Earned Value Management Changes to the Glossary and Chapter 7 of the *PMBOK® Guide* – Third Edition.

Errata for Chapter 7 *(Replacement pages provided)*

Deleted "up to a given point in time" from the description for Planned Value (PV) on page 173.

Deleted "during a given time period" from the descriptions for Earned Value (EV), and Actual Cost (AC) on page 173.

Deleted the first bullet on page 174 which contained the description for "Cumulative CPI"

Added a new paragraph on page 174 after the Schedule performance index (SPI) descriptive Bullet.

Removed the superscript C from all the acronyms on page 175 and page 176.

Deleted the word "cumulative in most cases on pages 172-176

Glossary

Actual Cost revised definition:

Actual Cost (AC). Total costs actually incurred and recorded in accomplishing work performed for a *schedule activity* or *work breakdown structure component*. Actual cost can sometimes be direct labor hours alone, direct costs alone, or all costs including indirect costs. Also referred to as the actual cost of work performed (ACWP). See also *earned value management* and *earned value technique*.

7.3.1 Cost Control: Inputs

.1 Cost Baseline
Described in Section 7.2.3.1.

.2 Project Funding Requirements
Described in Section 7.2.3.2.

.3 Performance Reports
Performance reports (Section 10.3.3.1) provide information on cost and resource performance as a result of actual work progress.

.4 Work Performance Information
Work performance information (Section 4.4.3.7) pertaining to the status and cost of project activities being performed is collected. This information includes, but is not limited to:

- Deliverables that have been completed and those not yet completed
- Costs authorized and incurred
- Estimates to complete the schedule activities
- Percent physically complete of the schedule activities.

.5 Approved Change Requests
Approved change requests (Section 4.4.1.4) from the Integrated Change Control process (Section 4.6) can include modifications to the cost terms of the contract, project scope, cost baseline, or cost management plan.

.6 Project Management Plan
The project management plan and its cost management plan component and other subsidiary plans are considered when performing the Cost Control process.

7.3.2 Cost Control: Tools and Techniques

.1 Cost Change Control System
A cost change control system, documented in the cost management plan, defines the procedures by which the cost baseline can be changed. It includes the forms, documentation, tracking systems, and approval levels necessary for authorizing changes. The cost change control system is integrated with the integrated change control process (Section 4.6).

.2 Performance Measurement Analysis
Performance measurement techniques help to assess the magnitude of any variances that will invariably occur. The earned value technique (EVT) compares the value of the budgeted cost of work performed (earned) at the original allocated budget amount to both the budgeted cost of work scheduled (planned) and to the actual cost of work performed (actual). This technique is especially useful for cost control, resource management, and production.

An important part of cost control is to determine the cause of a variance, the magnitude of the variance, and to decide if the variance requires corrective action. The earned value technique uses the cost baseline (Section 7.2.3.1) contained in the project management plan (Section 4.3) to assess project progress and the magnitude of any variations that occur.

The earned value technique involves developing these key values for each schedule activity, work package, or control account:

- **Planned value (PV).** PV is the budgeted cost for the work scheduled to be completed on an activity or WBS component.
- **Earned value (EV).** EV is the budgeted amount for the work actually completed on the schedule activity or WBS component.
- **Actual cost (AC).** AC is the total cost incurred in accomplishing work on the schedule activity or WBS component. This AC must correspond in definition and coverage to whatever was budgeted for the PV and the EV (e.g., direct hours only, direct costs only, or all costs including indirect costs).
- **Estimate to complete (ETC) and estimate at completion (EAC).** See ETC and EAC development, described in the following technique on forecasting.

The PV, EV, and AC values are used in combination to provide performance measures of whether or not work is being accomplished as planned at any given point in time. The most commonly used measures are cost variance (CV) and schedule variance (SV). The amount of variance of the CV and SV values tend to decrease as the project reaches completion due to the compensating effect of more work being accomplished. Predetermined acceptable variance values that will decrease over time as the project progresses towards completion can be established in the cost management plan.

- **Cost variance (CV).** CV equals earned value (EV) minus actual cost (AC). The cost variance at the end of the project will be the difference between the budget at completion (BAC) and the actual amount spent. Formula: CV= EV – AC
- **Schedule variance (SV).** SV equals earned value (EV) minus planned value (PV). Schedule variance will ultimately equal zero when the project is completed because all of the planned values will have been earned. Formula: SV = EV – PV

These two values, the CV and SV, can be converted to efficiency indicators to reflect the cost and schedule performance of any project.

- **Cost performance index (CPI).** A CPI value less than 1.0 indicates a cost overrun of the estimates. A CPI value greater than 1.0 indicates a cost underrun of the estimates. CPI equals the ratio of the EV to the AC. The CPI is the most commonly used cost-efficiency indicator. Formula: CPI = EV/AC

- **Schedule performance index (SPI).** The SPI is used, in addition to the schedule status (Section 6.6.2.1), to predict the completion date and is sometimes used in conjunction with the CPI to forecast the project completion estimates. SPI equals the ratio of the EV to the PV. Formula: SPI = EV/PV

The parameters of Planed Value (PV), Earned Value (EV), and Actual Cost (AC) may be reported and used on both a period by period basis and on a cumulative basis. This allows measures such as the Cost Variance (CV), Cost Performance Index (CPI), Schedule Variance (SV), and Schedule Performance Index (SPI) to also be developed and used on both a period by period basis and on a cumulative basis.

Figure 7-7 uses S-curves to display EV data for a project that is over budget and behind the work plan.

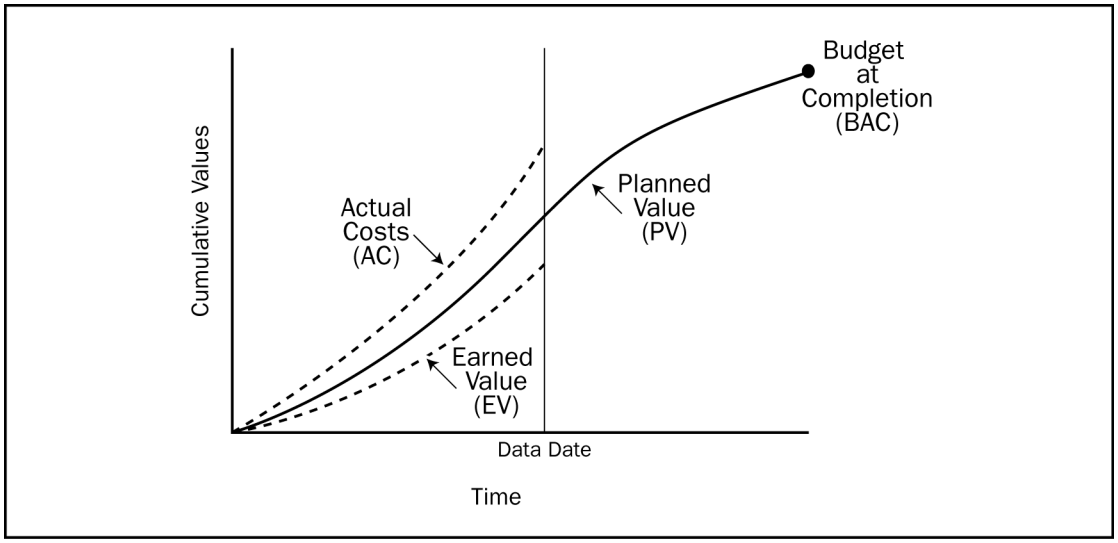

Figure 7-7. Illustrative Graphic Performance Report

The earned value technique in its various forms is a commonly used method of performance measurement. It integrates project scope, cost (or resource) and schedule measures to help the project management team assess project performance.

.3 Forecasting

Forecasting includes making estimates or predictions of conditions in the project's future based on information and knowledge available at the time of the forecast. Forecasts are generated, updated, and reissued based on work performance information (Section 4.4.3.7) provided as the project is executed and progressed. The work performance information is about the project's past performance and any information that could impact the project in the future, for example, estimate at completion and estimate to complete.

The earned value technique parameters of BAC, actual cost (AC) to date, and the CPI efficiency indicator are used to calculate ETC and EAC, where the BAC is equal to the total PV at completion for a schedule activity, work package, control account, or other WBS component. Formula: BAC = total PV at completion

Forecasting techniques help to assess the cost or the amount of work to complete schedule activities, which is called the EAC. Forecasting techniques also help to determine the ETC, which is the estimate for completing the remaining work for a schedule activity, work package, or control account. While the earned value technique of determining EAC and ETC is quick and automatic, it is not as valuable or accurate as a manual forecasting of the remaining work to be done by the project team. The ETC forecasting technique based upon the performing organization providing the estimate to complete is:

- **ETC based on new estimate.** ETC equals the revised estimate for the work remaining, as determined by the performing organization. This more accurate and comprehensive completion estimate is an independent, non-calculated estimate to complete for all the work remaining, and considers the performance or production of the resource(s) to date.

Alternatively, to calculate ETC using earned value data, one of two formulas is typically used:

- **ETC based on atypical variances.** This approach is most often used when current variances are seen as atypical and the project management team expectations are that similar variances will not occur in the future. ETC equals the BAC minus the earned value to date (EV). Formula: ETC = (BAC - EV)
- **ETC based on typical variances.** This approach is most often used when current variances are seen as typical of future variances. ETC equals the BAC minus the EV (the remaining PV) divided by the cost performance index (CPI). Formula: ETC = (BAC - EV) / CPI

An EAC is a forecast of the most likely total value based on project performance (Section 4.4) and risk quantification (Section 11.4). EAC is the projected or anticipated total final value for a schedule activity, WBS component, or project when the defined work of the project is completed. One EAC forecasting technique is based upon the performing organization providing an estimate at completion:

- **EAC using a new estimate.** EAC equals the actual costs to date (AC) plus a new ETC that is provided by the performing organization. This approach is most often used when past performance shows that the original estimating assumptions were fundamentally flawed or that they are no longer relevant due to a change in conditions. Formula: EAC = AC + ETC

The two most common forecasting techniques for calculating EAC using earned value data are some variation of:

- **EAC using remaining budget.** EAC equals AC plus the budget required to complete the remaining work, which is the budget at completion (BAC) minus the earned value (EV). This approach is most often used when current variances are seen as atypical and the project management team expectations are that similar variances will not occur in the future. Formula: EAC = AC + BAC – EV
- **EAC using CPI.** EAC equals actual costs to date (AC) plus the budget required to complete the remaining project work, which is the BAC minus the EV, modified by a performance factor (often the CPI). This approach is most often used when current variances are seen as typical of future variances. Formula: EAC = AC + ((BAC – EV) / CPI)

Each of these approaches can be the correct approach for any given project and will provide the project management team with a signal if the EAC forecasts are not within acceptable tolerances.

.4 Project Performance Reviews

Performance reviews compare cost performance over time, schedule activities or work packages overrunning and underrunning budget (planned value), milestones due, and milestones met.

Performance reviews are meetings held to assess schedule activity, work package, or cost account status and progress, and are typically used in conjunction with one or more of the following performance-reporting techniques:

- **Variance analysis.** Variance analysis involves comparing actual project performance to planned or expected performance. Cost and schedule variances are the most frequently analyzed, but variances from plan in the areas of project scope, resource, quality, and risk are often of equal or greater importance.
- **Trend analysis.** Trend analysis involves examining project performance over time to determine if performance is improving or deteriorating.
- **Earned value technique.** The earned value technique compares planned performance to actual performance.

.5 Project Management Software

Project management software, such as computerized spreadsheets, is often used to monitor PV versus AC, and to forecast the effects of changes or variances.

.6 Variance Management

The cost management plan (Section 7.1.3.4) describes how cost variances will be managed, for example, having different responses to major or minor problems. The amount of variance tends to decrease as more work is accomplished. The larger variances allowed at the start of the project can be decreased as the project nears completion.