A-1. DoD Total (Base + Supplemental) Budget by Appropriation Title (\$ in millions)

Total Budget	FY 2021*	FY 2022**	FY 2023	Δ FY22-23
Military Personnel	163,025	167,379	173,883	+6,504
Operation and Maintenance	284,396	307,402	309,343	+1,941
Procurement	140,704	145,440	145,939	+499
RDT&E	105,909	118,917	130,097	+11,180
Revolving and Management Funds	2,155	2,521	1,583	-938
Defense Bill	696,188	741,660	760,846	+19,186
Military Construction	7,144	13,375	10,198	-3,177
Family Housing	1,401	1,525	1,956	+431
Military Construction Bill	8,545	14,900	12,154	-2,746
DoD TOTAL	704,734	756,560	773,000	+16,440

Source: Comptroller Information System

Numbers may not add due to rounding.

* FY 2021 actuals

** FY 2022 reflects enacted

DoD's Operation and Support Costs, by Appropriation Title and as Categorized by CBO

Billions of 2024 dollars

	President's budget request, 2024	FYDP, 2028	CBO's projections based on DoD's plans, 2038
By CBO category			
Compensation			
Military personnel ^b	179	194	215
Civilian personnel ^{b,c}	106	106	118
Contractors ^c	44	47	52
Total	329	347	384
Military Health System ^d			
Military compensation	10	10	11
Accrual payments for retirees	11	24	31
Civilian compensation	8	8	9
O&M in the MHS	30	18	21
Total	59	59	72
Other O&M ^e	151	156	171

Reasoning

- Organizations/SPOs (System Program Offices) responsible for long-term Sustainment persist for decades and perform activities far beyond basic Operations and Support

- Large enough to be new acquisition programs

- Baseline Divergence
- Modernization
- Service Life Extension
- Major Capability Upgrades
- Etc.

1980s - Present



1980s - Present



- Large enough to be handled internally with annual budgets

- Form-Fit-Function Replacements
- Modification/Upgrades
- Special Projects
- Special Studies
- Etc.

1980s - Present



1950s - Forever



Opportunity for Analysis

Theory

- Sustainment organizations should have superior historic data, plentiful local engineering resources, and potentially decades of execution experience to plan and deliver vital projects on time in support of continuous operations and system capability enhancement

Rationale

- Project Cost Estimation
 - System is a tangible asset already fielded
 - Can utilize any technique
 - Analogous
 - Parametric
 - Engineering Buildup
 - Actual Cost
- Project Planning
 - Prioritization based on criticality, needs, and available budget

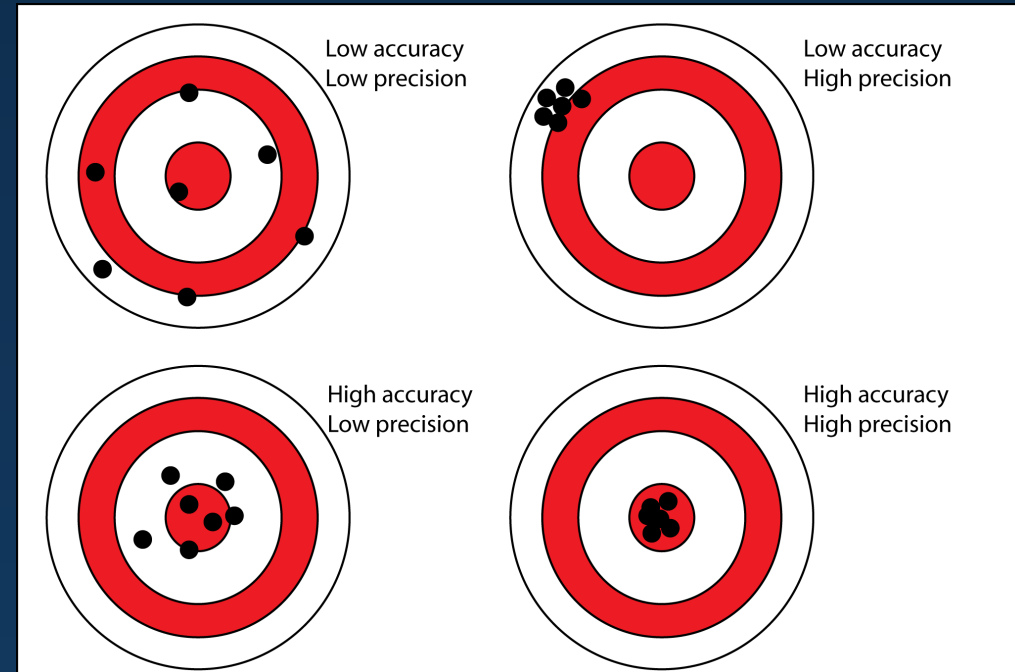


Reality

- ?

Case Study Parameters

- Selected top-level metrics to measure success of continuous Project Planning process in a Sustainment environment
 - Accuracy and precision
 - **Cost estimation**
 - **Schedule duration**
 - Adaptation
 - Project scope stability
 - Estimate update frequency
- Ideal candidate criteria for study
 - Sustainment Organization
 - Integrate Project Planning Process
 - O&M Funding
 - System of Systems
 - Awards 4-8 projects/studies annually with values ranging from ~\$500K - \$20M on multiple contracts



Collection of Data

- Historic planning documentation captured available estimated cost for each project
 - Estimates were predominantly Engineering ROMs (Rough Order Magnitude) or WAGs
 - Limited cost team involvement and/or inputs used for planning purposes
 - Included likely PoP (Period of Performance) for contractor to complete work
 - Tracked Initial and Final values
- Contract documentation captured cost actuals for project
 - Data includes award type
 - Tracked Initial Award Price and Final Price (post modifications)
 - Tracked Initial Agreed PoP and Final “Agreed” PoP

Project ID	Planning														Execution					
	Estimate (\$M)													PoP (Days)		Price (\$M)		PoP (Days)		
	Initial	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	Final	Initial	Final	Award Type	Initial	Final	Initial	Final
1	0.50			0.50	0.50	0.50							0.50	182	182	FFP	0.50	0.50	210	210
2	3.00			3.00	5.00	5.00							5.00	365	548	CPFF	6.00	6.50	729	1323
3	2.00				2.00	2.00							2.00	730	730	CPFF	2.50	2.00	729	1797
4	12.00			12.00	14.50	14.50	14.50						14.50	730	1095	CPFF	19.00	19.00	1280	2019

Estimated Schedule

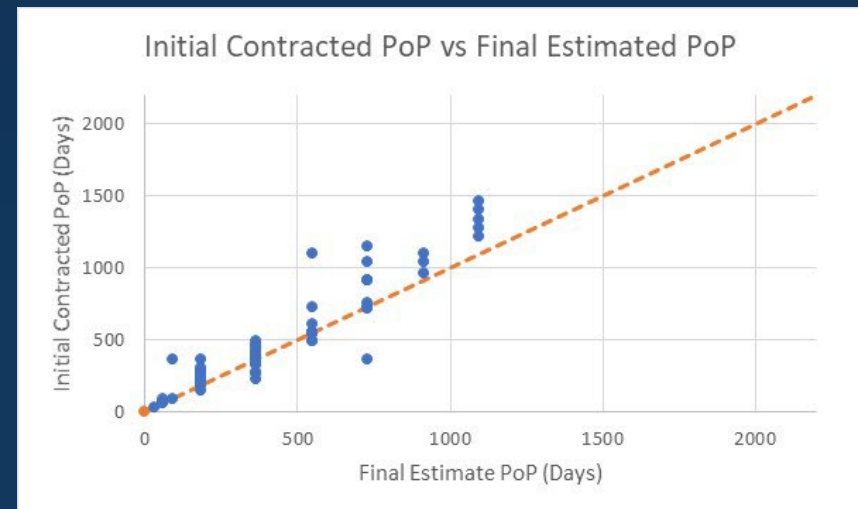
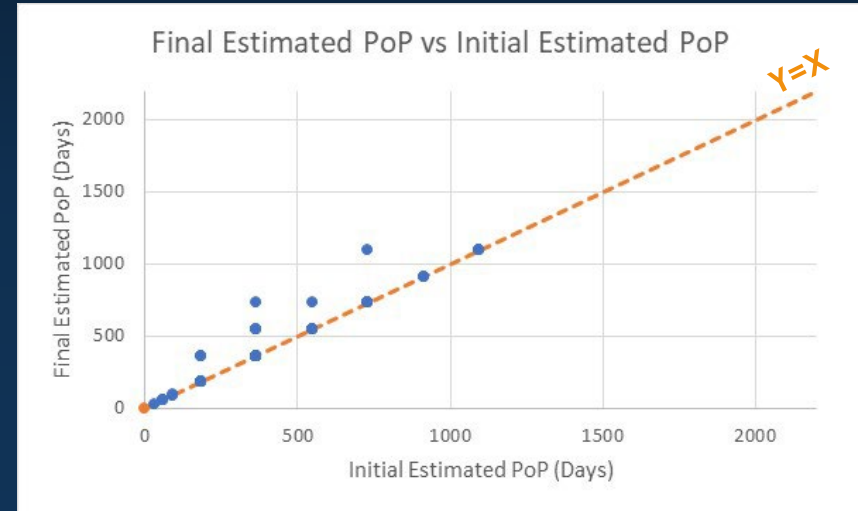
- Collectively the Final Estimated PoP for projects was increased by ~7%
 - Noticed trend of estimating schedule in 0.5 year intervals based on judgement
 - 15% of projects had PoP adjusted
- Collectively the Initial Contracted PoP was ~12% higher than Final Estimated PoP registered in Project Planning
 - Immediately indicates a major flaw in estimating PoP utilizing discrete 0.5 year increments for larger project

Possible Messages to Organization:

Great job adjusting schedule when possible!

Could we utilize more cost personnel to collect and analyze analogous project historical duration data for better forecasting?

Schedule analysis could help narrow the cost gaps if burn rate methodologies are being used.



Final Delivery Schedule

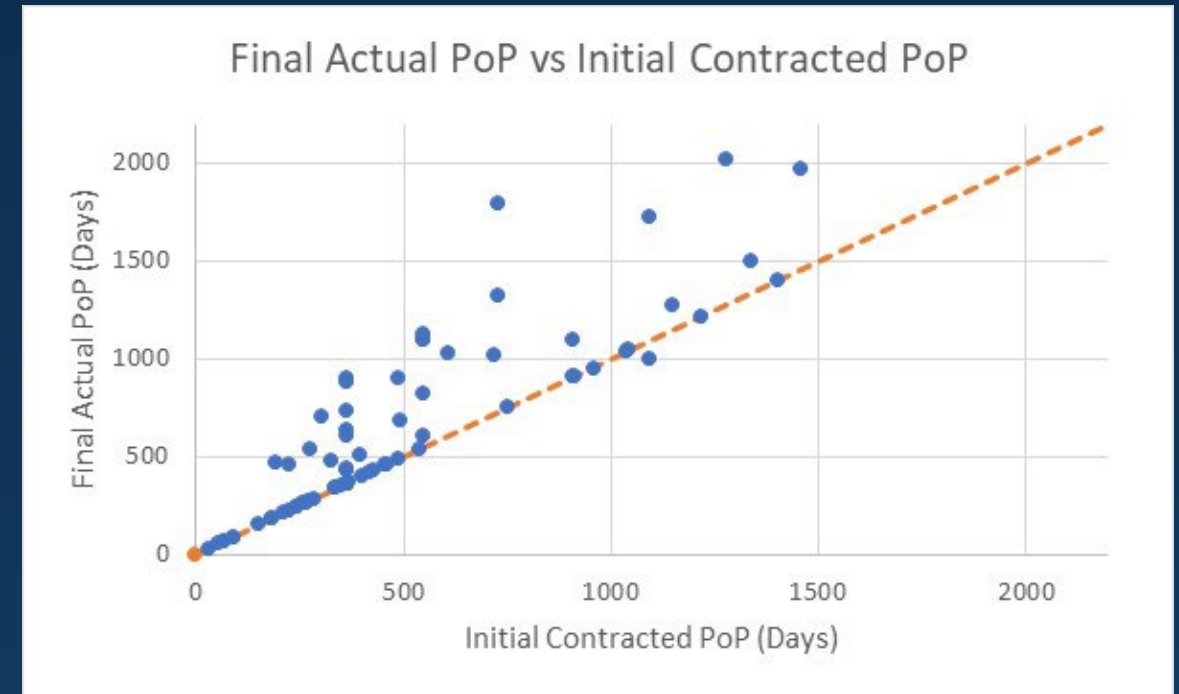
- Collectively the Final Actual PoP for projects was ~28% higher than durations negotiated at Contract Award
 - PoP extensions regularly performed during execution, not just tail end of PoP
 - Includes data points with no significant deltas
 - Showcases well known fact that Prime Contractors also struggle to estimate realistic PoP durations
- Ignoring data points with schedule slips/gains less than 100 days; collectively the Final Actual PoP for projects is ~60% higher than duration negotiated at Contract Award

Possible Messages to Organization:

Negotiated Delivery time is consistently lower than Actual Delivery time.

Do we incorporate past performance data into discussions with Prime contractors?

Have we assessed external environmental factors that could be driving delays?

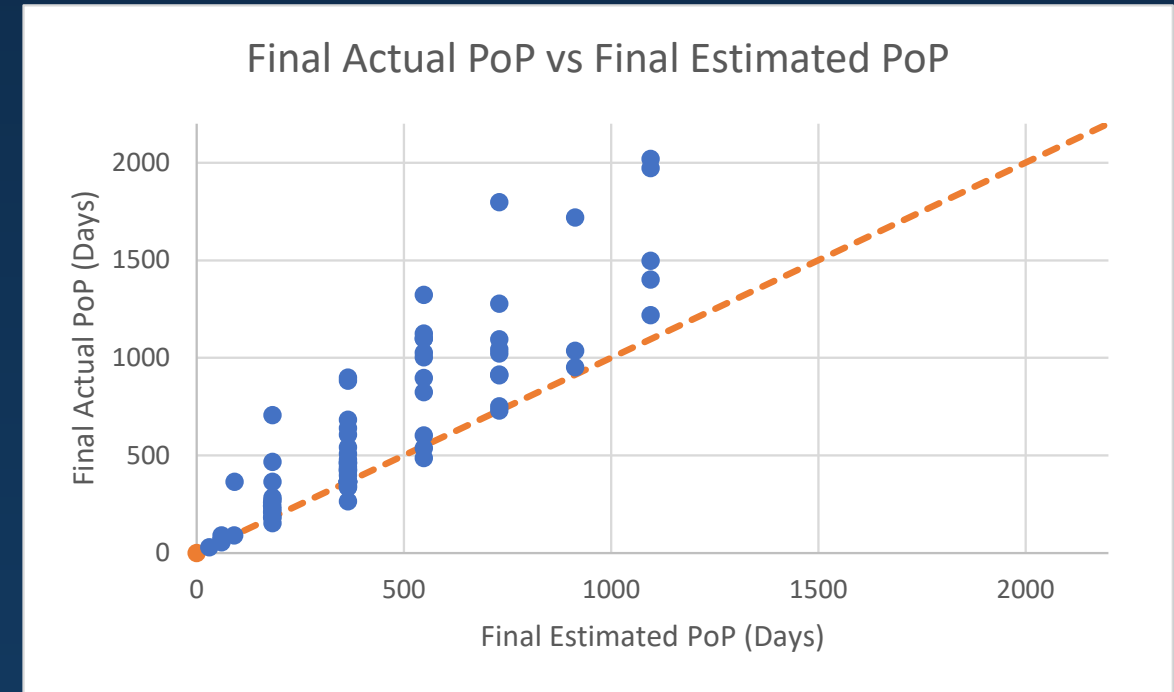


Schedule Estimation Summary

- Collectively the Final Actual PoP for projects was ~43% higher than durations outlined in Final Project Estimates used for Project Planning purposes
 - Potentially fault of contractor to deliver completed project in a reasonable time
 - Detrimental to planning if projects are on critical path
- Estimating schedule in 0.5 year intervals based on judgement limits options for PoP inputs
- Any burn rate methodologies will be significantly impacted and thus yield poor cost estimation
- Results are beyond simple Schedule Growth and point to a systemic problem in the organization

Possible Messages to Organization:

Overly precise inputs, totally inaccurate results.
What are we doing?
Can we fix it?



Estimated Cost

- Collectively the forecasted project costs were increased by ~13% over a ten year period of planning
- Primary reasons for adjustments
 - Changes in scope
 - Adjustments to major HW/SW items required to complete projects
 - Adjustments to PoP utilized in burn rate methodologies
- Collectively the Initial Award Price was ~8% higher than the Final Estimated Value used in planning over a ten year period
- Projects over \$4M have greater volatility with a collective delta of ~15% higher than estimate
 - Poorly defined and/or last minute scope changes
 - Greater impact to Project Planning

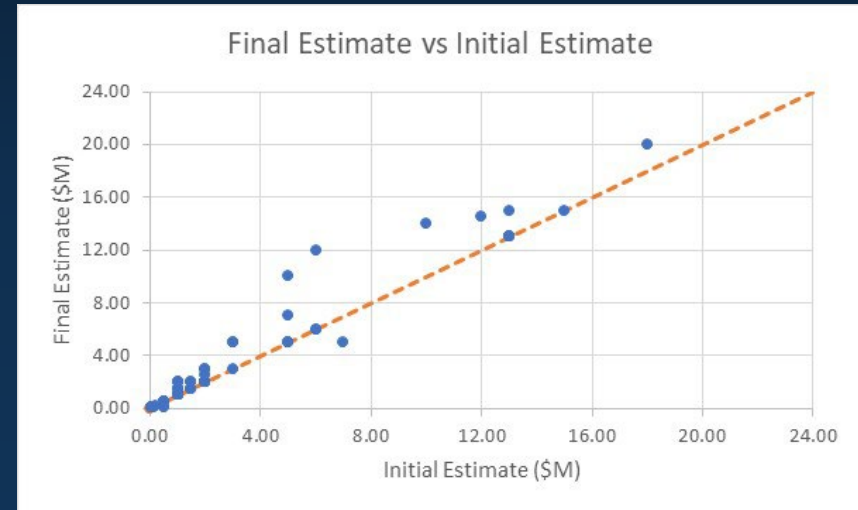
Possible Messages to Organization:

Great job updating estimates when nearing year of award!

How long was the initial WAG part of the planning discussions?
 What is the frequency of updating estimates?

Can we attempt to develop firm scope and requirements definitions early?

How well are the cost personnel involved in developing detailed tech baselines, uncertainty models, cost tracks, etc. and do we have good historic cost data to aid negotiations?



Final Delivery Price

- Collectively the Final Price was ~7% higher than the Initial Award Price negotiated with contractor
 - Minority of the efforts were Firm Fixed Price (FFP) and don't allow detailed analysis, Requests for Equitable Adjustments (REAs) incorporated into data as deltas
 - Majority of cost increases attributable to project scope changes enacted during execution
 - ~80% of projects experienced no cost growth

Possible Messages to Organization:

Do we perform delta estimates and incorporate values into overall Project Planning?

Are we satisfied with final deliveries?



Cost Estimation Summary

- Collectively the Final Price was ~15% higher than the Final Estimate values used during Project Planning
 - Not a significant issue for smaller sized project in the aggregate
 - Major Project scope changes can't be foreseen and are detrimental to Project Planning efforts
 - Potentially deprioritizes other critical projects, delaying till future years
 - Domino effect in disrupting planning and constraining available outyear funding

Possible Messages to Organization:

Expect larger projects to experience cost overruns and schedule slips that require outyear funding.

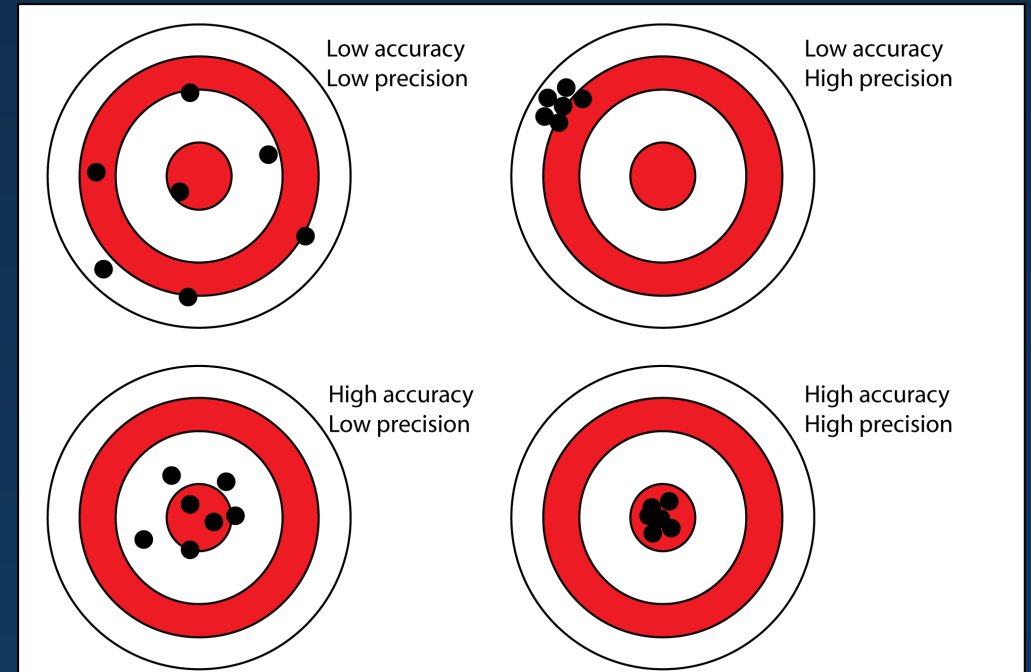
Can we assign budgets an annual 15% Management Reserve line for overruns?

Do we have cost estimators analyzing scope and execution data to identify reasons for deltas?



Case Study Scorecard Attempt

- **Cost Estimation**
 - Low Accuracy and Medium Precision
- **Schedule Estimation**
 - Low Accuracy and High Precision
- **Price Estimation (by Contractor)**
 - Medium/High Accuracy and Medium Precision
- **Schedule Estimation (by Contractor)**
 - Medium Accuracy and Low Precision
- **Project Scope**
 - Mostly stable after award
- **Estimate Update Frequency**
 - Poor



Case Study Results Summary

- Performed top-level analysis of Project Planning process with comparison to execution
- Qualities of this organization's process:
 - Schedule duration is estimated in discrete intervals based on judgment without analysis of historical data
 - Project scope is well defined and absolute until contractor responds to proposals and/or the team violently pivots to reduce cost or increase spending
 - Low frequency of revisiting cost estimates
- **Consequences of this organization's process:**
 - Recycling outdated/unchecked methodologies
 - Accepting ROM/WAG estimation as "the best we got"
 - Meager data collection efforts and shallow analysis
 - Cost estimation suffers from cascading deficiencies
 - Project Planning suffers as past mistakes continue to disrupt future efforts and execution timelines



Recommendations

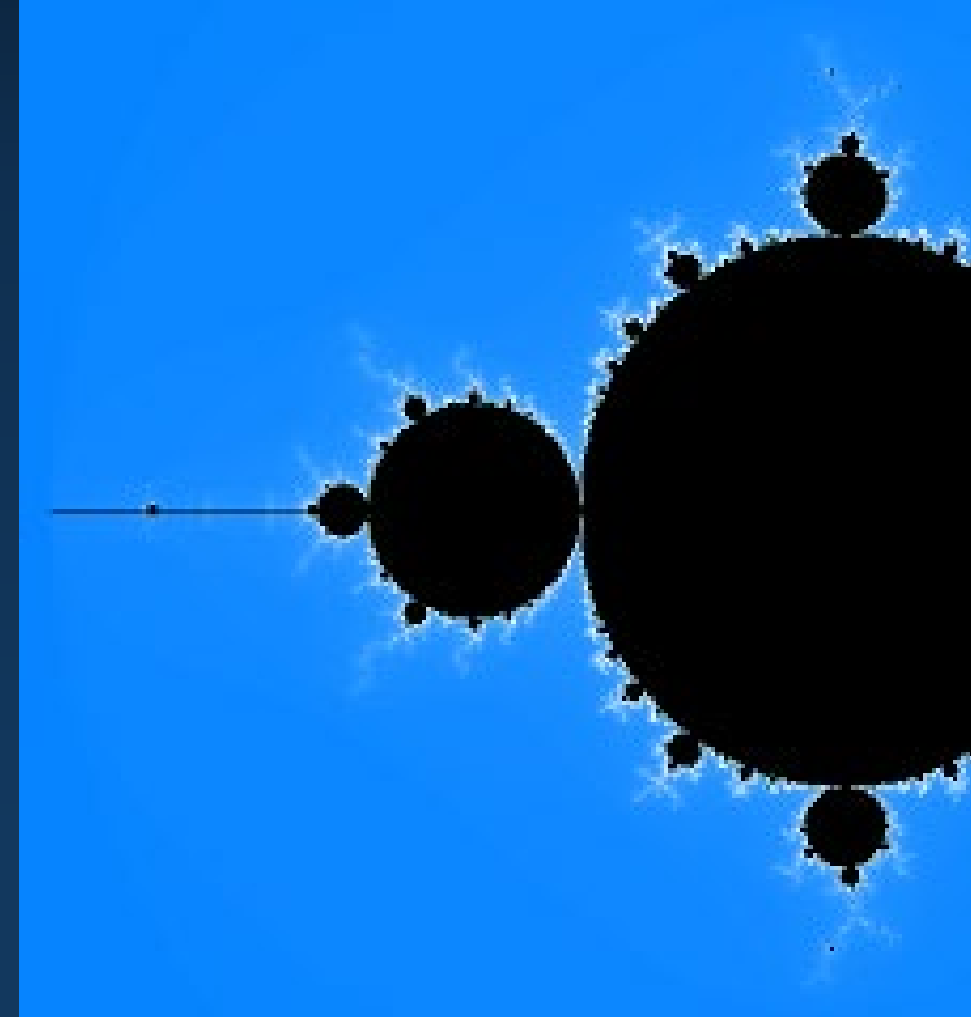
Top tailored recommendations for this organization:

1. Bring more focus and effort to estimating the cost of larger projects above \$4M as they have longer durations, more complexity, and prone to major cost overruns
2. Incorporate some basic analysis of past effort durations to better forecast likely schedule for upcoming projects
3. Assess environmental factors that could be driving delays such as project backlog bottlenecks, team size maximums, highly specialized work, etc.
4. Justify an annual Management Reserve budget by estimating the cost of potential scope changes and incorporating the deltas into Project Planning picture
5. Ask for simple cost data reporting on all projects above a certain threshold, it may save us all later



Summary

- Operations and Support phase of any program or system is an exciting but unglamorous microcosm of smaller acquisition efforts
 - ✓ Plentiful engineering resources
 - ✓ Decades of execution experience
 - Superior historic (cost) data?
- Despite fixed annual budgets and relaxed oversight/review procedures, O&S deserves attention from the cost community to uncover this forgotten world
- Exabytes of data are waiting analysis to develop tailored cost products necessary to keep the lights on efficiently
- Can we get some quality cost reporting in O&S for smaller portfolios/projects and involve our cost personnel throughout the Project Planning process?





Questions?



Abstract

Explore the intriguing world of Project Planning within a typical sustainment organization, spanning nearly a decade worth of estimation and execution data for dozens of special projects as PMs, Engineers, and Estimators desperately fight to defend their budgets and keep the system operating. Did we prioritize having thoroughly developed requirements definitions or wait till the 11th hour to establish them? Was schedule and scope realistic or heavily reliant on optimism as a primary methodology? Did we find ourselves broken and send up a signal flare or accept the shackles of a constrained budget? It is accepted that no plan or estimate is perfect, but rarely do we scrutinize and quantify the errors of our ways to encourage improvements within the process. Join this thought-provoking expedition, as we use metrics to judge the performance of planning practices, seeking insights and wisdom for the projects that lie ahead.