Why the PERT Method Should Be Avoided or Closely Monitored

The Program Evaluation and Review Technique (PERT) earned value calculation method, or as some refer to it, the PERT Cost Formula, was developed long before the EIA-748 Standard for Earned Value Management Systems (EVMS) Guidelines were first published in 1995. Because it was considered the forerunner of the earned value concept and involved a very simple calculation of the budgeted cost for work performed (BCWP), it historically has been an acceptable BCWP calculation method, or earned value technique (EVT), with certain limitations. It has traditionally been used for less risky elements of an EVMS implementation.

The PERT cost method calculates an approximation of the percentage of work completed by using actual costs. The BCWP percent complete is calculated by:

> Dividing the cumulative to date actual cost of work performed (ACWP) by the estimate at completion (EAC), then multiplying the quotient by the budget at completion (BAC) or:
>
> BCWP = (ACWP / EAC) x BAC.

The downside to using the PERT cost method is that it requires the EAC to be updated every month for the BCWP calculation to be valid. Assuming the EAC is calculated by adding the cumulative to date ACWP plus the estimate to (ETC) for the remaining work, the ETC must be actively evaluated and updated every reporting period. When the ETC/EAC is not actively maintained or updated every month, the result is an inaccurate BCWP calculation that could be misleading at best. Another downside is that it is only an approximation of work accomplishment and operates on the assumption that spending (ACWP) is strongly correlated with earned value (BCWP).

As EVM best practices have evolved, US Government agencies such as the DoD and DOE have established EVM policy and guidance regarding the use of the PERT EVT. Both restrict usage to non-critical work effort with high quantity, low value, and low risk material.

The DoD EVMS Interpretation Guide (EVMSIG)[1] stipulates (underline emphasis added):

> *"For some low-value material items, BCWP may be calculated using a formula method, such as the Program Evaluation and Review Technique (PERT) …"*
> *"This method is <u>only appropriate for high quantity, low-value and low-risk material items</u> (e.g., material that is consumable such as bolts, fasteners, welding rods, etc.). Any other material items labeled as low value must have defined controls regarding price and quantity considerations and ensure performance measurement will not be skewed without adequate consideration of price variability, price ranges, as well as, similar or like categories of material."*

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[1] Eanred Value Management System Interpretation Guide (EVMSIG), March 2019, Guideline 21, Track and Report Material Cost/Quantities, page 49.

The DOE Office of Project Management (PM) EVMS Compliance Review Standard Operating Procedure (ECRSOP) Appendix A Compliance Assessment Governance (CAG)[2] stipulates (underline emphasis added):

> *"Another technique called PERT cost is defined as cost/EAC. The key to this technique is a regular review of the EAC. It is preferred to LOE for low-value material but <u>may only be used for low-value material</u>.*

A contractor's EVM System Description should define what is classified as high value or critical material and what is classified as low value material. In some instances, a project manager may provide additional guidance in a project directive to further clarify project specific requirements.

For high value material items, separate discrete effort work packages should be defined. They are always assigned a discrete EVT. Critical material may be high or low value, however, because the material is critical, the work package must be assigned a discrete EVT. Activity attribute fields in the integrated master schedule (IMS) are often used to identify high value or critical material resource requirements for management visibility and control. The PERT EVT should never be used for work packages with high value or critical materials.

The EVM System Description should state how low value material is planned and options for claiming earning value. As an example, the low value items may be planned and scheduled as a single work package, consistent with the control account scope of work, and planned need/consumption date. The work package could use a discrete EVT, apportioned effort method, or level of effort (LOE) method for claiming earned value.

When an EVM System Description allows the use of the PERT EVT, it is often limited to production environments where the low value or common materials such as nuts, bolts, lubricants, bar stock, coatings, etc. are consumed in the manufacturing process. Depending on the situation, the PERT cost method may provide better status information than either LOE where BCWP is always equal to the BCWS or a purely subjective percent complete.

However, the PERT cost method has inherent weaknesses and risks that a more objective EVT avoids. Specifically, when the PERT EVT is used for a work package:

- The work package ETC/EAC must be evaluated and updated every month. Note the Cost Performance Index (CPI) will always equal the To Complete Performance Index (TCPI). For reference, CPI = BCWP / ACWP and TCPI = (BAC − BCWP) / (EAC − ACWP).

- The cumulative to date ACWP must be current and accurate, and estimated ACWP should be used when applicable to ensure that the budgeted cost for work scheduled (BCWS), BCWP, and ACWP are aligned in the same accounting period in the EVM cost tool.

- Fluctuations in the ACWP, EAC, and BAC will be automatically reflected in the calculated BCWP. Negative adjustments in BAC or ACWP as well as large EAC increases may result in a negative incremental BCWP.

A contractor's EVM System Description should clearly state when the PERT EVT can be used. It should also provide additional guidance to ensure the ETC/EAC is actively maintained so the calculated BCWP is a valid approximation of the percent complete.

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[2] Compliance Assessment Governance (CAG) 2.0, June 2022, C.8 Appropriate Assignment of Earned Value Techniques (EVTs), Effectiveness Criteria C.8.2, page 108.