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Bonnie Biafore is a Project Management Professional (PMP) with more than 25 years of experience helping clients, large and small. She's an award-winning author of 26 books—including several Missing Manuals—about project management, investing, personal finance, Microsoft Project, QuickBooks, and other software programs.

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Microsoft Project 2013: The Missing Manual

by Bonnie Biafore

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NOTE You can download one additional chapter—Chapter 25: Collaborating on Projects with SharePoint—from this book's Missing CD page at *www.missingmanuals.com/cds*. See page xxii for more about the Missing CD page.

- **Budget.** The Budget Cost visual report is like the Baseline Cost report with budget resource costs added (see page 475). It lets you compare scheduled costs, baseline costs, and the budget line item values so you can see where expenditures are relative to your allotted budget dollars.

NOTE Earned value analysis is such an effective way to evaluate project costs that it gets its own section, which starts below. Project's earned value reports are described there.

Comparing Project Costs to a Budget

Budget resources can represent line items in a financial budget. You can allot budget dollars to budget resources in a Project file and then compare your project costs to the budgeted amounts. Setting up budget resources for this type of comparison takes several steps, explained in detail in Chapter 10 (page 273). If you use budget resources, then you can compare budgeted costs to scheduled costs by category, as shown in Figure 10-12 on page 286.

Budget resources are a type of resource in Project, so you need a resource view like Resource Usage to see them in order to compare budget-resource costs to scheduled costs. With Resource Usage view grouped by budget item, Project creates a summary row for each budget category you track. (The BudgetItem group is available in *ProjectMM_Customizations.mpp*, which you can download from this book's Missing CD page at *www.missingmanuals.com/cds*. In the Organizer, select the Groups tab, and then select the Resource option.) The Budget Cost or Budget Work cells in group summary rows show the budgeted values for each budget category, allowing you to see all the work, material, and cost resources associated with that budget item.

Earned Value Analysis

Earned value analysis is like the idea behind that old Smith Barney slogan, "We make money the old fashioned way—we earn it." Earned value analysis measures progress according to how much of your project's value (its cost) you've earned so far by completing work.

Project customers, sponsors, and stakeholders want to know how far along a project is. Earned value alone tells you only how much of the project's cost you've earned—it doesn't say anything about the schedule. Other earned value measures provide a picture of schedule status. If a project has spent half its budget, consumed half its forecast duration, and completed half of its work, you're all set. However, if the budget and duration are half spent, but the work is only 25 percent complete, something is wrong. You have only 50 percent of the budget and duration left to complete 75 percent of the work.

This section explains how to use various earned-value measures to keep tabs on your project.

NOTE Earned value analysis requires a baseline in your Project file, so you have a plan to compare to. If you haven't set a baseline yet (page 374), all the earned value fields are zero. You also have to set a status date and enter actual values as of that date (see Chapter 13) to show what you've accomplished and how much it cost.

Gauging Performance with Earned Value Measures

Earned value analysis uses several calculations to measure schedule and cost status. However, all earned value measures are based on three basic measurements:

- **Planned cost for scheduled work.** In project-management circles, you'll hear *planned value* described as the *budgeted cost of work scheduled* (or BCWS, which is also the name of the corresponding Project field). In English, planned value is the cost you expected to incur for the work scheduled through the status date—that is, the baseline cost for the work that should have been completed as of the status date.

  For example, suppose you're managing a tiger-taming project that's scheduled to tame 24 tigers over 24 months for a total cost of $240,000—$10,000 per tiger. According to that plan, 10 tigers should be tamed at the end of 10 months at a planned value of $100,000.

- **Planned cost for completed work.** This measure is called *earned value* because it represents the baseline cost you've earned by completing work as of the status date. It's also known as *budgeted cost of work performed* or BCWP (the name of the corresponding Project field). For example, if you've tamed six tigers as of the status date, then the earned value is $60,000.

- **Actual cost of completed work.** Actual cost is easy: It's how much you actually spent as of the status date. For example, if you've spent $50,000 through the first 10 months of tiger taming, that's your actual cost of completed work. This measure is sometimes called *actual cost of work performed* or ACWP (again, the name of the Project field).

Analyzing an Earned Value Graph

Because planned value, earned value, and actual cost are all monetary values, you can compare them to evaluate schedule and cost performance. In earned value graphs, the relative positions of the three lines for these measures show whether the project is on schedule and within budget.

Gleaning schedule and cost performance from an earned value graph is easy once you know how to compare planned value, earned value, and actual costs. The Earned Value Report, a new graphical report shown in Figure 14-5, graphs all three measures over time. Here's how you evaluate schedule and cost performance with these three measures:

- **Schedule performance.** The comparison between planned value and earned value is what provides you with a schedule status. Planned value is the baseline cost for the work you *expected* to complete, while earned value is the baseline cost of the work that's *actually* complete. If earned value is less than planned value (like $60,000 versus $100,000 in the tiger-taming project), less work is complete than you expected—thus, the project is behind schedule. If earned value is greater than planned value, then more work is complete than you expected, and the project is ahead of schedule.

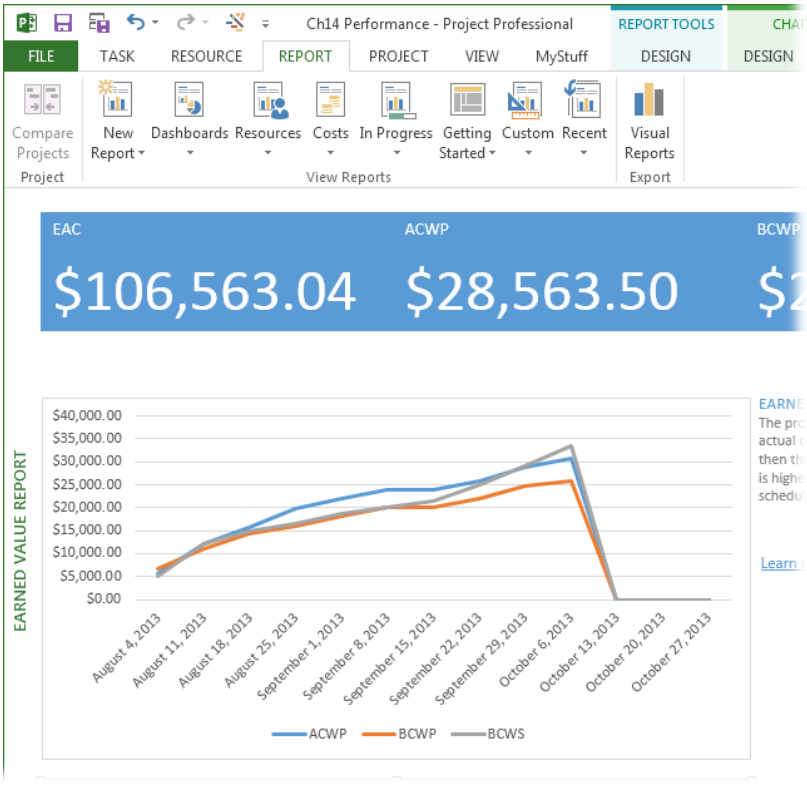

FIGURE 14-5.
An earned value graph shows cost along the y-axis and time along the x-axis. When you use the new graphical Earned Value Report, you can edit the chart to show only past time periods. In this example, earned value (BCWP) is less than planned value (BCWS), so the project is behind schedule. In addition, planned value is less than actual value, so the project is also over budget.

- **Cost performance.** This is the difference between earned value and actual cost. If the earned value is greater than the actual cost, then the work performed cost less than you planned—the project is under budget. For example, the earned value for the tiger taming project is $60,000, while the actual is only $50,000, so it's $10,000 under budget. If earned value is less than the actual cost, then the project is over budget.

Using Additional Earned Value Measures

You can combine a project's planned value, earned value, and actual cost to view project performance from different perspectives. Additional measures show the efficiency of the project or estimated final costs based on performance so far. Here are the additional earned value measures and what they do:

- **Schedule variance** (the SV field in Project) is earned value minus planned value (BCWP – BCWS), the difference between how much work you've completed and how much you planned to complete. If SV is positive, more work is complete than you planned, so you're ahead of schedule. SV for the tiger project is $60,000 minus $100,000, which equals negative $40,000, so the project is behind schedule.
- **Cost variance** (the CV field in Project) is earned value minus the actual cost—in other words, the difference between the baseline and actual cost of the work performed (BCWP – ACWP). If CV is positive, then the baseline cost is greater than the actual cost, so the project is under budget. CV for the tiger project is $60,000 minus $50,000, or $10,000, so the project is under budget. (The box on below explains the difference between Project's Cost Variance and CV fields.)

GEM IN THE ROUGH

Is Positive Variance Good or Bad?

You don't see the Cost Variance and CV fields side by side in any built-in Project tables, which is good because they seem to contradict one another. For example, if the Cost Variance field shows a variance of $1,000, then the CV field shows a variance of ($1,000)—that is, negative $1,000.

With one variance positive and the other negative, it's hard to figure out whether the cost variance is good or bad. The CV field is earned value minus actual cost, which is the *true* arbiter of cost performance. As you've already learned, if earned value is greater than the actual cost, then the project or task is under budget. To help you remember, CV is a positive value when the project or task is under budget, a desirable (that is, positive) result. Keep in mind that the CV field applies only to completed work, because tasks have earned value only for the portion of the task that's complete. (See page 448 to learn how to change the definition of "complete" in Project.)

On the other hand, the Cost Variance field is the Cost field minus the Baseline Cost field, so it's a positive value when the result is *undesirable*—the project or task is over budget.

- **Schedule performance index** (SPI) is the ratio of earned value divided by the planned value (BCWP / BCWS). For example, when the project is on schedule, earned value and planned value are equal, and SPI equals 1.0. An SPI less than 1.0 means earned value is less than planned value, indicating that the project is behind schedule. SPI for the tiger project is $60,000 / $100,000 or 0.6—that is, it's behind schedule.

  Because it's a ratio, SPI tells you how good or bad schedule performance is, regardless of the dollars involved. For example, a small project may have SV equal to $5,000, while a large project SV may be $125,000. However, an SPI of 0.6 shows that both projects have earned value that's 60 percent of the planned value.

- **Cost performance index** (CPI) is the ratio of earned value to actual cost (BCWP / ACWP). If the ratio is greater than 1.0, then earned value is greater than actual cost, which means you spent less to complete the work performed than you'd planned—so the project is under budget. For example, CPI of 1.2 means earned value is 20 percent higher than the actual cost. CPI for the tiger project is $60,000 / $50,000 or 1.2. The project is under budget, but *not* by 20 percent! If you remember your algebra, the percentage this sample project is under budget is ($60,000 – $50,000) / $60,000. That's equal to $10,000 / $60,000, or 16.6 percent under budget.

NOTE You might wonder why earned value analysis calculates the cost performance index, instead of the percentage that the project is over or under budget. Because CPI is a simple ratio of earned value to actual cost, you can use it to forecast the cost of the project at completion, as described in the "Estimate at completion" measure described below.

- **Budget at completion** (BAC) is simply the baseline cost. If you look carefully, you'll see that the Baseline Cost and BAC fields are always equal.
- **Estimate at completion** (EAC) is an estimate of how much a task will cost when it's done, based on the performance so far. Here's the formula for EAC:

  ```
  ACWP + ((BAC - BCWP) / CPI)
  ```

  EAC has two components. The first is the actual cost so far (ACWP). The second, (BAC – BCWP) / CPI, is a cost forecast based on the cost performance index. It's the remaining baseline cost (baseline cost minus the earned value) divided by the cost performance index. For example, here's the calculation for the tiger project EAC:

  ```
  Actual cost = $50,000
  BAC - BCWP = $240,000 - $60,000 = $180,000
  (BAC - BCWP) / CPI = $180,000 / 1.2 = $150,000
  EAC = $200,000
  ```

  Because the cost performance index shows that the project is under budget, EAC assumes that trend will continue. That's why project EAC is only $200,000 compared with project BAC of $240,000.

NOTE Project's Cost and EAC fields are not the same. Cost combines actual costs, remaining labor costs (work multiplied to the resource rates), overtime, and other types of cost like those for materials and cost resources. EAC, on the other hand, assumes that the remaining cost will be inflated or decreased by the same amount as the cost so far; it doesn't take remaining work into consideration at all.

- **Variance at completion** (VAC) is the estimated variance when the task or project is done. It's the baseline cost at completion (BAC) minus the estimate at completion (EAC). For example, VAC for the tiger-taming project is $240,000 – $200,000, or $40,000.

- **To complete performance index** (TCPI) is the ratio of the work that remains (expressed in dollars) to remaining available dollars. Here's the formula:

  ```
  (BAC - BCWP) / (BAC - ACWP)
  ```

  The numerator of the ratio is the remaining baseline cost for the remaining work; the denominator is the remaining available dollars. If TCPI is greater than 1.0, then the remaining baseline cost is greater than the remaining dollars—in other words, you don't have enough money left to pay for the remaining work. If the baseline cost for the remaining work is less than the available dollars, then you have a surplus.

  TCPI for the tiger project is $180,000 / $190,000 or 0.95, which means the project is under budget.

TIP When you're looking at Project tables and need a quick review of these fields and formulas, position your mouse pointer over the appropriate column's header. When the ScreenTip appears, click the link to the help topic for the column's Project field.

Viewing Earned Value in Project

You can examine earned value measures in several places in Project. To see earned value task by task, nothing beats the program's earned value tables. Project also has a new graphical report that provides a visual status of earned value. And you can run the Earned Value Over Time visual report if you want to analyze earned value in more ways than the graphical Earned Value Report can (page 442). Here's where you can find earned value in Project:

- **Earned Value table.** Apply this table, shown in Figure 14-6, to any task-oriented view (in the View tab's Data section, click Tables, and then choose More Tables. In the More Tables dialog box, double-click Earned Value). This table includes all the basic earned value fields: planned value (BCWS), earned value (BCWP), actual cost (ACWP), SV, CV, EAC, BAC, and VAC.
- **Earned Value Cost Indicators table.** This table focuses on cost performance. It includes basic earned value fields but adds CV% (CV as a percentage of the planned value), CPI, and TCPI.
- **Earned Value Schedule Indicators table.** This table focuses on schedule performance. It includes planned value (BCWS), earned value (BCWP), SV, CV, SV%, and SPI.

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