

## E. EARNED VALUE ANALYSIS GUIDE

This guide provides instructions on how to complete an earned value analysis. Developing an earned value analysis is premised upon the completion of a well-developed project plan. The information required to complete the initial earned value analysis template during the planning / proposal stage includes:

- Project title
- Project tracking number
- Project start and end dates
- Critical path milestones (CPM)
- The planned value (budgeted cost of work scheduled) for each critical path milestone
- Planned critical path milestone start and completion dates

During project execution, additional information will be required to measure project progress against the approved plan. The additional information required to update the Earned Value Analysis template to produce progress reports includes:

- Actual CPM start date
- Actual CPM completion date
- Actual cost of CPM work performed
- Percent of CPM planned work actually completed

Be sure to attach the following documents to the completed Application:

<b>Deliverable</b>	<b>Directions</b>
Earned Value Template	Print/attach a copy of completed earned value template to the application.
Progress Reports	As critical path milestones are completed, print/attach a copy of the updated Earned Value Template.

### Overview

Earned value is a management technique that measures cost and schedule performance against a baseline plan. All work is planned, budgeted, and scheduled in time-phased planned value increments constituting a cost and schedule measurement baseline. There are two major objectives of an earned value (EV) system to encourage the use of effective internal cost and schedule management control systems, and to provide the appropriate oversight authority with timely data for the purpose of determining project status.

Earned Value utilizes projections derived from a completed project plan (in accordance with OMB Circular No. A-11, Appendix 300A, 2000), to ensure that cost, schedule, and performance goals for the project can be measured throughout the acquisition process. This tracking and evaluation system allows the project manager and VA to assess a given project's progress, analyze significant variances from the plan, forecast impacts to cost and schedule, and take corrective action as appropriate.

The template focuses on linear, critical path milestones. It assumes that each phase is completed prior to the start of the next phase, and a delay in the completion of one phase will impact the start of the next phase (and ultimately the project completion date). The template will allow you to include other non-critical path milestones; however, it is recommended that all project costs are rolled-up into the critical path milestones. Including non-critical path milestones could result in a misleading schedule performance index.

**Figure 1: Succession of Critical Path Milestones**



### The Process

During the Capital Investment Methodology process, the Strategic Management Council evaluates and adopts the earned value plan when approving and allocating project funding. Only Planned Value projections (light blue cells) are needed to complete the Earned Value task for the proposal stage.

Once the project is approved and funded, project tracking begins based upon the critical path milestones: total daily effort, schedule and budget figures established during the proposal stage of the process. As work is performed, it is earned on the same basis as it was planned (in dollars or other quantifiable units such as labor hours). In evaluating cost performance, the earned value (planned value or budget of work performed) is compared to the actual cost of work performed – any difference is a cost variance. In evaluating schedule performance, the earned value is compared to planned value of work scheduled – any difference is a schedule variance.

At the completion of each critical path milestone, the updated Earned Value Analysis spreadsheet will be reviewed to determine project status. This process allows VA and project managers to identify concerns as early as possible before they threaten the project budget or completion date goals.

## Complete the Template

The Earned Value Analysis template is designed to assess performance at the conclusion of each critical path milestone and at any given time prior to completion of a milestone. It also provides forecasts of projected expenditures and efficiencies allowing the project manager a quick and simple method of assessing work performance. If a more comprehensive assessment is required, Microsoft Project® or other commercial project management software packages allow project managers to develop detailed project plans and monitor them throughout their completion.

## Getting Started

Step 1. Open the file titled *Earned Value Template.xls*

Step 2. You will fill in ONLY the light blue fields during the initial planning proposal phase. During project execution, you will complete the yellow cells to monitor project performance.

Step 3. At the top of the sheet, input the Project Title and Project Number. These should be found on the proposal application.

Step 4. Input the planned Project Start Date and Project End Date. Below these dates is a cell for the current date that is automatically generated by Excel and will be used in various calculations. Do not attempt to input data into this cell. To the right of these dates are five dark blue fields with white text. These are project summary values that are automatically generated based on the input of planned and actual milestone values:

- Budget at Completion – (Cell I6) – the sum of all planned values (budgets) (Cells B15 – B256) allocated to the project.
- Estimate at Completion – (Cell I7) – the dollar value representing the projected final costs of work at project completion. Calculated as Budget at Completion (Cell I6) divided by the Cumulative Cost Performance Index (Cell I13).
- Total Budget Expended – (Cell I11) – the sum of the Actual Cost of Work Performed (Cells G15 – G256) for each critical milestone.
- Total Earned value – (Cell I12) – the sum of the Budgeted Cost of Work Performed (Earned Value) (Cells I15 – I256) for each critical milestone.
- Cumulative CPI – the cumulative Cost Performance Index (efficiency factor) calculated as the Total Earned Value (Cell I12) divided by the Total Budget Expended (Cell I11)

## Input Initial Proposal Information

Input information into the light blue cells of the worksheet as specified in the description column below:

Column	Title	Description
A	Critical Milestone	Input a brief description of the Critical Path Milestone as specified in the project plan.
B	Planned Value (Budgeted Cost of Work Scheduled)	Input the estimated planned value (budget amount) required to complete the work in the specified milestone.
C	Planned Start Date	Input the anticipated start date for the milestone in the standard date format MM/DD/YY.
E	Planned Completion Date	Input the anticipated completion date for the milestone in the standard date format MM/DD/YY.

One example for an IT project might include:

Critical Milestone	Planned Value (Budgeted Cost of Work Scheduled)	Planned Start Date	Planned Completion Date
Completion of the Requirements Analysis	\$750,000.00	03/30/2000	04/30/2000
Completion of Data Modeling	\$750,000.00	05/01/2000	06/01/2000
Completion of System Design	\$5,000,000.00	06/02/2000	10/24/2000
Completion of Implementation	\$2,000,000.00	10/25/2000	01/10/2001
Completion of Testing	\$750,000.00	01/11/2000	02/20/2001
Completion of Training	\$750,000.00	02/21/2001	04/15/2001

While a construction example might include:

Critical Milestone	Planned Value (Budgeted Cost of Work Scheduled)	Planned Start Date	Planned Completion Date
Architectural and Infrastructure Review	\$600,000.00	05/15/2000	06/06/2000
Legal and Environmental Review	\$600,000.00	06/07/2000	07/01/2000
Award Construction Contract	\$10,000.00	07/02/2000	07/06/2000
Mid-Point Review of Construction	\$4,800,000.00	07/07/2000	12/20/2000
Completion Review of Construction	\$4,800,000.00	12/21/2000	05/30/2001
Space Deliver/Occupancy	\$1,100,000.00	06/01/2001	07/10/2001

Remember that the critical path milestones used to complete the earned value analysis are directly derived from the project plan. These are the milestones that require completion before another milestone can begin.

### Monitoring Project Performance During Milestone Progress

At some point you will be requested to generate a progress report. To do this, you will input information in Columns D, F, G, & H. Input information into the yellow cells of the worksheet as specified in the Description column below:

Column	Title	Description
D	Actual Start Date	Input the actual start date for the specified milestone.
F	Actual Completion Date	Input the actual finish date for the specified milestone.
G	Actual Cost of Work Performed	<p>As of the date of the report generation, input the number of dollars expended toward completion of the milestone. For example, if \$500,000 has been spent (not obligated), you would input "500,000" in the cell. This includes both labor and non-labor costs. If contractor labor is being used, calculate monies spent as follows:</p> <p><u>Fixed Price Contract:</u> Multiply the percentage in Column L by the Budgeted Dollars for Work Performed in Column I. Fixed price generally implies a direct correlation between expenditures and level of effort. Cost overruns will require adjustments to appear in Column J of the <i>Earned Value Analysis</i> worksheet.</p> <p><u>Time and Materials Contract:</u> Multiply the varying rates for labor against the hours billed for each category to date. This provides the current level of direct expenditures.</p>
H	Percent of Milestone Work Completed	As of the date of the report generation, estimate the percentage of work completed for the specified milestone. For example, if you estimate that 60 percent of the work toward the first milestone is complete, input a "60" in the cell.

Once this data has been input, several pieces of information will be generated automatically. These are displayed in the gray cells of the worksheet and are described in the table below:

Column	Title	Description
I	Earned Value (Budgeted Cost of Work Performed)	This represents the budget or planned value of work completed. For completed milestones, this value will equal the Budgeted Cost of Work Scheduled (planned value). For in-progress milestones, this value is calculated by multiplying the Percent of Milestone Work Completed (Cell H256) by the Budgeted Cost of Work Scheduled (planned value)
J	Cost Variance	This is the numerical difference between the earned value (Cell I256) and the Actual Cost of Work Performed (Cell G256).
K	Cost Performance Index (CPI)	The cost efficiency factor representing the relationship between the actual costs expended (Cell G256) and the value of the physical work performed (earned value - Cell I256). Calculated as Earned Value divided by Actual Cost of Work Performed.
L	Planned Value of Work Scheduled as of Today's Date (straight line)	<p>This represents the value of work scheduled to be completed as of the current date (using the straight line method) and is used to calculate the Schedule Variance and the Schedule Performance Index. For example, if a planned value of \$100,000 of work is scheduled to be completed over a period of 10 days, the calculation will assume that \$10,000 of work should be accomplished on each of the 10 days.</p> <p>If today's date is halfway between the Planned Start Date and the Planned Finish Date, the calculation will assume that one-half of the Planned Value was scheduled to have been completed.</p> <p>If today's date is past the CPM Planned Completion Date, the calculation will assume that 100% of the Planned Value was scheduled to have been completed.</p> <p>If today's date is BEFORE the CPM Planned Start Date, the calculation will assume that none of the Planned Value was scheduled to have been completed.</p>
M	Schedule Variance	The numerical difference between the earned value (Cell I[n]) and planned value (Planned Value – Cell B[n])
N	Schedule Performance Index (CPI)	The planned schedule efficiency factor representing the relationship between the value of the initial planned schedule (Cell B256) and the value of the physical work performed (earned value – Cell I256). Calculated as Earned Value divided by Budget Cost of Work Scheduled (Planned value).

## Analyzing the Milestone

In analyzing the progress of a specific milestone and the impacts to the overall project, the critical measures to be evaluated are the cost variance, cost performance index, schedule variance, and schedule performance index. These performance metrics evaluate what was actually accomplished against what was planned to be accomplished. Significant deviations above or below the project plan should be examined and corrective action taken as necessary to keep the project on track.

A *Cost Variance* is indicated by the difference between the earned value (the planned value / budget of work accomplished) and the actual cost of work accomplished. A negative cost variance indicates a cost overrun whereas a positive cost variance indicates that the milestone is under budget.

The *Cost Performance Index (CPI)* indicates cost efficiency and is calculated by dividing the Earned Value by the Actual Cost. Potential concerns are indicated by a decrease in actual work performed in excess of plus or minus 10% of budget. An acceptable variance in the cost performance index (CPI) should therefore fall between .90 and 1.10. A CPI = 1.0 indicates the plan is being executed at cost. A CPI less than one is unfavorable and indicates possible cost overruns. A CPI greater than 1.0 is favorable and indicates work is being accomplished under cost. For example, a CPI = .80 indicates that for every dollar of work that the project had planned to accomplish, only 80 cents was actually done. If this trend continues, the project is likely to complete 20% over budget. Note: The Estimate at Completion (Cell I7) for the overall project is calculated for you based on the critical milestones cumulative CPI.

The *Schedule Variance* is defined as the difference between the earned value and the planned value of work scheduled at a particular point in time. A negative schedule variance indicates that the milestone is behind schedule whereas a positive schedule variance indicates that the milestone is ahead of schedule.

It should be noted that getting significantly ahead of schedule may have negative impacts on overall project performance, depending upon the causes, similar to being behind schedule. If a project is ahead of schedule, the project manager should determine the causes to ensure that all planned activities are taking place. For example, the project manager should 1) ensure that control activities are proceeding according to plan, and 2) determine if resources will be available to maintain the positive schedule variance, or if the original schedule was simply too generous.

The *Schedule Performance Index* is an efficiency indicator and is defined as Earned Value divided by the Planned Value. As with cost, schedules should stay within 10% of the baseline plan. The schedule performance index (SPI) should fall between .90 and 1.10. As an example, an SPI = .80 would indicate that only

80% of the work planned to be completed was actually completed. If this rate continues, it is likely that the project schedule will slip by 20%. A Schedule Performance Index (SPI) of 1.0 would indicate that the project schedule was progressing exactly as planned. An index less than 1.0 means the project is behind schedule. An SPI greater than 1.0 shows the project is progressing ahead of schedule.

### **Print a Progress Report**

You can print a progress report directly from the screen. The sheet has been formatted to contain all necessary information in successive sheets. However, a full print without selecting relevant pages will result in unnecessary pages of print. It is suggested that Print Preview be used to verify the print area selected.