

Headquarters U.S. Air Force

Integrity - Service - Excellence

EVM for Executive Decision-Making



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**Prepared for SAF/AQX
PEM/AO Training Course**

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Purpose

- **Purpose:**
 - Provide tutorial on the use of earned value at the executive decision making level
 - Discuss Analyst vs Management Charts
- **Usefulness:** Indicator of program health
 - Do I have confidence in my Program Manager's assessment of contract performance?
 - Are there potential funding issues with the program?
- **Application:**
 - DAES/MAR Analysis and Review
 - Program/portfolio reviews

Earned Value: A powerful business case tool for Executive management



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Overview

- **Data Sources**
- **Basic EV Terminology**
- **Using Four Metrics**
 - **Contract Performance Graph**
 - **Cost and Schedule Variance Graph**
 - **Budget Realism Graph**
 - **Completion Estimate Realism Graph**
- **Other Uses for EV**
- **Using EV to Drive Organizational Behavior**



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Earned Value Data Sources

- **DAES Reports**
 - Required Quarterly for MDAP/ACAT I Programs
 - Section 7 - Supplemental Contract Cost Information
 - Must report for non-FFP contracts receiving EVM data
- **MAR Reports**
 - Must report for all programs (new policy)
 - Use estimated percentages for non-earned value contracts
- **Level of reporting**
 - “Top Line” for SAF/AQX and OSD
 - As required or requested by PEO
 - At Least Level 3 by SPO - lower levels driven by risk

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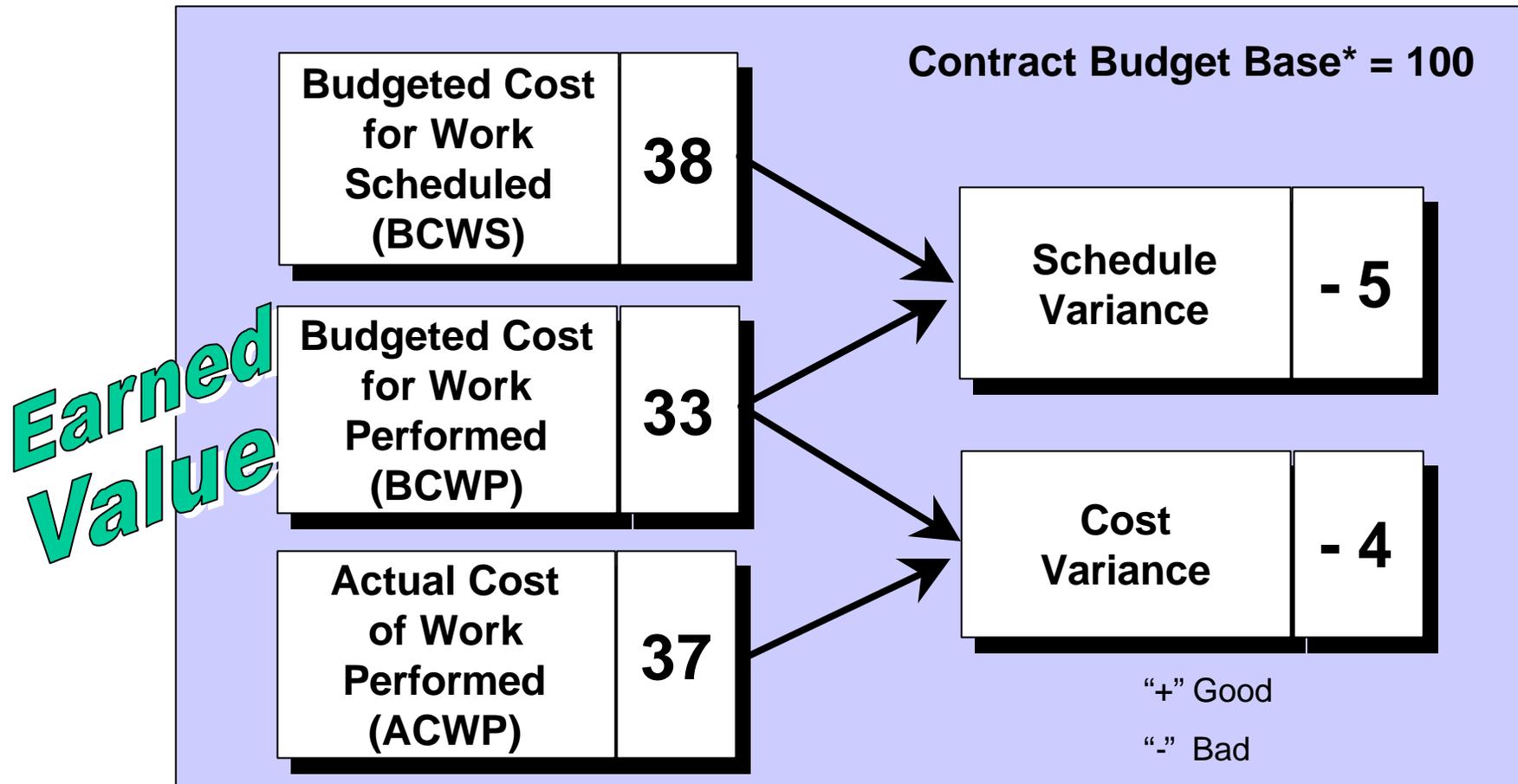
Basic Earned Value

- **Earned Value is:**
 - A management technique to use “work in progress” to statistically project completion costs
 - A way of integrating cost, schedule and technical plans and progress
 - A way of ensuring business process discipline
 - Only as good as the confidence of the baseline
- **Earned Value is not:**
 - A financial management tool
 - A replacement for sound management
 - An assurance of project success



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Basic Earned Value



Note: All Earned Value calculations are performed at the Contract Budget Base (CBB). Analysis is based on “cost”, and not “price”, which would include fee.

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Schedule Variances

- **Schedule Variance = BCWP - BCWS**
 - Difference between the amount of work you've accomplished and what your baseline said you should have accomplished. **(negative is bad)**
 - $\$33\text{M} - \$38\text{M} = -\$5\text{M}$ (*behind schedule*)
- **Percent Schedule Variance = SV / BCWS**
 - $-\$5\text{M} / \$38\text{M} = -13\%$ (*behind schedule*)
- **Schedule Performance Index (SPI) = BCWP / BCWS**
 - Work Performed / Work Scheduled
 - $\$33 / \$38\text{M} = 0.87$
 - Only 87% of the work planned to be completed by this date has been completed



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Cost Variances

- **Cost Variance = BCWP - ACWP**
 - Difference between the cost of work you've accomplished and what your baseline said that work should have cost. **(negative is bad)**
 - $\$33 - \$37M = -\$4M$ (*cost overrun*)
- **Percent Cost Variance = CV / BCWP**
 - $-\$4M / \$33M = -12\%$ (*cost overrun*)
- **Cost Performance Index = BCWP / ACWP**
 - Work Performed / Actual Costs
 - $\$33M / \$37M = 0.89$

For every dollar spent only 89 cents of work has been completed



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Estimating Expected Completion Cost

- Estimate at Completion (EAC): Pgm Manager's
- Latest Revised Estimate (LRE): Contractor's
- Calculation provides the statistical "floor"

$$\frac{\text{Target Cost}}{\text{CPI}} = \frac{\$100}{0.89} = \$112.3$$

- A contract will never cost less (Assuming no corrective actions in place)
- Other formulas available
 - CPI x SPI, Weighted CPI/SPI, Current vs Cumulative
- PM and Ktr should also assess risk.
 - Final EAC or LRE is somewhat subjective

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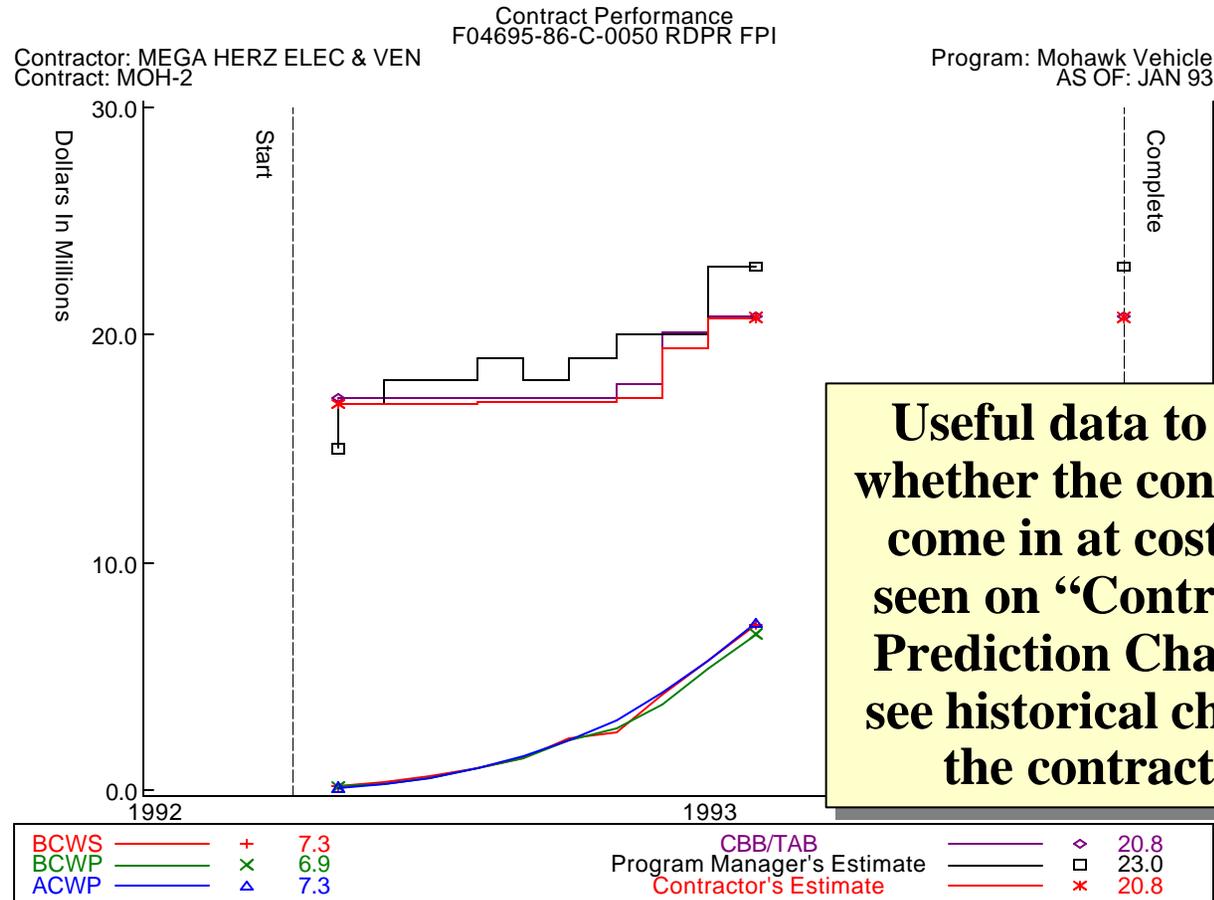
Contract Performance Graph

- **Purpose: Visualize changes in contract value and EAC over life of contract**
 - **Plots key Earned Value metrics using BCWP as control. Also plots EAC history**
 - **Best for contracts 25 and 75% complete**
 - **Primary value: None, used because OSD uses**
 - **Secondary value: Visually verifies health**
 - **BCWS & BCWP must intersect target cost and completion date**
 - **ACWP must intersect EAC and completion date**
 - **If freehand projections of these intersections don't make sense, neither will the actual lines**
 - **If contract is in OTB it will be stated in notes**



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Traditional Contract Performance Chart

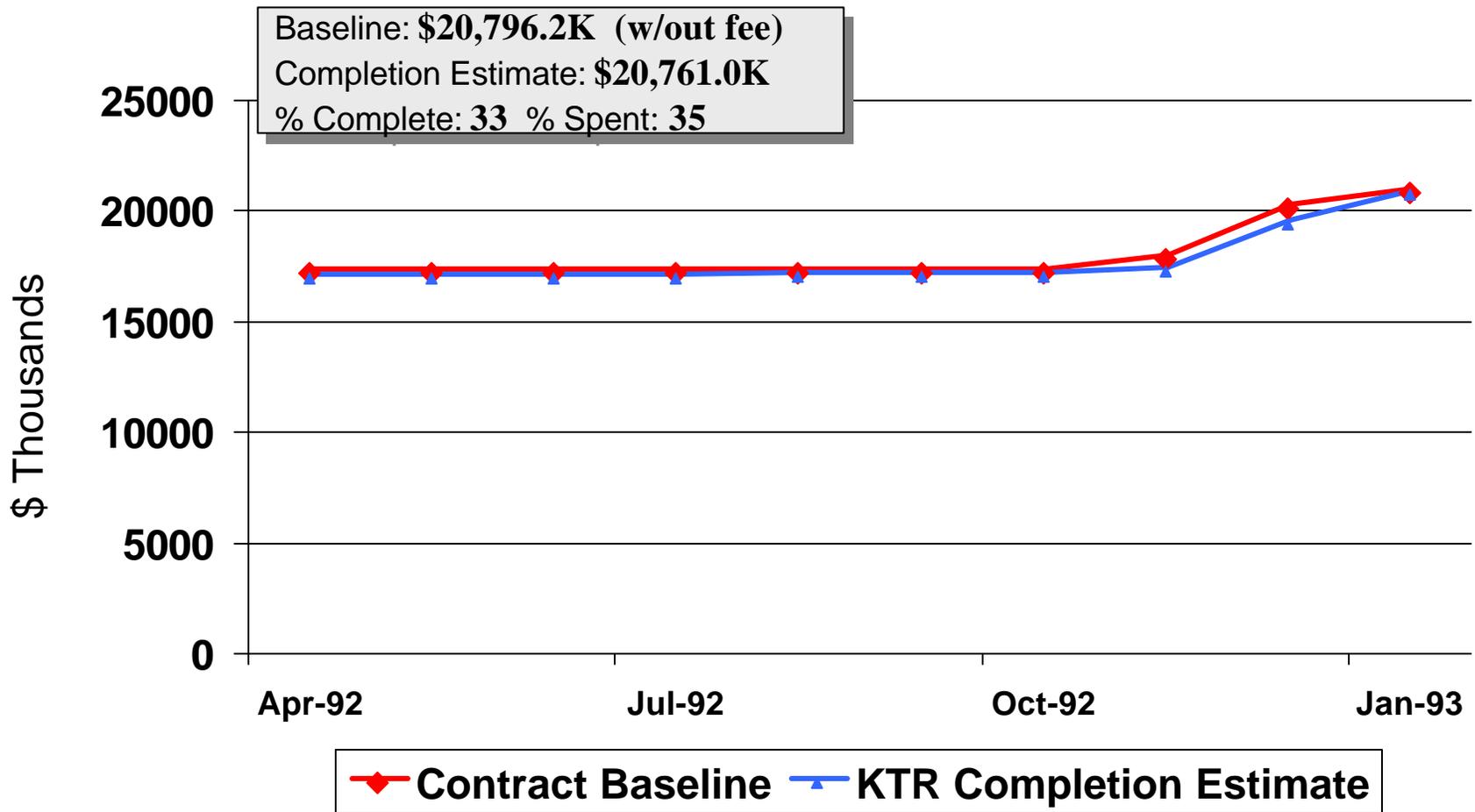


Useful data to predict whether the contract will come in at cost (better seen on “Contract Cost Prediction Chart”) and see historical changes in the contract cost.



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Baseline History



Contract: MOH-2 Ktr: Mega Hertz (CPAF) as of Jan 93

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Variations Graph

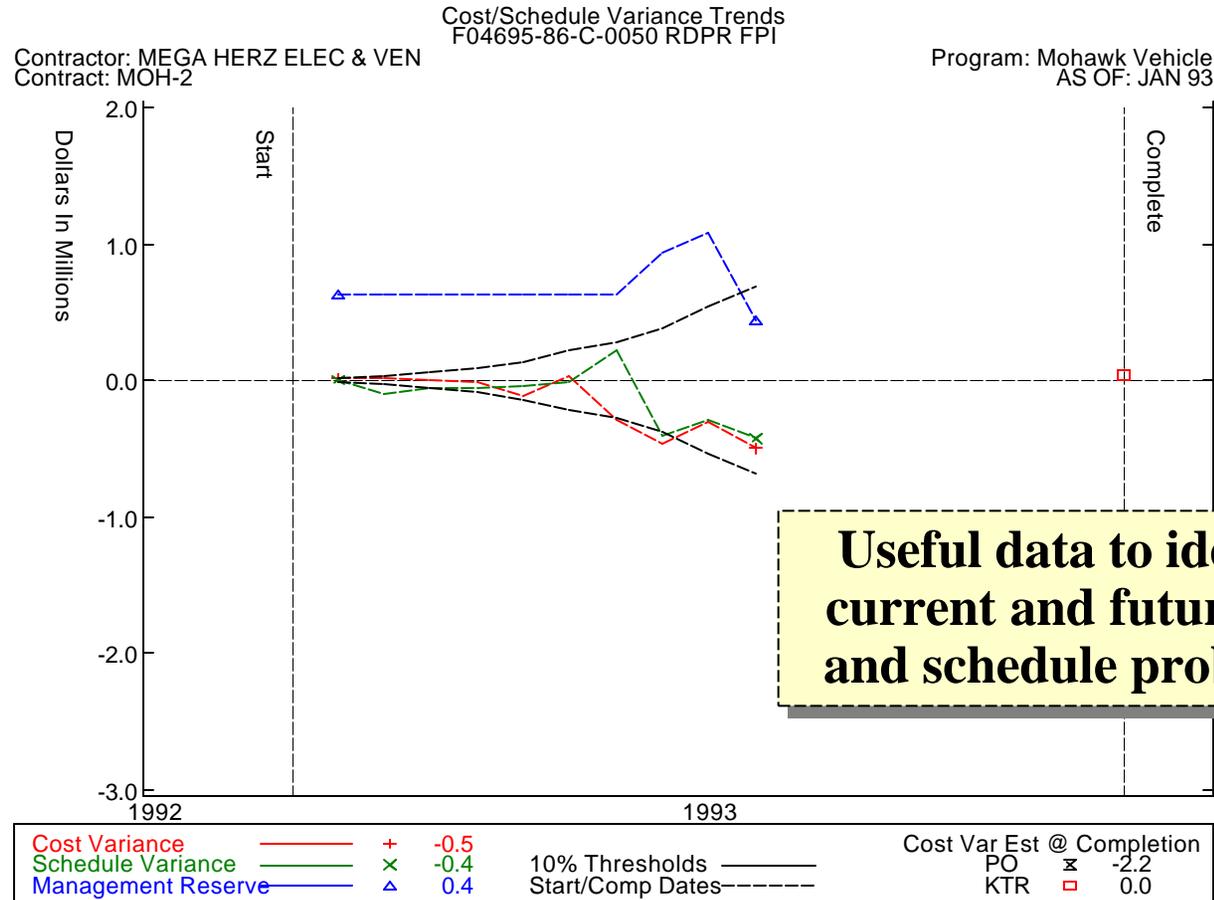
- **Purpose: Early warning of funding problems**
 - **Compares cost & schedule variances within a +/- 10% control limit. Also plots use of management reserve**
 - **Primary value: Expect cost and schedule variances to be within the 10% variance bands.**
 - **If overrunning at 15% complete -- will finish that way**
 - **CV% will not improve by more than 10% (10% Rule)**
 - **Secondary value: Track Management Reserve Usage**
 - **Early use of MR may suggest poor planning, and masks CV**
 - **Secondary value: Estimate variance at completion:**
 - **Straight Line Method: extrapolate the CV to the completion time to determine the potential overrun**
 - **Tertiary value: shows re-baselines**
 - **Resetting of CV and SV to 0 (saw tooth effect)**

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Traditional Cost and Schedule Variance Trends Chart



Useful data to identify current and future cost and schedule problems.



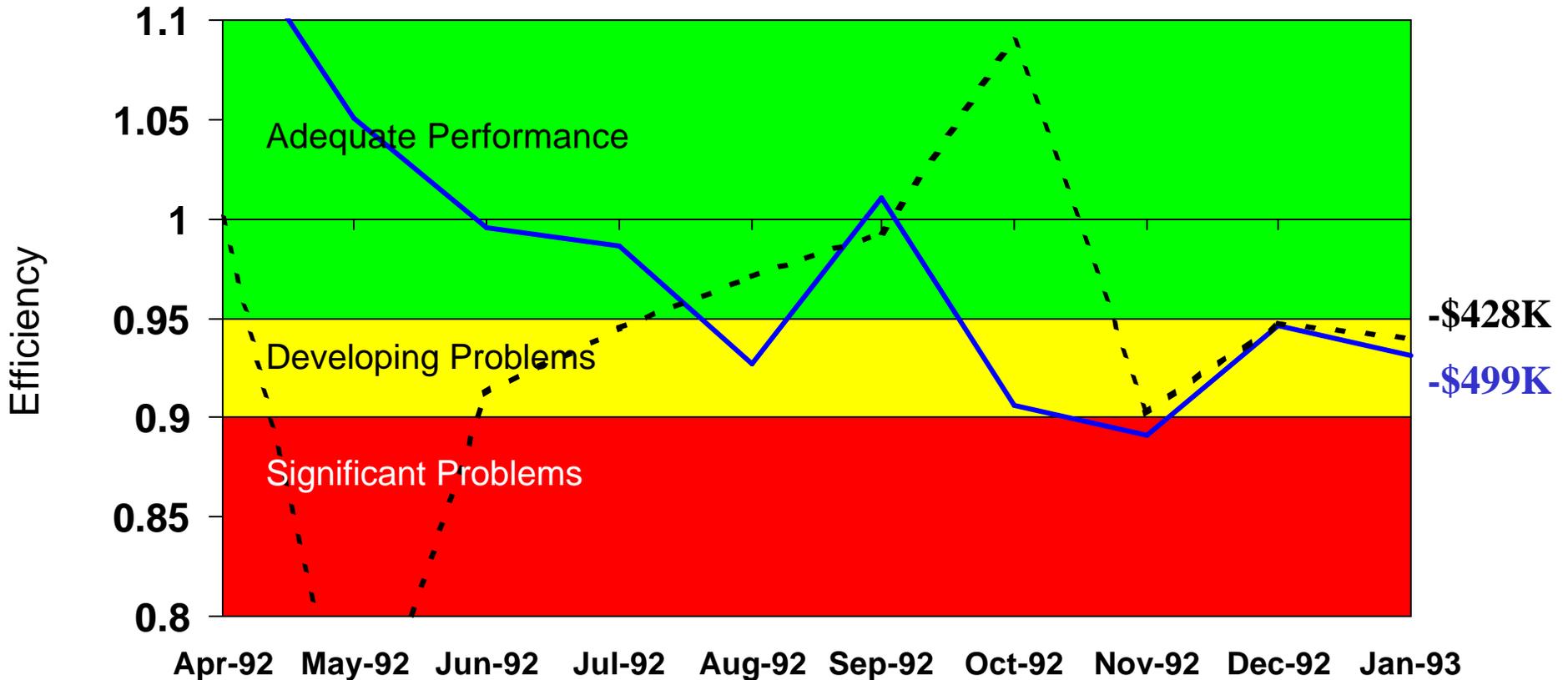
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Performance Review

Cost and schedule efficiency (Compared to plan)

Baseline: \$20,796.2K (w/out fee)
 Completion Estimate: \$20,761.0K
 % Complete: 33 % Spent: 35

— Cost - - - - Schedule



Contract: MOH-2 Ktr: Mega Hertz (CPAF) as of Jan 93

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LRE or EAC* Graph

- **Purpose: Tests realism of completion estimates**
 - **Compares baseline Budget at Completion (BAC) to Contractor's Latest Revised Estimate (LRE) using Cumulative CPI as a control measure**
 - **Primary value: LRE should be at or above Cum CPI**
 - **Statistically, Cum CPI forecast represents the LOWEST cost at which a contract will complete**
 - **LRE's below Cum CPI should be questioned for believability**
 - **Secondary value: Does contract have enough money?**
 - **If contract is experiencing unrecoverable costs, LRE should be higher than BAC**
 - **Additionally, BAC's lower than Cum CPI indicate need for money**

* Note: analysis is valid whether it it on LRE or EAC



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LRE or EAC Graph

- **Another realism test for completion estimates is TCPI vs CPI**
 - **TCPI and CPI should be within 5% of each other for a believable Completion Estimate.**
 - **If differ by more than 10% the Estimate is underestimated**
 - **TCPI can be based on both the Budget or the Estimate**

TCPI: To-Complete Cost Performance Index

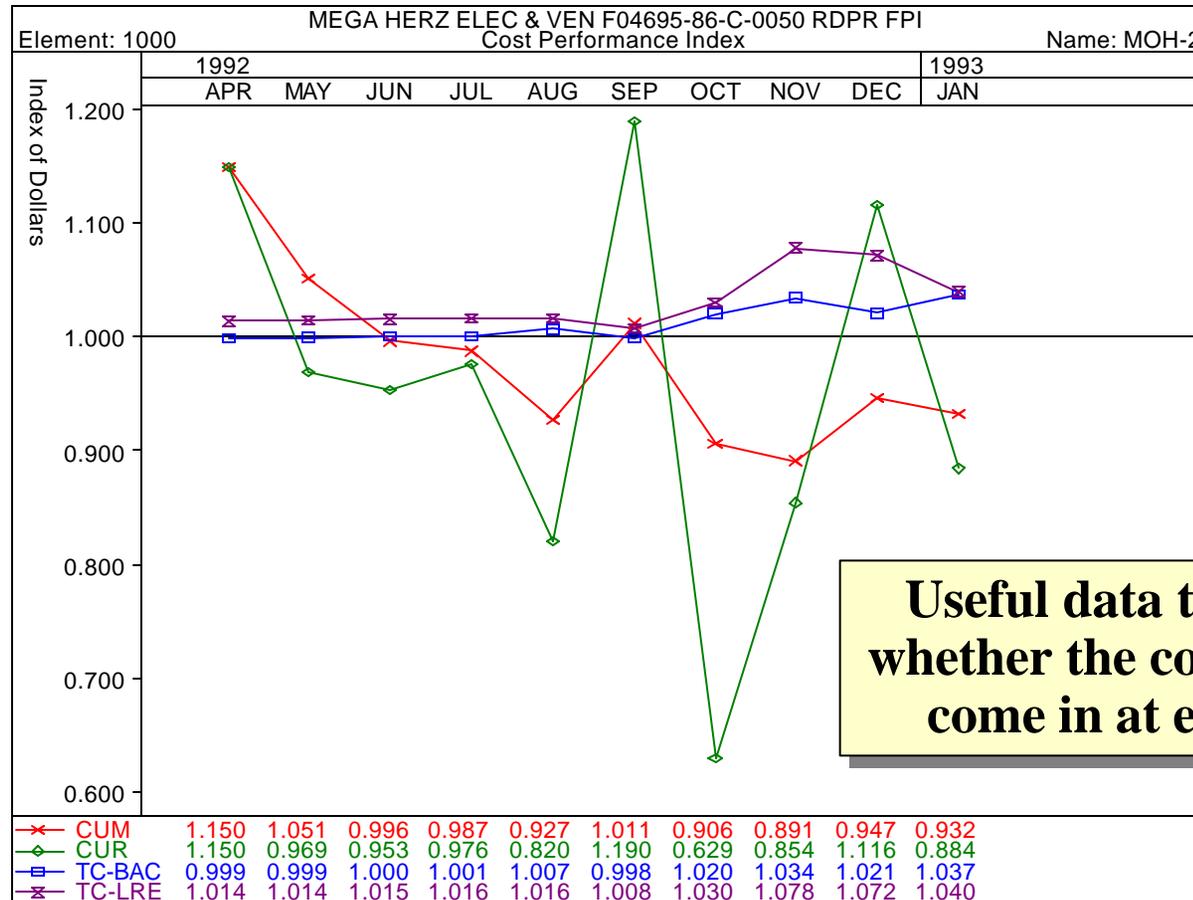
TCPI is an indicator of how efficient the contractor needs to be from now on in order to finish the contract at the BAC or LRE. Since CPI reflects the historical efficiency, it is very difficult to make large changes between the two.

$$\text{TCPI} = \frac{\text{BAC} - \text{BCWP}}{\text{LRE} - \text{ACWP}}$$

TCPI is the CPI of the remaining work



Traditional Cost Variance/EAC Analysis Chart (CPI Chart)





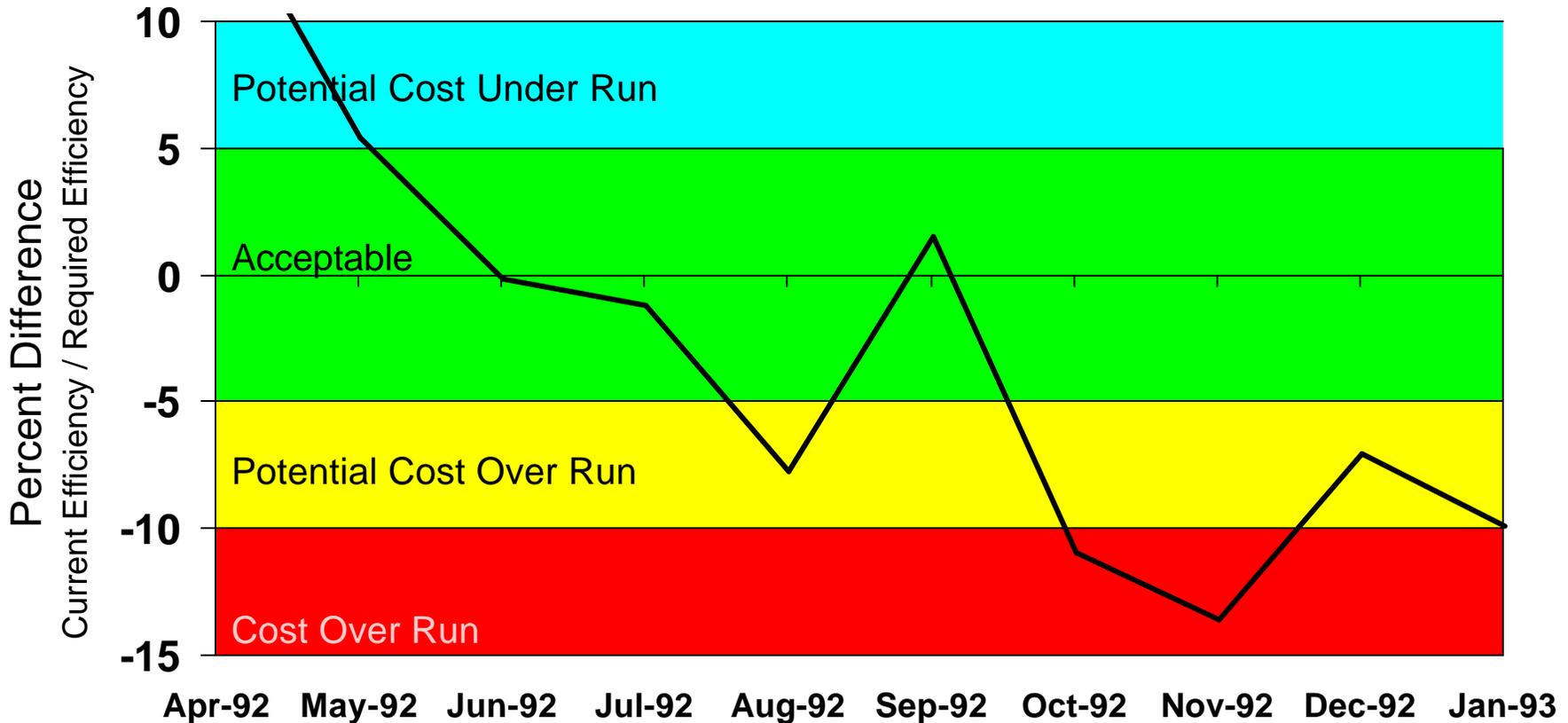
Confidence in Contract Value

Will contract complete at baseline value?

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$$\left(\frac{CPI_{CUM}}{TCPI_{BAC}} - 1 \right) \times 100$$

Baseline: \$20,796.2K (w/out fee)
Completion Estimate: \$20,761.0K
% Complete: 33 % Spent: 35



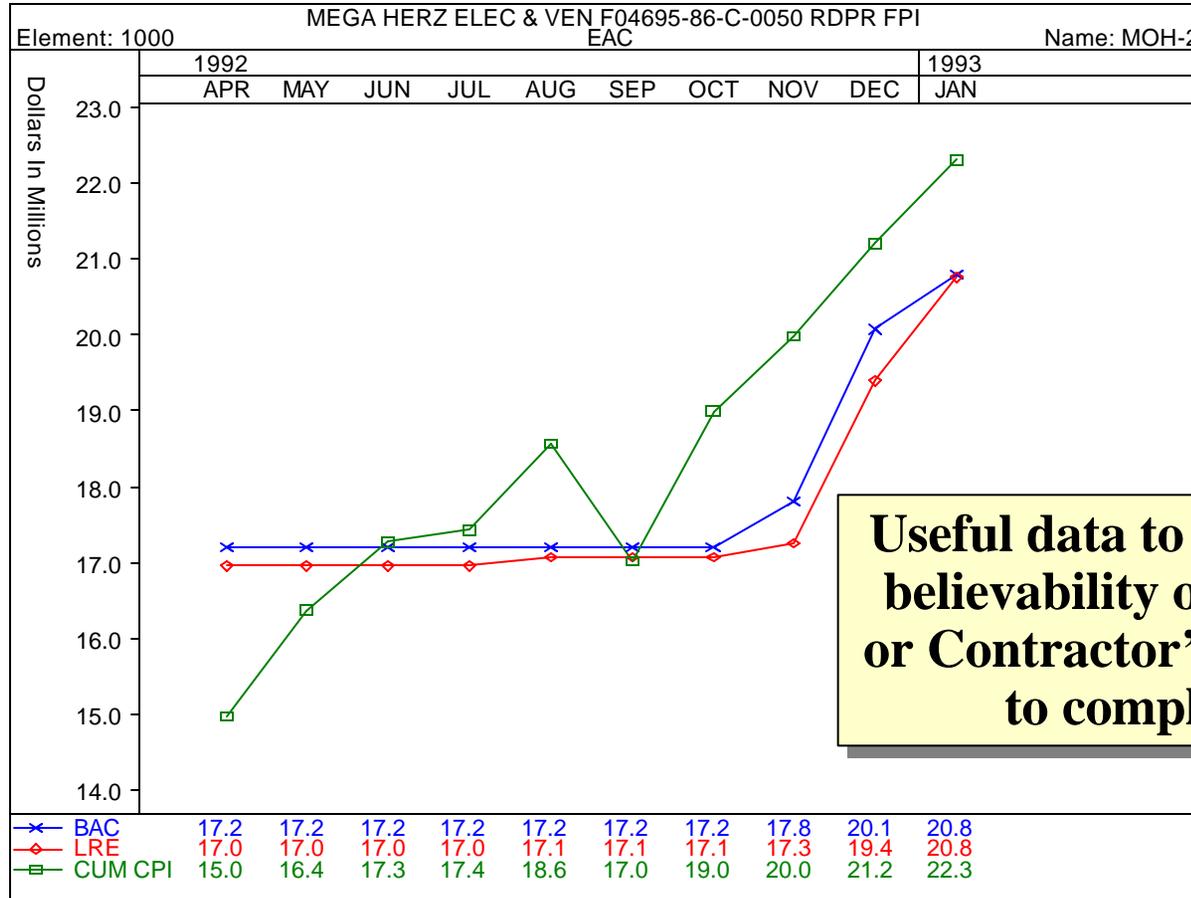
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Traditional EAC Realism Chart (EAC Chart Modified to Include Cum CPI)





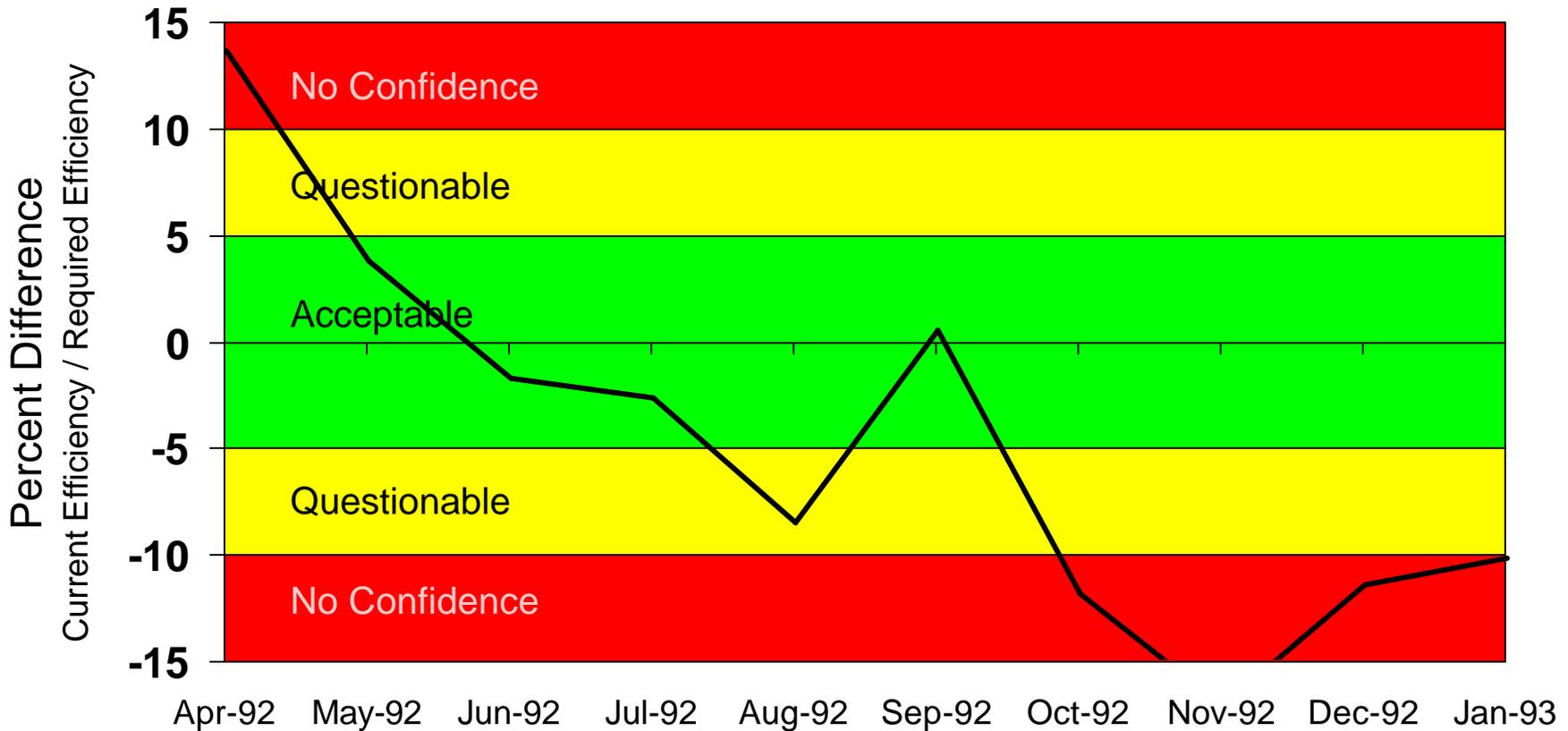
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Confidence in Estimate

Will contract complete at contractor's current estimate?

$$\left(\frac{CPI_{CUM}}{TCPI_{LRE}} - 1 \right) \times 100$$

Baseline: \$20,796.2K (w/out fee)
Completion Estimate: \$20,761.0K
% Complete: 33 % Spent: 35



Contract: MOH-2 Ktr: Mega Hertz (CPAF) as of Jan 93

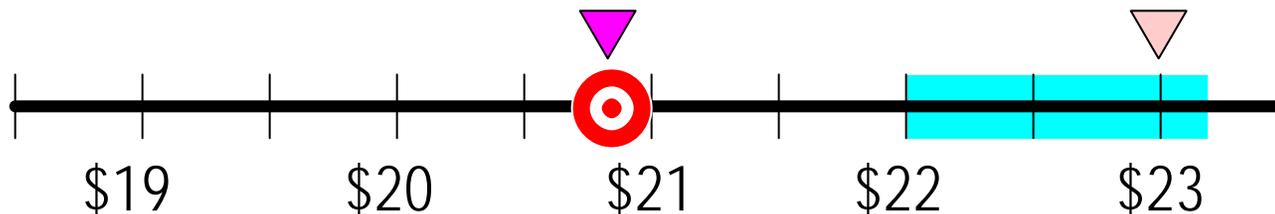
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Expected Completion Estimate

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Contract Budget Baseline:	\$20.8M	
Contractor Estimate:	\$20.8M	
PM Estimate:	\$23.0M	
AQXR Low:	\$22.0M	
AQXR High:	\$23.1M	



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Over Target Baseline (OTB)

- A situation where the Earned Value data no longer reflects the Contract Budget Base
- The Target Cost (or Total Allocated Budget) is larger than the Contract Budget Base. All Earned Value calculations are performed against the Target Cost
 - This is not a contractual increase in value
 - Can only be determined by the source data, but is noted on Contract Performance slide
 - OTB represents an Operating Plan used for Performance Measurement purposes
- Instituted in those times when the Cost Variance (and sometimes Schedule Variance) are so large that they are masking true progress



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Other Uses for EV

- **Crosscut Analysis**
 - Evaluate management between portfolios
 - Evaluate management between contractors
- **Identify Systemic Management Problems**
 - Poor Cost Estimating
 - Requirements Creep
 - Funding Instability
 - Technical Risk
 - Economic Assumptions
 - Poor Management (Uncontrolled cost/schedule growth)

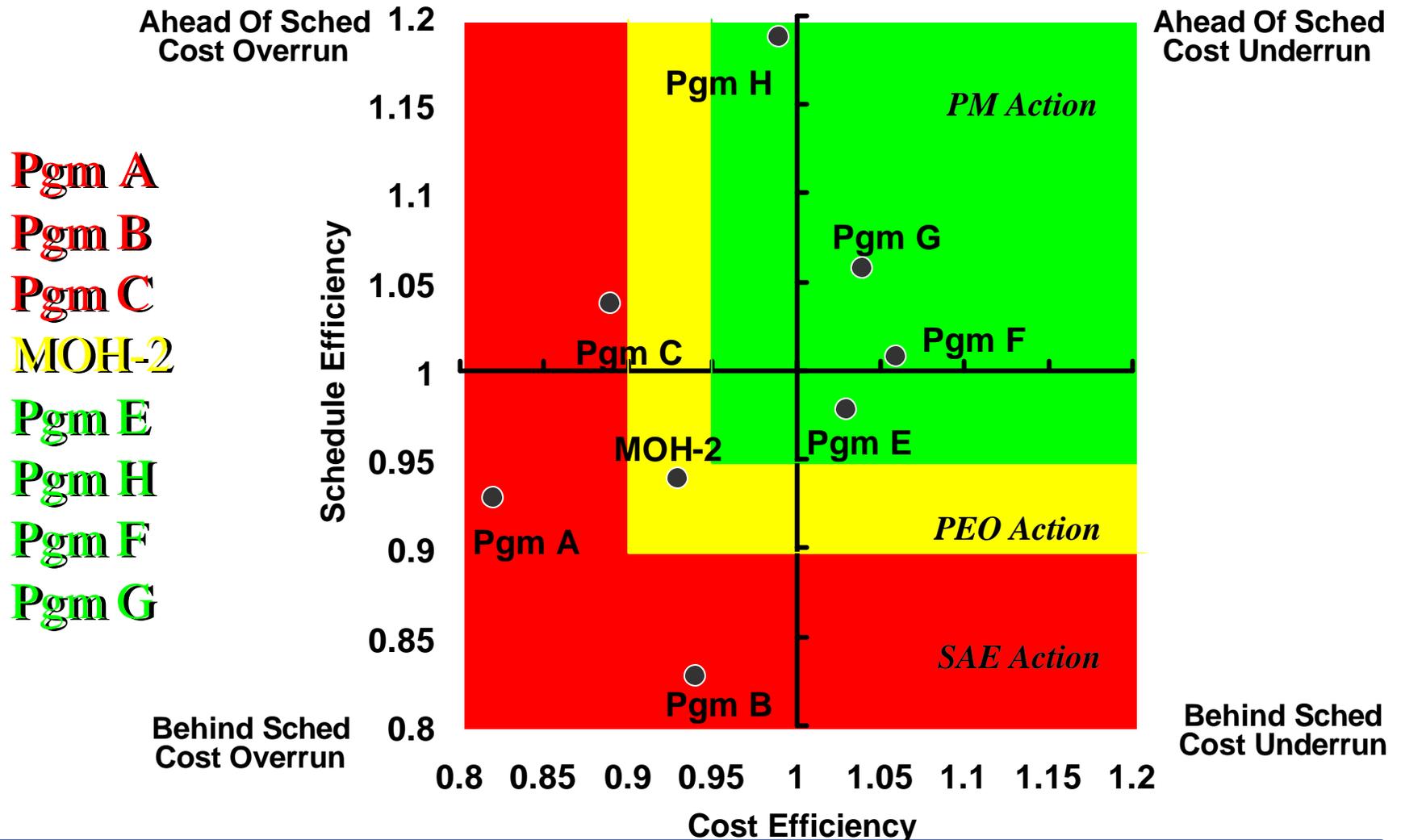
Analysis Requires a Database

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Portfolio Evaluation XX Portfolio



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Driving Behavior

- **Place importance on solid program management**
 - **Baseline management is key**
 - Why should I believe your EAC?
 - Is your APB current? Why not?
 - What is the biggest impediment on your critical path?
- **Reward good program management with proper funding streams**
 - Based on EV projections +/- acceptable risk
 - Promote PM's who implement EV on themselves

Executives Role: Drive Organizational Behavior -- EV helps!

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