

Developing a Realistic Estimate **at Completion (EAC)**

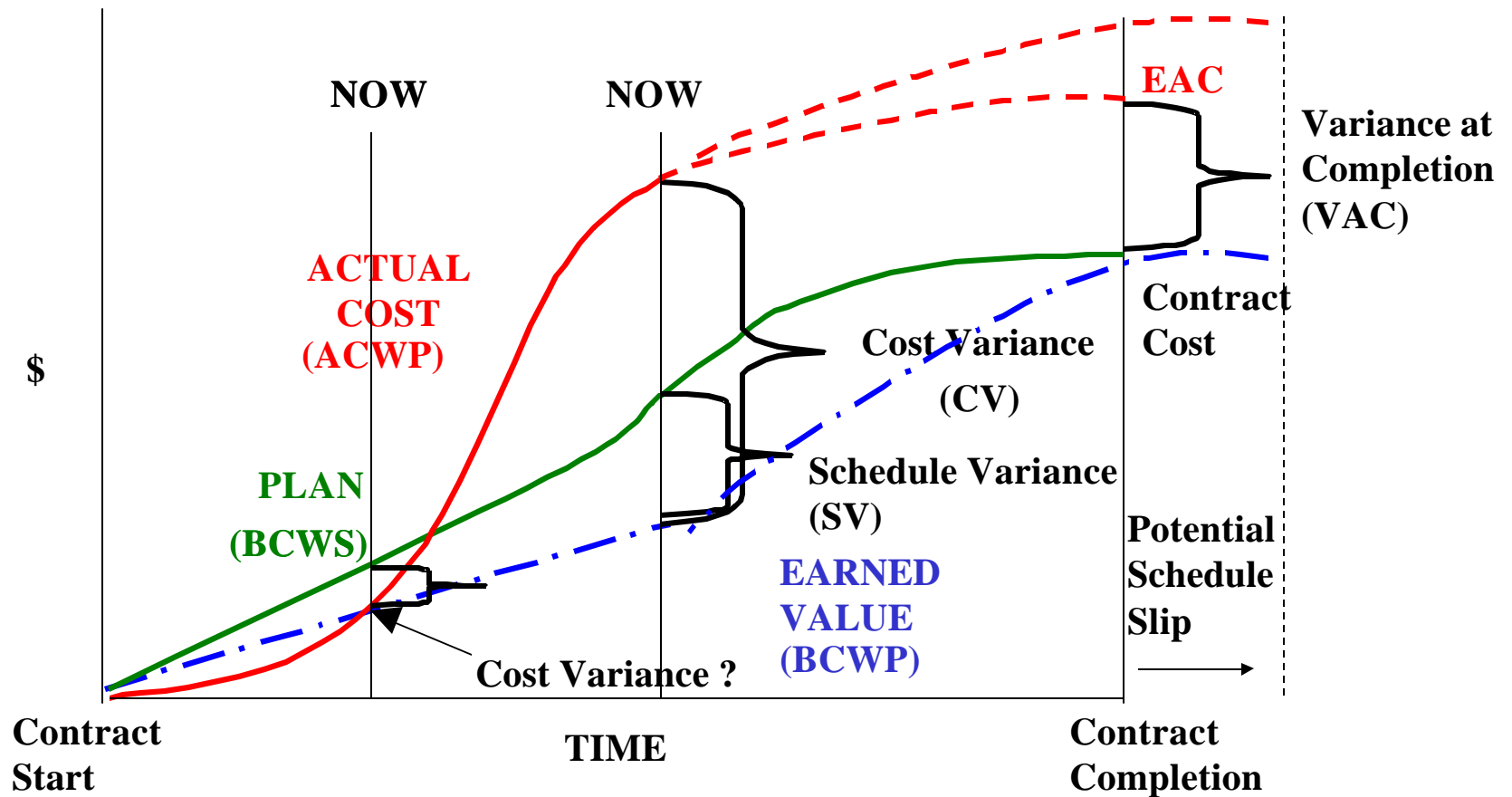
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Outline

- **The Concept of Performance Measurement Based on Earned Value**
- **Key EVM Terms**
- **Metrics for Assessing the Reasonableness of an EAC**
- **Generating EACS**
 - **The Generic EVM Approach to Formula-based EACs**
 - **Common Formulas**
 - **Using metrics to assess the reasonableness of EACs**
- **Concluding Thoughts**

The Concept of Performance Measurement Based on Earned Value

The Concept of Performance Measurement based on Earned Value



Key EVM Terms

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- **Budgeted Cost of Work Scheduled (BCWS)**
 - The amount of work **PLANNED**
- **Budgeted Cost of Work Performed (BCWP)**
 - The amount of work **COMPLETED**
 - **BCWP = Earned Value**
- **Actual Cost of Work Performed (ACWP)**
 - The actual cost of the completed work
- **Target Cost**
 - The contract cost (also referred to as **Contract Budget Base, Budget at Completion**)
- **Estimate at Completion (EAC)**
 - The most recent estimate of the entire task
 - The term **Latest Revised Estimate (LRE)** is often used to refer to the contractor's estimate in government terminology

Metrics for Assessing the Reasonableness of an EAC

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- **METRIC 1: Compare Cumulative Cost Variance to Variance at Completion**

	Cost Variance	Variance at Completion	Variance at Completion
Example in \$	-\$200	\$0	-\$200
Example in %	-25%	0%	-10%

Does a Variance at Completion of \$0 make sense? How about a Variance at Completion of \$200?

Metrics for Assessing the Reasonableness of an EAC

- **METRIC 2: Compare cumulative Cost Performance Index (CPI) to To Complete Cost Performance Index (TCPI)**
 - The CPI tells you the efficiency with which money is being spent
 - The TCPI tells you what the EAC projects the CPI for the future work to be
 - If the CPI has been 80% on a project, is an estimate that assumes a future cost performance efficiency of 120% reasonable? **Historically, NO.**

	Cost Performance Index	To Complete Cost Performance Index
Example Index	80%	120%

Metrics for Assessing the Reasonableness of an EAC

- **SCHEDULE PERFORMANCE INDEX (SPI)**

- The efficiency with which the schedule is being accomplished

What does a SPI of 100% mean? You are right on schedule.

What does a SPI of 80% mean? You are accomplishing less than you planned.

Generating EACs

The Generic EVM Approach to Formula-based EACs

Cumulative ACWP + $\frac{\text{Budgeted Cost of Work Remaining}}{\text{Performance Factor}}$

Typical Performance Factors:

CPI

SPI

Combination of CPI and SPI

Sample Database

BCWS = 38

BCWP = 35

ACWP = 45

Contract Budget Base = 100

Latest Revised Estimate = 105

Common EAC Formulas

- **A common formula that research has shown to be accurate:**

$$\text{EAC} = \text{Cumulative ACWP} + \frac{\text{Budgeted Cost of Work Remaining}}{(\text{CPI})}$$

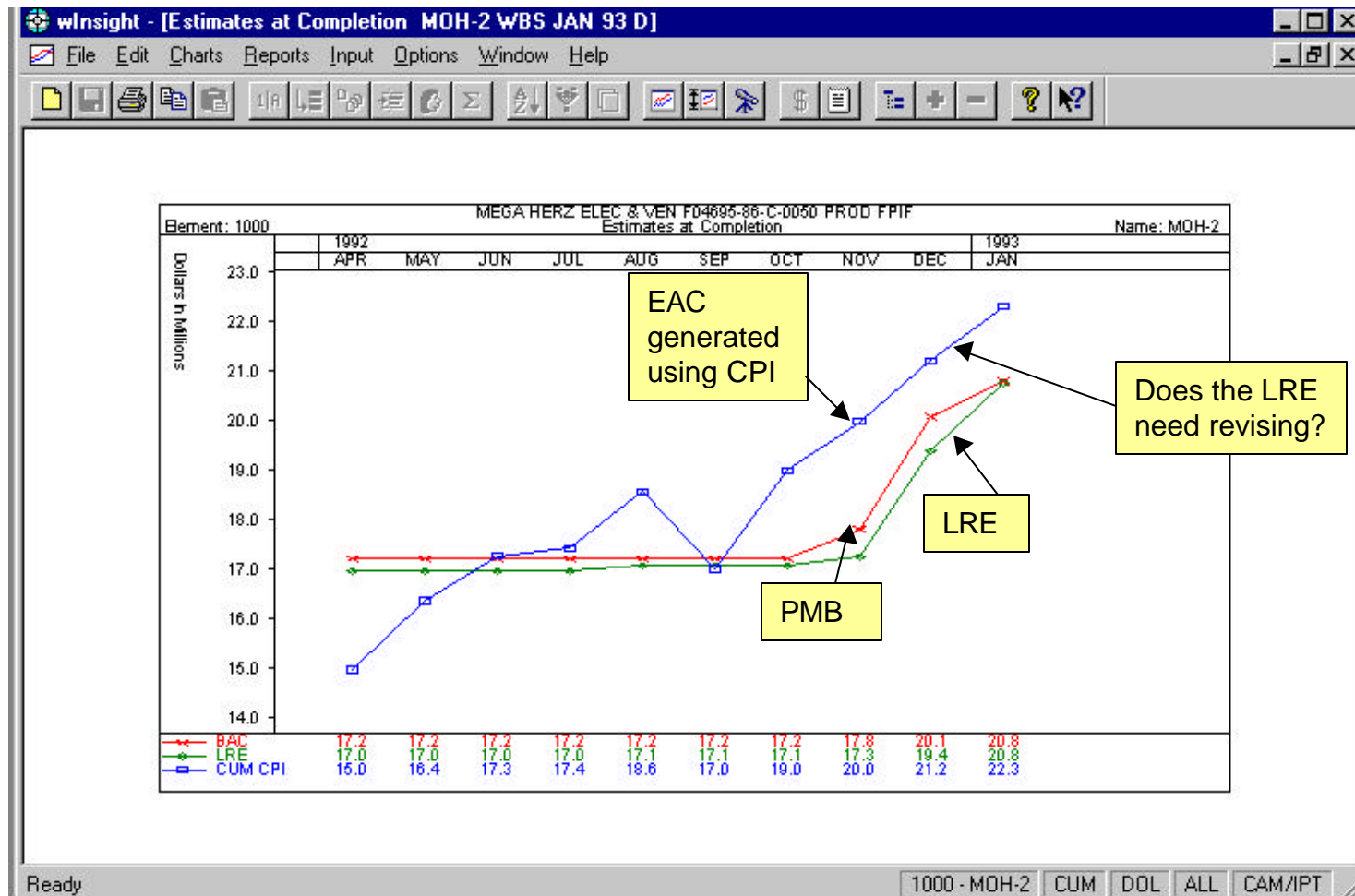
Calculation with Sample Data

$$\begin{aligned}\text{CPI} &= \text{BCWP}/\text{ACWP} \\ &= 35/45 \\ &= 78\% (.78)\end{aligned}$$

$$\begin{aligned}\text{Budgeted Cost of Work Remaining} &= \text{Contract Cost} - \text{BCWP} \\ &= 100 - 35 \\ &= 65\end{aligned}$$

$$\begin{aligned}\text{EAC:} &= 45 + (65)/(.78) \\ &= \$129\end{aligned}$$

Trend Charts: EAC Comparisons



Common EAC Formulas

- **Another common formula:**

$$\text{EAC} = \text{Cumulative ACWP} + \frac{\text{Budgeted Cost of Work Remaining}}{(\text{CPI} * \text{SPI})}$$

Calculation with Sample Data

$$\begin{aligned} \text{CPI} &= \text{BCWP}/\text{ACWP} \\ &= 35/45 \\ &= 78\% (.78) \end{aligned}$$

$$\begin{aligned} \text{SPI} &= \text{BCWP}/\text{BCWS} \\ &= 35/38 \\ &= 92\% (.92) \end{aligned}$$

$$\begin{aligned} \text{Budgeted Cost of Work Remaining} &= \text{Contract Cost} - \text{BCWP} \\ &= 100 - 35 \\ &= 65 \end{aligned}$$

$$\begin{aligned} \text{EAC} &= 45 + 65/(\text{.78} * \text{.92}) \\ &= 45 + 65/\text{.72} \end{aligned}$$

$= \$136$

Using Metrics to Assess EAC Reasonableness

- 1. Compare Cumulative Cost Variance (CV) to Variance at Completion (VAC)**
- 2. Compare CPI to TCPI**

Metric 1: Compare Cumulative CV to VAC

1. Compute the Metrics.

- **Cumulative CV**

- **In dollars:** $BCWP - ACWP = 35 - 45 = -\10
- **As a percentage:** $CV \text{ in } \$/BCWP = -10/35 = -35\%$

- **VAC (LRE)**

- **In dollars:** $Contractual \text{ Cost} - LRE = 100 - 105 = -\5
- **As a percentage:** $VAC \text{ in } \$/Contractual \text{ Cost} = -\$5/100 = -5\%$

- **VAC (EAC based on CPI)**

- **In dollars:** $Contractual \text{ Cost} - EAC = 100 - 129 = -\29
- **As a percentage:** $VAC \text{ in } \$/Contractual \text{ Cost} = -\$29/100 = -29\%$

- **VAC (EAC based on CPI*SPI)**

- **In dollars:** $Contractual \text{ Cost} - EAC = 100 - 136 = -\36
- **As a percentage:** $VAC \text{ in } \$/Contractual \text{ Cost} = -\$36/100 = -36\%$

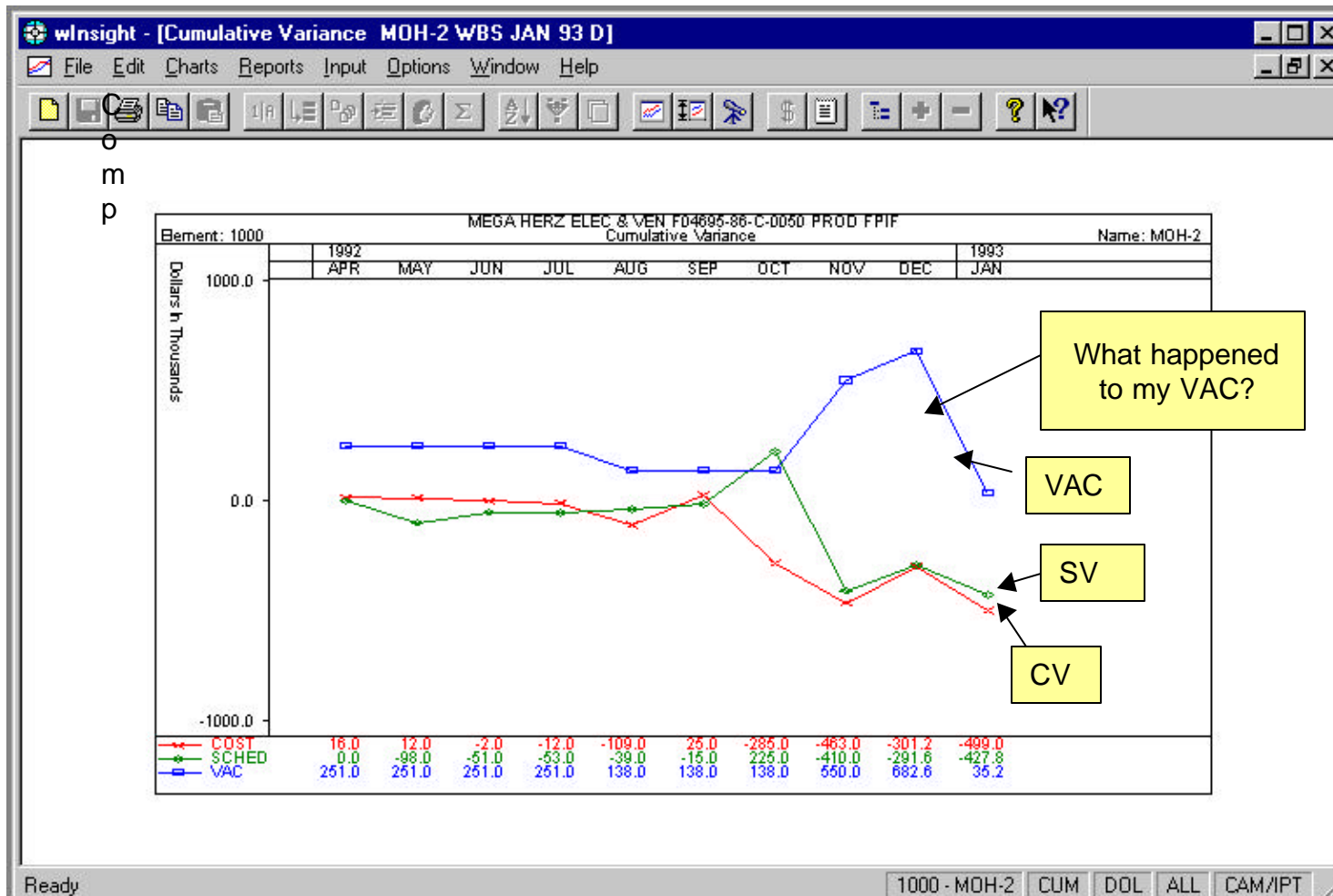
- **% Complete:** $BCWP/Contractual \text{ Cost} = 35/100 = 35\%$

Metric 1: Compare Cumulative CV to VAC

2. Make the comparison. Do the estimates appear reasonable?

	CV	VAC (LRE)	VAC (EAC based on CPI)	VAC (EAC based on CPI*SPI)
Example in \$	-\$10	-\$5	-\$29	-\$36
Example in %	-35%	-5%	-29%	-36%

Trend Charts: Metric 1- Compare Cumulative CV to VAC



Metric 2: Compare CPI to TCPI

1. Compute the To Complete Performance Indexes

- **TCPI (LRE)**

- Formula : Budgeted Cost of Work Remaining/Budget Remaining

$$\frac{\text{BAC} - \text{Cumulative BCWP}}{\text{LRE} - \text{Cumulative ACWP}} = \frac{100 - 35}{105 - 45} = 108\%$$

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- **TCPI (EAC Based on CPI)**

- Formula : Budgeted Cost of Work Remaining/Budget Remaining

$$\frac{\text{BAC} - \text{Cumulative BCWP}}{\text{EAC} - \text{Cumulative ACWP}} = \frac{100 - 35}{129 - 45} = 78\%$$

$$\frac{\text{BAC} - \text{Cumulative BCWP}}{\text{EAC} - \text{Cumulative ACWP}} = \frac{100 - 35}{129 - 45} = 78\%$$

- **TCPI (EAC Based on CPI*SPI)**

- Formula : Budgeted Cost of Work Remaining/Budget Remaining

$$\frac{\text{BAC} - \text{Cumulative BCWP}}{\text{EAC} - \text{Cumulative ACWP}} = \frac{100 - 35}{136 - 45} = 72\%$$

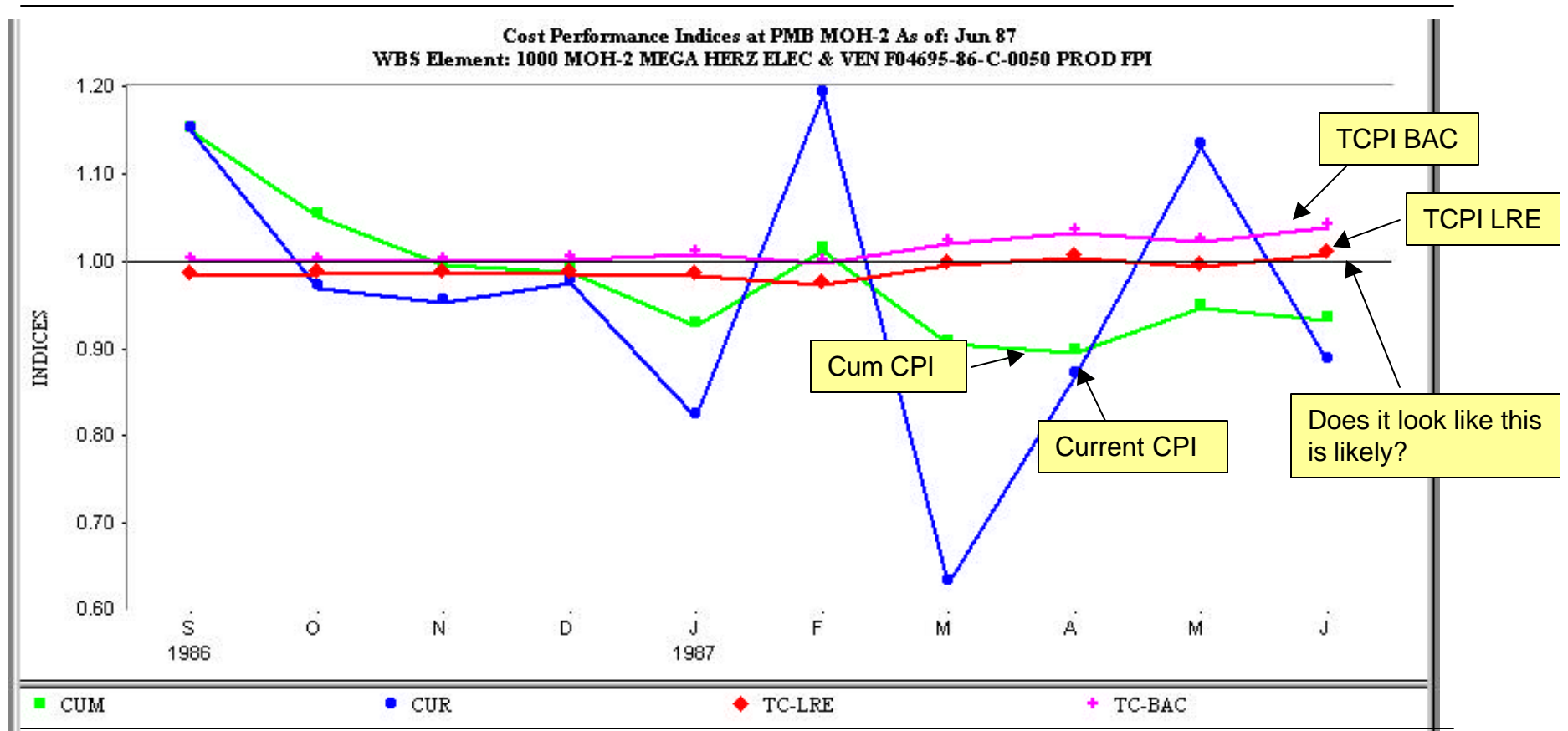
$$\frac{\text{BAC} - \text{Cumulative BCWP}}{\text{EAC} - \text{Cumulative ACWP}} = \frac{100 - 35}{136 - 45} = 72\%$$

Metric 2: Compare CPI to TCPI

2. Make the comparison. Do the estimates appear reasonable?

	CPI	TCPI (LRE)	TCPI (EAC based on CPI)	TCPI (EAC based on CPI*SPI)
Example Index	77%	108%	77%	71%

Trend Charts: Metric 2 - Compare CPI to TCPIs



Concluding Thoughts

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- **Research Has Shown:**
 - **The accuracy of index-based formulas depends on the type of system, stage and phase of the contract**
 - **No one formula is always best**
 - **Averaging over shorter periods is more accurate than averaging over longer periods, especially during the middle stages of a contract when costs are often accelerating**
 - **An EAC is clearly understated if**
 - **the adverse VAC is less than the cumulative CV (once past 15% completion)**
 - **the reported EAC is less than the EAC computed using the the cumulative CPI**
 - **the cumulative TCPI is more than 10% greater than the cumulative CPI and the contract is more than 20% complete**