

**Earned Value Management Tutorial  
Module 5: EVMS Concepts and Methods**

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## Module 5: EVMS Concepts and Methods

Welcome to Module 5. The objective of this module is to introduce you to Basic Earned Value concepts and methods.

The Topics that will be addressed in this Module include:

- Earned Value Management System (EVMS) Criteria
- The definitions and illustrations of the basic EVMS terminology
- The definition and illustrations of the EV methods



## Review of Previous Modules

In the previous four modules, we discussed the framework needed to perform Earned Value and develop an Earned Value Management System (EVMS).

- In Module 1 we introduced you to earned value and the requirements for properly implementing an earned value management system (EVMS)
- In Module 2 we discussed the development of the work breakdown structure (WBS), organizational breakdown structure (OBS) and the integration of WBS and OBS in creating the responsibility assignment matrix (RAM)
- In Module 3 we discussed the development of the project schedule and the schedule baseline
- In Module 4 we discussed the development of the project budget and the cost baseline

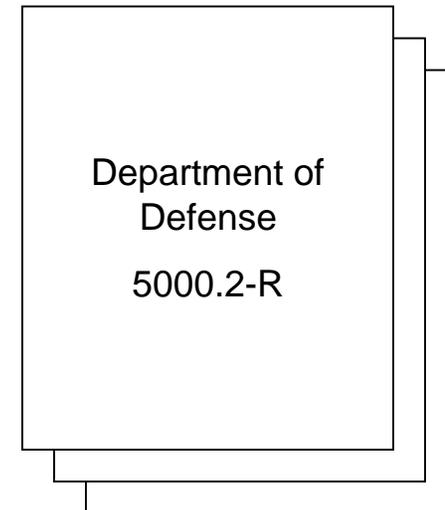
Now lets discuss the basic Earned Value concepts and methods.



## EVMS Criteria

Before we start discussing the Earned Value concepts and methods, let's look at an overview of the criteria needed for EVMS. There are numerous EVMS guidelines that have been developed in both the government and commercial industry.

**On the next page,** we will look at the Industry Standard Earned Value Management System guideline published in DoD 5000.2-R. These guideline comes from the ANSI/EIA standard 748-98.

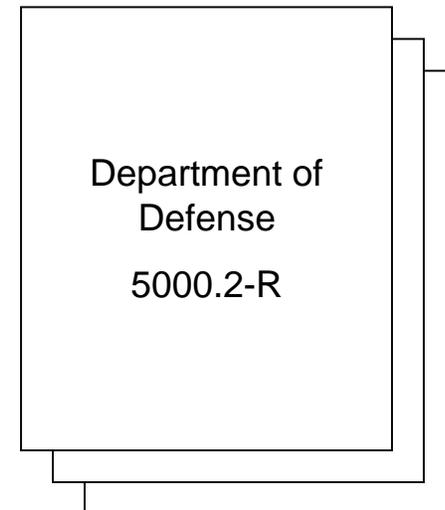




## EVMS Criteria

**The Industry Standard Earned Value Management System** guide provides a uniform set of 32 criteria for developing an EVMS. It is compliant with the ANSI/EIA Standard 748-98 discussed in Module 1.

The criteria represents the requirements against which the validity of a contractor's Earned Value Management System will be judged. The criteria provides contractors the flexibility to develop and implement effective management systems tailored to meet their respective needs, while still ensuring that fundamental Earned Value Management concepts are provided for.



Let's review these criteria **on the next page**.



## EVMS Criteria

The criteria are divided into five categories:

- Organization
- Planning and Budgeting
- Accounting
- Analysis and Management Reporting
- Revisions and Data Maintenance



On the followings pages we provide a summary level review of the criteria. As mentioned earlier there are 32 criteria but for the purpose of a summary review, the criteria were combined. For a complete list of the criteria and the guideline go to the frequently asked questions (FAQ) section or reference section of this web site.



## EVMS Criteria - Organization

The first category is Organization. Within Organization the criteria require the following:

- Define the Work Breakdown Structure (WBS)
- Define the Organizational Breakdown Structure (OBS)
- Establish the work authorization and cost accumulation processes
- Establish Cost and Schedule Integration Process
- Identify Indirect/Overhead Cost Structure
- Create the Responsibility Assignment Matrix (RAM)

### Industry Standard Earned Value Management System

- **Organization**
- Planning & Budgeting
- Accounting
- Analysis & Management Reporting
- Revisions & Data Maintenance



## EVMS Criteria – Planning and Budgeting

The second category is Planning and Budgeting. Within Planning and Budgeting the criteria require the following:

- Create the Integrated Master Schedule
- Identify Milestones, Key Events, Technical Performance Measures
- Establish and Maintain a Time-Phased Budget Baseline
- Identify Management Reserves and Undistributed Budget
- Ensure that the Contract Budget Base (CBB) is reconciled with the Total Allocated Budget (TAB)

### Industry Standard Earned Value Management System

- Organization
- **Planning & Budgeting**
- Accounting
- Analysis & Management Reporting
- Revisions & Data Maintenance



## EVMS Criteria - Accounting

The third category is Accounting. Within Accounting the criteria require the following:

- Record direct and indirect costs in accordance with company disclosure statement
- Provide summary and detail visibility of costs
- Establish process for reporting Material, Other Direct Costs, and Subcontractor Costs
- Provide full accounting of all material purchased for the project

### Industry Standard Earned Value Management System

- Organization
- Planning & Budgeting
- **Accounting**
- Analysis & Management Reporting
- Revisions & Data Maintenance



## EVMS Criteria – Analysis and Management Reports

The fourth category is Analysis and Management Reports. Within Analysis and Management Reports the criteria require the following:

- At least monthly, provide information at the Control Account Level necessary for analysis and reporting using actual cost data that is reconcilable with the approved accounting system
- Provide variance reporting of Budget (BCWS), Earned Value (BCWP), and Actual (ACWP)
- Provide explanation of indirect costs
- Implement recovery plans, management actions, recommendations
- Develop revised estimates (EACs, LREs) based on performance to date and estimates of future performance

### Industry Standard Earned Value Management System

- Organization
- Planning & Budgeting
- Accounting
- **Analysis & Management Reporting**
- Revisions & Data Maintenance



## EVMS Criteria – Revisions and Data Maintenance

The final category is Revisions and Data Maintenance. Within Revisions and Data Maintenance the criteria require the following:

- Establish Change Management System
- Provide Reconciliation and Revision Reports
- Control and Document changes

### Industry Standard Earned Value Management System

- Organization
- Planning & Budgeting
- Accounting
- Analysis & Management Reporting
- **Revisions & Data Maintenance**



## EVMS Criteria – Revisions and Data Maintenance

In modules 1 through 4, we discussed the criteria in the first 3 categories: Organization, Planning and Budgeting, and Accounting.

In this and succeeding modules we will cover the criteria in the final two categories: Analysis and Management Reporting, and Revisions and Data Maintenance.

Let's get started!

### Industry Standard Earned Value Management System

- Organization
- Planning & Budgeting
- Accounting
- Analysis & Management Reporting
- Revisions & Data Maintenance



## EVMS Basic Concepts

At this point, you should understand that Earned Value helps determine if your project is on schedule and within budget. It does this by assessing the project on the basis of cost and schedule as compared to what has been accomplished.

In determining the status of projects, three key components are examined

- Cost and Schedule baseline
- Actual Charges (expenditures)
- Reported accomplishments or “Earned Value”

Understanding how the three components work in earned value is explained on the following pages.



## Planned Value (PV)

Cost and Schedule baseline refers to the physical work scheduled and the approved budget to accomplish the scheduled work. **Together, they result in an important value: Planned Value (PV). PV tells you what you plan to do. Simply stated,**

**Planned Value = Physical Work + Approved Budget**

PV can be looked at in two ways: cumulative and current.

Cumulative PV is the sum of the approved budget for activities scheduled to be performed to date.

Current PV is the approved budget for activities scheduled to be performed during a given period. This period could represent days, weeks, months, etc.



## Planned Value (PV) consists of a 5 step process...

PV, also known as Budget Cost of Work Scheduled (BCWS), can be defined as:

1. Define Scope: What you are tasked to do (Scope Statement)
2. Assign Scope: Breakdown scope into manageable parts (WBS)
3. Schedule Scope: Time-phased, logic driven with critical path (Project Schedule)
4. Budget Scope: develop cost (budget) for all approved scope (Performance Measurement Baseline)
5. Baseline: Snap-shot in time, frozen. What performance measurement will be based on.

Now let's look at an example of Planned Value **on the next page**.



## Planned Value (PV) example

We are working on a Client/Server project, and part of the scope is for Software Design. The time frame is 5 months and the budget for this scope is \$15,000, **resulting in a budget of \$3,000 per month.**

Client/Server Project - WBS 1.1.1 Software Design					
	Dollars				
	JAN	FEB	MAR	APR	MAY
PV	3000	3000	3000	3000	3000

**Time Now** →



## Planned Value (PV) example

Based on these figures, we can calculate the cumulative PV and the current PV.

The Cumulative PV is the total for the elapsed months: January – March. The cumulative PV is \$9,000.

The Current PV is the budget for the current month, March, and equals \$3,000.

Client/Server Project - WBS 1.1.1 Software Design						
	Dollars					
	JAN	FEB	MAR	APR	MAY	
PV	3000	3000	3000	3000	3000	

**Time Now** →

This example uses dollars as units of measure, but note that you can use any unit of measurement: hours, days, dollars, etc.



## Budget at Completion (BAC)

So far we have discussed the cumulative budget and current budget, but what about the budget at the end of the project? Earned Value also uses this figure, termed Budget at Completion (BAC).

BAC is the sum of all budgets allocated to a project scope.

Keep some important points in mind regarding BAC:

- BAC = PMB
- BAC can be examined by work packages and control accounts
- The Project BAC must always equal the Project Total PV. If they are not equal, your earned value calculations and analysis will be inaccurate.

Let's examine BAC using our previous example. Take a look on the next page.



## Budget at Completion (BAC)

Take a moment to review the Software Design project. Knowing that BAC is the sum of all budgets allocated to a project, what is the BAC for this project if Software Design is the complete scope of the project?

Client/Server Project - WBS 1.1.1 Software Design						
Dollars						
	JAN	FEB	MAR	APR	MAY	
PV	3000	3000	3000	3000	3000	

Yes,  $BAC = \$15,000$ . And, in keeping with the previous points about BAC, the project BAC equals the Project Total PV. The Earned Value calculations are correct.



## EVMS Basic Concepts

As you recall from earlier in the module, three key components are required to determine the status of projects. So far, we have examined the first: Cost and Schedule Baseline.

Now let's turn our attention on the following pages to the second, Actual Charges.

- ü Cost and Schedule baseline
- ∅ Actual Charges (expenditures)
  - Reported accomplishments or "Earned Value"



## Actual Cost (AC)

Actual Cost (AC), also called actual expenditures, is the cost incurred for executing work on a project. This figure tells you what you have spent and, as with Planned Value, can be looked at in terms of cumulative and current.

Cumulative AC is the sum of the actual cost for activities performed to date.

Current AC is the actual costs of activities performed during a given period. This period could represent days, weeks, months, etc.

AC is also called Actual Cost of Work Performed (ACWP).



## Actual Cost (AC) example

Illustrating again from the Client/Server project example, can you determine the cumulative AC and current AC? Remember, Cumulative AC is the sum of the actual cost for activities performed to date, and Current AC is the actual costs of activities performed during a given period.

Client/Server Project - WBS 1.1.1 Software Design						
	Dollars					
	JAN	FEB	MAR	APR	MAY	
PV	3000	3000	3000	3000	3000	
AC	1100	900	1200			

**Time Now**

The Cumulative AC is the total for the elapsed months: January – March. The cumulative AC is \$3,200.

The Current AC is the actual cost for the current month, March, and equals \$1,200.



## EVMS Basic Concepts

So far, we have examined Cost and Schedule Baseline and Actual Changes.

Now let's turn our attention on the following pages to the last of the three components, Actual Charges.

- ü Cost and Schedule baseline
- ü Actual Charges (expenditures)
- Ø Reported accomplishments or "Earned Value"



## Earned Value (EV)

To report the accomplishments of the project, you must apply Earned Value (EV) to the figures and calculations in the project.

EV is the quantification of the “worth” of the work done to date.

In other words, EV tells you, in physical terms, what the project has accomplished. As with PV and AC, EV can be presented in a Cumulative and Current fashion.

Cumulative EV is the sum of the budget for the activities accomplished to date.

Current EV is the sum of the budget for the activities accomplished in a given period.

Earned Value is also called Budgeted Cost of Work Performed (BCWP).



## Earned Value (EV) example

Through the Software Design example we have answered several questions, namely, the cumulative PV and AC, the current PV and AC, and the BAC. Let's now determine the cumulative and current EV.

Client/Server Project - WBS 1.1.1 Software Design						
	Dollars					
	JAN	FEB	MAR	APR	MAY	
PV	3000	3000	3000	3000	3000	
AC	1100	900	1200			
EV	800	1300	1000			

Time Now

The Cumulative EV is the sum of the budget for the activities accomplished to date: January – March. The cumulative EV is therefore \$3,100.

The Current EV is the sum of the budget for the activities accomplished in the current month, March, and equals \$1,000.



## Earned Value (EV) example

Armed with a thorough picture of this project's progress, let's summarize the findings we have.

Client/Server Project - WBS 1.1.1 Software Design						
	Dollars					
	JAN	FEB	MAR	APR	MAY	
PV	3000	3000	3000	3000	3000	
AC	1100	900	1200			
EV	800	1300	1000			

Time Now

Cum PV = \$9,000

Current PV = \$3,000

BAC = \$15,000

Cum AC = \$3,200

Current AC = \$1,200

Cum EV = \$3,100

Current EV = \$1,000



## Review

At this point, you should have a solid understanding of the three key earned value components. Let's review them now.

- Planned Value (PV) is determined by the cost and schedule baseline (discussed in Module 2 through 4)
- Actual Cost (AC) is determined by the actual cost incurred on the project
- Earned Value (EV) tells you, in physical terms, what the project accomplished.

- ü Cost and Schedule baseline
- ü Actual Charges (expenditures)
- ü Reported accomplishments or "Earned Value"



## Earned Value (EV) Methods

As you know, EV is determined by what has been physically accomplished. But how do you determine the “physical” accomplishment? Physical accomplishment is determined by measuring the progress of a given activity.

There are numerous EV methods to measure progress. On the following pages, we will focus on the following techniques:

### Earned Value Methods

- Fixed Formula
- Milestone Weights
- Milestone Weights with % Complete
- Units Complete
- Percent Complete
- Level of Effort



## Earned Value (EV) Methods - Fixed Formula

The Fixed Formula method for determining progress applies to work packages and control accounts that span a short period of time (within an accounting period, < 3 months). This method applies a percent complete to the start and finish of an activity. Generally, the percentages used in the formula are 0/100, 50/50, or 25/75.

### Earned Value Methods

- Ø Fixed Formula
- Milestone Weights
- Milestone Weights with % Complete
- Units Complete
- Percent Complete
- Level of Effort

**0/100** - Nothing is earned when activity starts but 100% of budget is earned when completed

**50/50** - 50% is earned when activity starts and the balance is earned on completion

**25/75** - 25% is earned when activity starts and the balance is earned on completion



## Earned Value (EV) Methods – Fixed Formula

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The Fixed Formula method has several advantages and disadvantages:

**Advantages:** Works well for short term work packages, and requires minimal effort to status.

**Disadvantages:** No significant disadvantages for short term, low value work packages. Not very effective for longer term work packages.



## Earned Value (EV) Methods – Milestone Weighting

The next method of calculating EV that we will discuss is Milestone Weights. The Milestone Weighting method assigns budget value to each milestone. Not until full completion of each milestone is the budget earned. Milestone Weighting is used as a method for work packages with long term durations and ideally should have milestones each month or accounting period.

Let's take a look at an example on the next page.

### Earned Value Methods

- ü Fixed Formula
- Ø Milestone Weights
  - Milestone Weights with % Complete
  - Units Complete
  - Percent Complete
  - Level of Effort



## Earned Value (EV) Methods – Milestone Weighting

Below is an example of the Milestone Weighting method. For the purposes of this and future examples, we will assume that the Building Design is the Control Account Level and the activities are at the Work Package level. Below are the activities and milestones in the Control Account for completing a building design. The dates for each milestone are given, along with the value for each milestone upon completion.

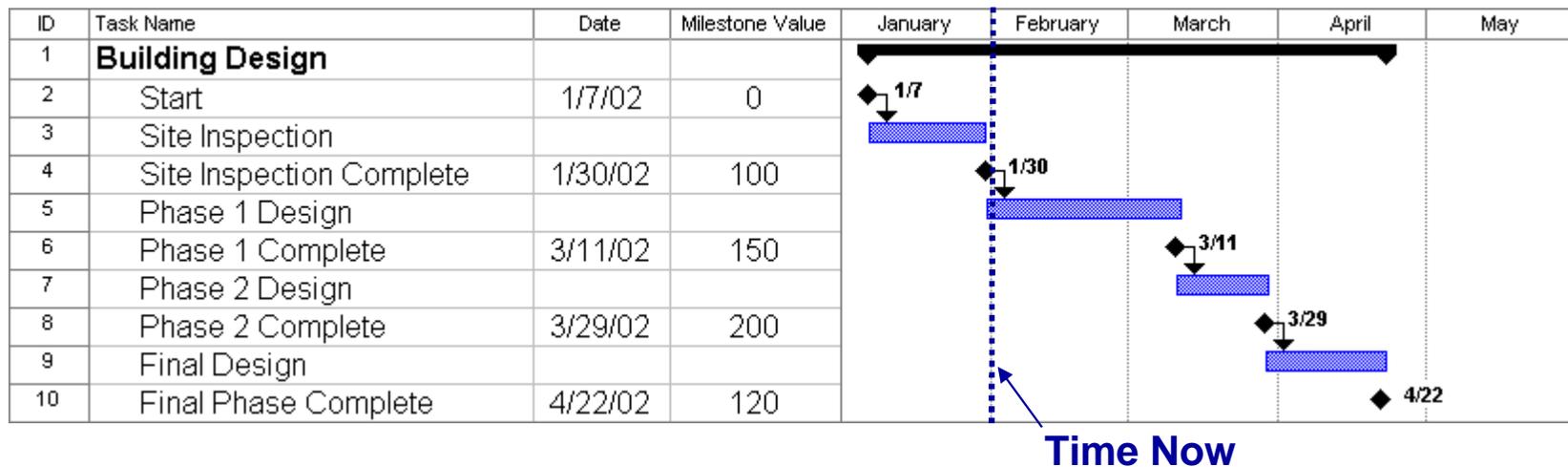
ID	Task Name	Date	Milestone Value	January	February	March	April	May
1	<b>Building Design</b>			[Gantt bar from Jan 7 to Apr 22]				
2	Start	1/7/02	0	◆ 1/7				
3	Site Inspection			[Bar]				
4	Site Inspection Complete	1/30/02	100		◆ 1/30			
5	Phase 1 Design				[Bar]			
6	Phase 1 Complete	3/11/02	150			◆ 3/11		
7	Phase 2 Design					[Bar]		
8	Phase 2 Complete	3/29/02	200				◆ 3/29	
9	Final Design						[Bar]	
10	Final Phase Complete	4/22/02	120					◆ 4/22

Let's use this example and see how Milestone Weighting is applied.



## Earned Value (EV) Methods – Milestone Weighting

For this example, assume that all activities begin and complete as scheduled.  
 With this in mind, can you determine the earned value as of January 31<sup>th</sup>?

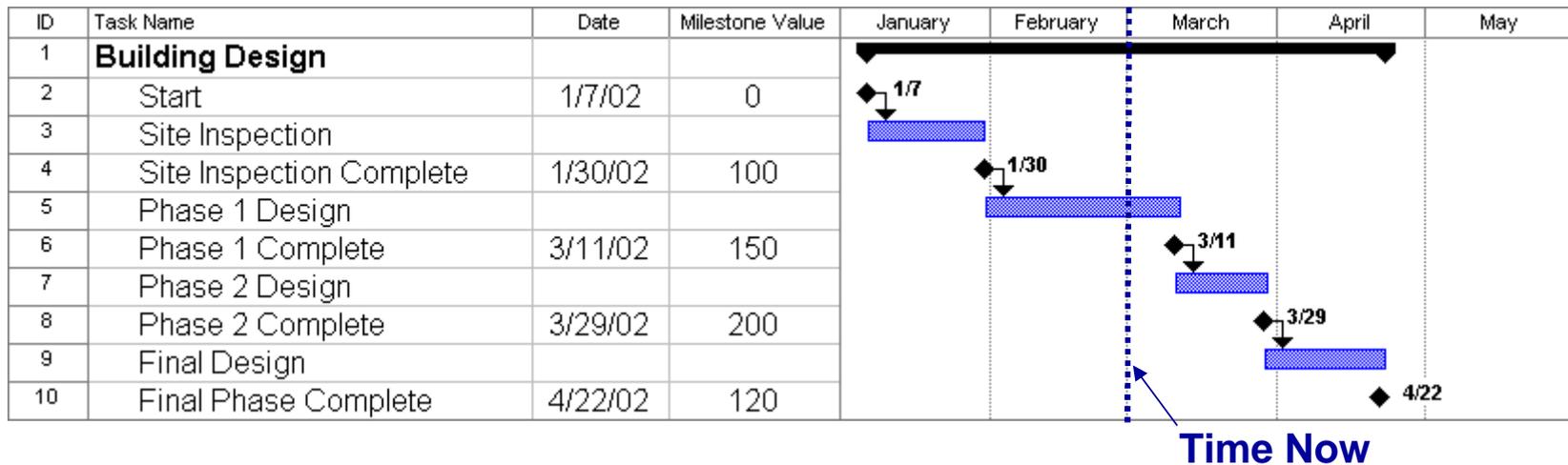


As you can see by the schedule the project has started (1/7). The “Start Inspection milestone” has been completed, but no value appears for that milestone. The “Site Inspection Complete” milestone has also been completed, and its value is 100. There are no more milestones completed through January, so our Current EV is 100. Because it is the first month for the control account, the Cumulative EV is also 100. Now let's look at what has been earned through February.



## Earned Value (EV) Methods – Milestone Weighting

As you can see by looking at the schedule below, there are no milestones scheduled for February (remember we assumed all activities will start and complete as scheduled), but we have started the Phase 1 Design. What are the Current EV and Cumulative EV as of February 28<sup>th</sup>?



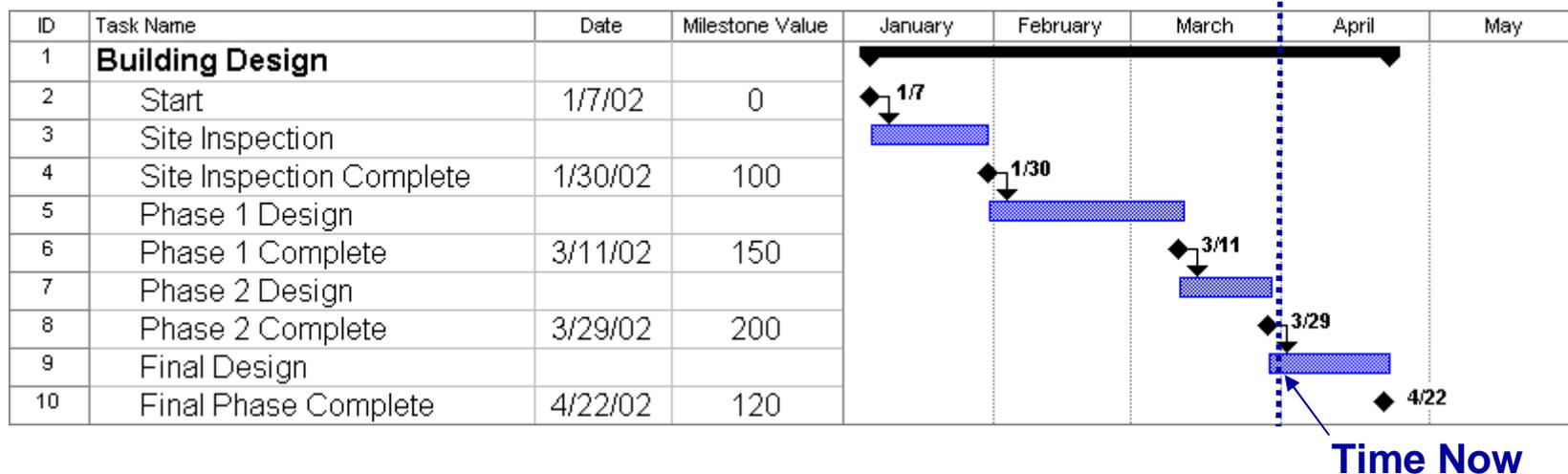
The Current EV is 0. Remember we can only take “earned” if milestone is complete. Since there were no milestones scheduled for or accomplished in February, we have earned no value under the milestone weighting approach. The Cumulative EV is 100, which includes the 100 from January and the 0 from February.

Lets take a look at one more month.



## Earned Value (EV) Methods – Milestone Weighting

Two milestones are scheduled for March. What is are Current EV and Cumulative EV as of March 31<sup>th</sup>?



The Current EV is 350. Completion of Phase 1 Design (150) and Phase 2 Design (200).

The Cumulative EV is 450, which includes the Site Inspection Complete from January (100), February (0), plus the current March EV (350).



## Earned Value (EV) Methods – Milestone Weighting

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The advantages and disadvantages of Milestone Weighting are:

**Advantages:** Requires objective measurable milestones, which most customers or Project Managers prefer.

**Disadvantages:** Does not allow partial credit for in-process work, and requires detailed milestone planning.



## Earned Value (EV) Methods – Milestone Weighting with Percent Complete

We will now look at the third method for determining EV: Milestone Weights with Percent Complete. The Milestone Weighting with Percent Complete method assigns budget value to each milestone, and it is earned based on the percent of work Completed against each individual milestone. Like Milestone Weighting, Milestone Weighting with Percent Complete is used as a method for work packages with long term durations and ideally should have milestones each month or accounting period.

Take a look on the following pages at how using Milestone Weighting with Percent Complete affects the Building Design example demonstrated previously using simple Milestone Weighting.

### Earned Value Methods

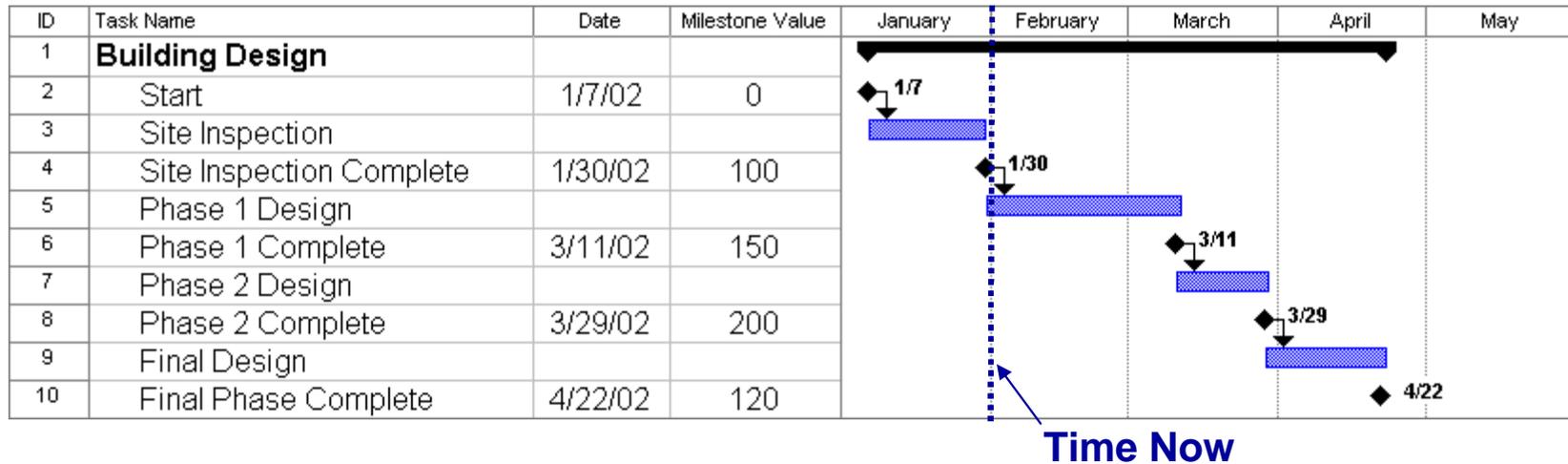
- ü Fixed Formula
- ü Milestone Weights
- ∅ Milestone Weights with % Complete
  - Units Complete
  - Percent Complete
  - Level of Effort



## Earned Value (EV) Methods – Milestone Weighting with Percent Complete

There is no difference using either Milestone Weighting method for determining the “earned” value for January because the milestone was 100% completed during the month.

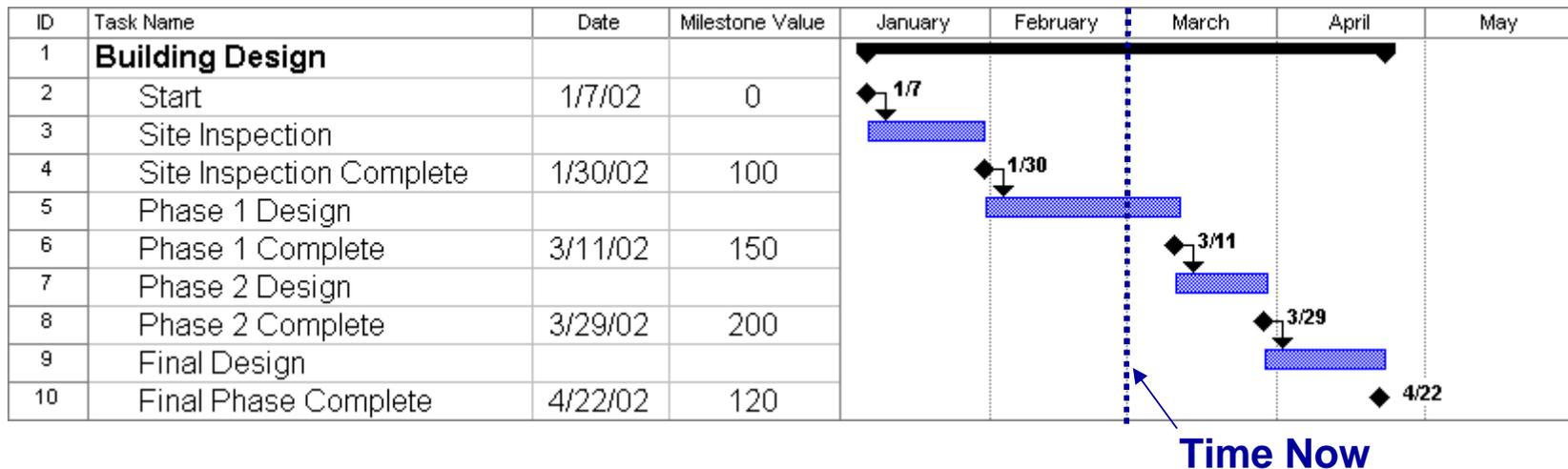
As of January 31th	Milestone Weighting	Milestone Weighting with Percent Complete
Current EV	100	100
Cumulative EV	100	100





## Earned Value (EV) Methods – Milestone Weighting with Percent Complete

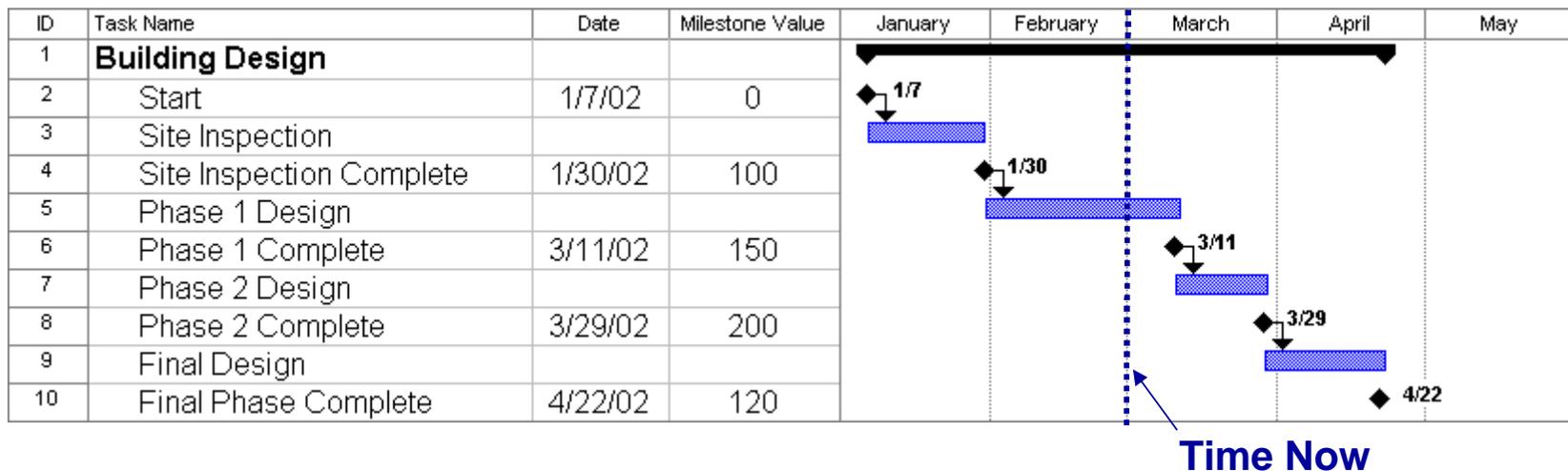
Through February the Milestone Weighting method had a current EV of 0 and a cumulative of 100. Remember, because there are no milestones completed in February, the project cannot earn anything. Using the Milestone Weighting with Percent Complete method, however, you are able to “earn” a portion of the value of the milestone equal to the amount of the work completed for the activity(s) that make up the milestone.





## Earned Value (EV) Methods – Milestone Weighting with Percent Complete

Using the Building Design schedule, you can see that the Phase 1 Design is nearly complete by the end of February. For example, let's say that at the end of February the Phase 1 Design was determined to be 70% complete. Now let's take this information and determine the EV for February using the Milestone Weighting with Percent Complete method and compare.

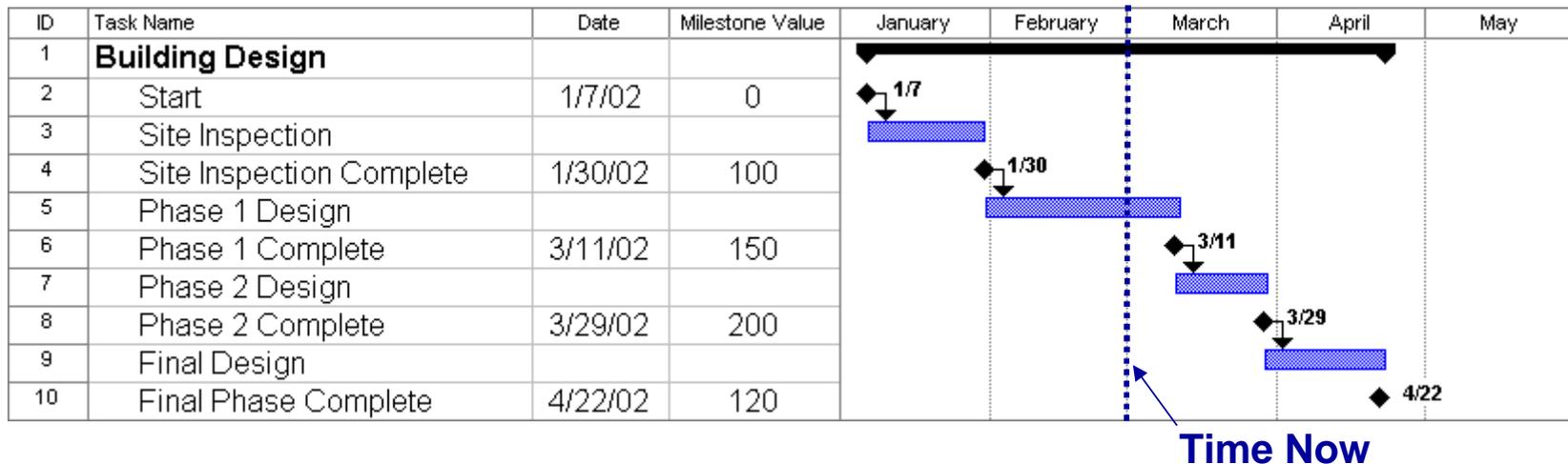




## Earned Value (EV) Methods – Milestone Weighting with Percent Complete

Because it has been determined that you are 70% complete with Phase 1 Design, you can take credit for earning 105 of the 150 for completing Phase 1 Design in February. See the chart below to compare the two methods as of February 28<sup>th</sup>.

As of February 28th	Milestone Weighting	Milestone Weighting with Percent Complete
Current EV	0	105
Cumulative EV	100	205





## Earned Value (EV) Methods – Milestone Weighting with Percent Complete

The advantages and disadvantages of Milestone Weighting with Percent Complete are:

**Advantages:** Requires objective measurable milestones, which most customers prefer, and allows for partial credit against milestones.

**Disadvantages:** Requires a Control Account Manager (CAM) assessment of the % complete for each milestone and requires documentation of assessment methodology.



## Earned Value (EV) Methods – Unit Complete

Now let's look at the Unit Complete method of computing EV. The Unit Complete method uses a physical count to determine what is earned. To use Unit Complete you must have units that are identical or similar and they must have the same budget value.

To examine the Unit Complete method, let's take a look at a different example on the next page.

### Earned Value Methods

- ü Fixed Formula
- ü Milestone Weights
- ü Milestone Weights with % Complete
- ∅ Units Complete
  - Percent Complete
  - Level of Effort



## Earned Value (EV) Methods – Unit Complete

For this example, you must install a total of 40 mainframe computers over five months. The number of units and the schedule to install them is listed below. After the 1<sup>st</sup> month, you have installed 12 mainframes, which means you are 30% complete with the total job. The earned value analysis shows that the PV is 10 units(\$10,000), EV is 12 units(\$12,000) and the AC is 12 units (\$12,000).

	JAN	FEB	MAR	APR	MAY
Main Frames (Units)	10	5	7	11	7
Cost = \$1000/unit	\$10,000	\$5,000	\$7,000	\$11,000	\$7,000

Total Units = 40

If after the 1st month you install 12 main frames, you are 30% complete

	PV	EV	AC
Units	10	12	12
Units (\$)	\$10,000	\$12,000	\$12,000



## Earned Value (EV) Methods – Unit Complete

The advantages and disadvantages of Unit Complete are:

**Advantages:** An objective and easy way of determining the earned value for an activity.

**Disadvantages:** Limited to production type atmosphere of similar items that are fixed unit prices. Does not take into consideration labor fluctuations so may misrepresent actual EV.



## Earned Value (EV) Methods – Subjective Percent Complete

The fifth method of EV calculation that we will review is Subjective Percent Complete. The Subjective Percent Complete method applies a percent complete to a budget value to determine what is earned. The percent complete value is determined by the Control Account Manager or other designated individuals. The percent complete is applied to the Budget at Completion (BAC) for a given activity to determine the current and cumulative EV.

### Earned Value Methods

- ü Fixed Formula
- ü Milestone Weights
- ü Milestone Weights with % Complete
- ü Units Complete
- ∅ Percent Complete
- Level of Effort

Take a look on the next page at how Subjective Percent Complete is used.



## Earned Value (EV) Methods – Subjective Percent Complete

To use the Subjective Percent Complete method, the value is placed on the work activity, not the milestone (as in the Milestone Weighting method). Using the Building Design Project from earlier, this becomes more clear.

ID	WBS	Task Name	Start	Finish	Milestone Value	January	February	March	April	May
1	1.1.2	<b>Building Design</b>	1/7/02	4/22/02		[Gantt bar from 1/7/02 to 4/22/02]				
2	1.1.2	Start	1/7/02	1/7/02		◆ 1/7				
3	1.2	Site Inspection	1/7/02	1/30/02	100	[Bar 1/7-1/30]				
4	1.1.2	Site Inspection Complete	1/30/02	1/30/02			◆ 1/30			
5	1.4	Phase 1 Design	1/31/02	3/11/02	150		[Bar 1/31-3/11]			
6	1.1.2	Phase 1 Complete	3/11/02	3/11/02				◆ 3/11		
7	1.6	Phase 2 Design	3/11/02	3/29/02	200			[Bar 3/11-3/29]		
8	1.1.2	Phase 2 Complete	3/29/02	3/29/02					◆ 3/29	
9	1.8	Final Design	3/29/02	4/22/02	120				[Bar 3/29-4/22]	
10	1.1.2	Final Phase Complete	4/22/02	4/22/02						◆ 4/22

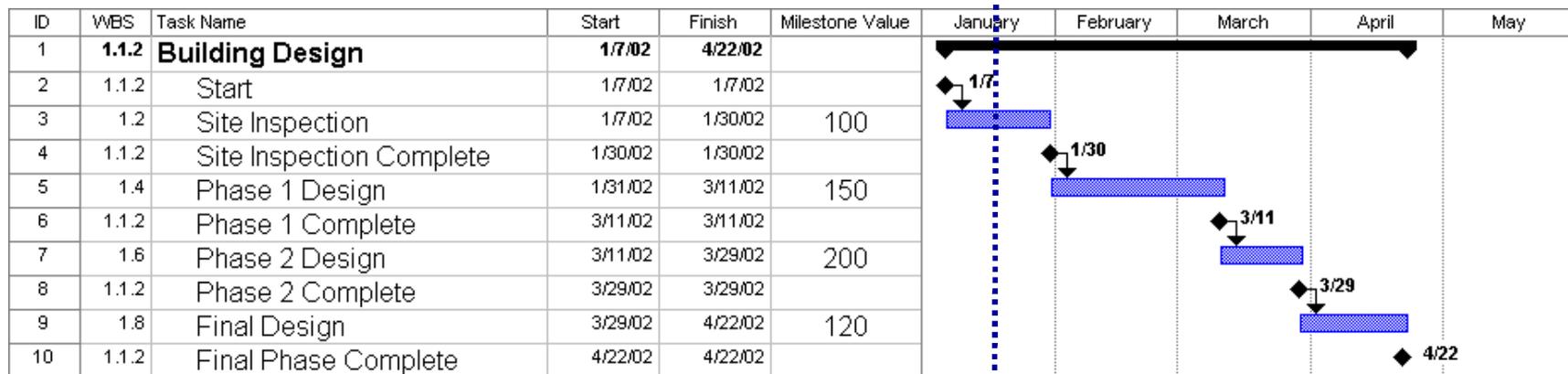


## Earned Value (EV) Methods – Subjective Percent Complete

Looking at the Site Inspection activity in the schedule below, the start date is January 7<sup>th</sup> with a scheduled completion date of January 30<sup>th</sup>. Let's status the activity as of January 15<sup>th</sup>.

To determine the percent complete for January 15<sup>th</sup>, the control account manager (CAM) must use an educated guess to determine the percent complete of the activity. The CAM must maintain the logic for assessing each activity's percent complete.

In this example, the CAM decides that the activity is 45% complete as of January 15<sup>th</sup>. Given this, the EV for Site Inspection as of January 15<sup>th</sup> is 45.





## Earned Value (EV) Methods – Subjective Percent Complete

The advantages and disadvantages of Subjective Percent Complete are:

**Advantages:** This is one of the more subjective methods. Earned Value is based on the CAM's assessment of the work package progress. Detailed planning at the milestone level is not required.

**Disadvantages:** Customer Satisfaction maybe low due to the subjectiveness involved and the lack of detailed planning, however, CAMs are required to provide the customer with their assessment methodology.

**Note:** Milestones do not apply to this method. Labor and non-labor must be identified in separate work packages if this method is applied. This method is highly subjective, and documentation in support of percent complete derivations is required.



## Earned Value (EV) Methods – Level of Effort

The last EV method to define is Level of Effort. The Level of Effort (LOE) method is based on the passage of time. A monthly budget value is earned with the passage of time and is always equal to the monthly planned amount. When using LOE, the PV is always equal to the EV (see chart below). This method is usually used for accounts that are more time related than task oriented. Example of an LOE account is Program and Project Management support.

Earned Value Methods	
ü	Fixed Formula
ü	Milestone Weights
ü	Milestone Weights with % Complete
ü	Units Complete
ü	Percent Complete
Ø	Level of Effort

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
PV	\$1,000	\$1,000	\$1,200	\$1,200	\$1,200	\$1,500	\$1,500	\$1,500
EV	\$1,000	\$1,000	\$1,200	\$0	\$0	\$0	\$0	\$0

Time Now



## Earned Value (EV) Methods – Level of Effort

The advantages and disadvantages of Level of Effort are:

**Advantages:** This EVM does not require statusing, and is appropriate for sustaining tasks like Program Management.

**Disadvantages:** Level of Effort work packages are often challenged by the customer. This EV method should be kept to a minimal number of work packages. LOE work packages require accurate assessment (planning) of monthly performance.



## Review

At this point, you should have a firm grasp of the EV methods of calculation.

### Earned Value Methods

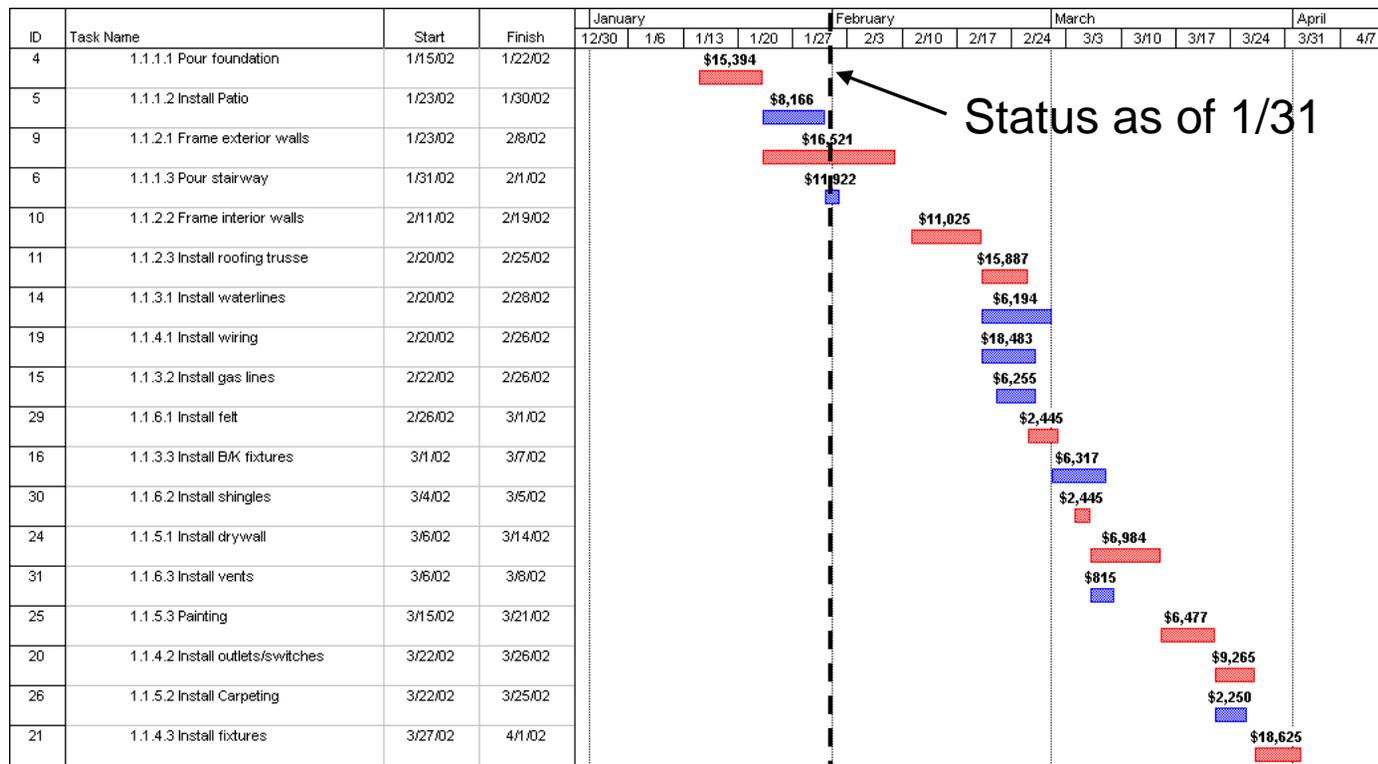
- Fixed Formula
- Milestone Weights
- Milestone Weights with % Complete
- Units Complete
- Percent Complete
- Level of Effort

Now that we are finished reviewing the EV methods, let's take a look at our ACME House Building project using the concepts discussed in this module.



## Project Status: Example

Let's recall, from previous modules, the project baseline (schedule and cost) for the House Building project. The project start date is 1/15, with an expected completion date of 4/1. It is now 1/31. The project started on schedule and needs to be statused as of 1/31. Look at the schedule and identify the activities that need to be reviewed for status.

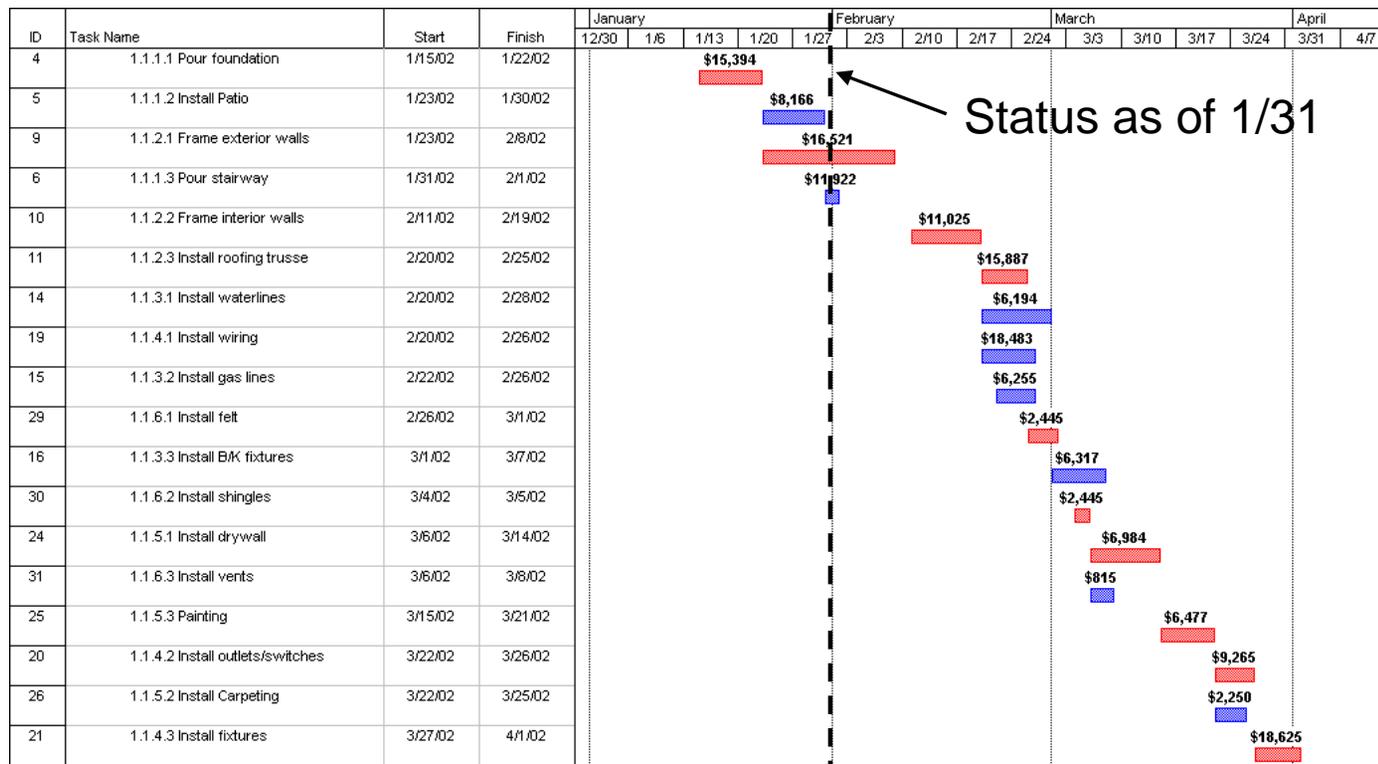




# Project Status: Example

According to the baseline, the following activities need to be reviewed for status as of 1/31:

- Pour Foundation
- Install Patio
- Frame Exterior Walls
- Pour Stairway







## Project Status: Example

Now we need to determine our Earned Value (EV) for each activity. As we discussed on the previous pages, there are numerous EV methods used for measuring progress each method more applicable to certain types of activities than other methods. For example we will use the following EV methods for, the four activities we are statusing.

Activity	EV Method
Pour Foundation	Fixed Formula: 0/100
Install Patio	Subjective % Complete
Frame Exterior Walls	Subjective % Complete
Pour Stairway	Fixed Formula: 25/75

Now that we understand what activities need statusing and what method of EV will be used for each activity, it is time to status the project activities.



## Project Status: Example

To obtain our project activity status, we will need to meet with the Project Manager or those responsible for the work. In our case, we will need to meet with the different CAMs or Project Superintendents responsible for each Control Account. Below are the results of that meeting.

Monthly Status Meeting  
January 31th, 2002

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				



## Project Status: Example

Now let's review the status of each activity.

The first activity is Pour Foundation. This activity was scheduled to start on 1/15 and finish on 1/22 (see schedule below). It's actually started on 1/15 and finished on 1/22 (see status report below). Thus this activity was on schedule and is 100% complete. What is its Planned Value (PV), Earned Value (EV), and Actual Cost (AC)?

Monthly Status Meeting  
January 31th, 2002

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				

ID	Task Name	Start	Finish	January					February		
				1/2/02	1/6	1/13	1/20	1/27	2/3	2/10	
4	1.1.1.1 Pour foundation	1/15/02	1/22/02								
5	1.1.1.2 Install Patio	1/23/02	1/30/02								
9	1.1.2.1 Frame exterior walls	1/23/02	2/8/02								
6	1.1.1.3 Pour stairway	1/31/02	2/1/02								



## Project Status: Example

The Planned Value is determined by what was “planned” or scheduled to be complete. Using the schedule below, the activity was planned to start on 1/15 and finish on 1/22 thus as of 1/31 the PV for Pour Foundation is \$15,394, the entire value of the activity.

The Earned Value (EV) is what was actually done as of 1/31. The activity is 100% complete and its EV is \$15,394 (100% of PV). Remember you cannot earn more than was planned.

Monthly Status Meeting  
January 31th, 2002

The Actual Cost (AC) is what was actually spent and can be obtained from the accounting system. The AC is \$15,850.

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				

ID	Task Name	Start	Finish	January					February		
				12/30	1/6	1/13	1/20	1/27	2/3	2/10	
4	1.1.1.1 Pour foundation	1/15/02	1/22/02								
5	1.1.1.2 Install Patio	1/23/02	1/30/02								
9	1.1.2.1 Frame exterior walls	1/23/02	2/8/02								
6	1.1.1.3 Pour stairway	1/31/02	2/1/02								



## Project Status: Example

The next activity, Install Patio, is handled the same way as the previous activity. It was completed on schedule and is 100% complete as of 1/31. Its PV, EV and AC are as follows:

Planned Value (PV) = \$8,166

Earned Value (EV) = \$8,166

Actual Cost (AC) = \$7,200

Monthly Status Meeting  
January 31th, 2002

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				

ID	Task Name	Start	Finish	January					February		
				1/2/02	1/6	1/13	1/20	1/27	2/3	2/10	
4	1.1.1.1 Pour foundation	1/15/02	1/22/02								
5	1.1.1.2 Install Patio	1/23/02	1/30/02								
9	1.1.2.1 Frame exterior walls	1/23/02	2/8/02								
6	1.1.1.3 Pour stairway	1/31/02	2/1/02								



## Project Status: Example

The next two activities are a little different because they are not 100% complete, and they use two different methods of determining EV.

Let's take a look at the activity, Frame Exterior Walls first. Check out this activity on the next page.

Monthly Status Meeting  
January 31th, 2002

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				

ID	Task Name	Start	Finish	January				February	
				1/2/02	1/6	1/13	1/20	1/27	2/3
4	1.1.1.1 Pour foundation	1/15/02	1/22/02						
5	1.1.1.2 Install Patio	1/23/02	1/30/02						
9	1.1.2.1 Frame exterior walls	1/23/02	2/8/02						
6	1.1.1.3 Pour stairway	1/31/02	2/1/02						



## Project Status: Example

The activity, Frame Exterior Walls, was schedule to start on 1/23 and finish on 2/8. It started on 1/23 and is forecasted to complete on 2/8 (see status report), thus the activity is on schedule. As of 1/31 the Project Superintendent said the activity was 40% complete. Remember the EV method used for this activity is Subjective % Complete. What is our PV, EV and AC?

Monthly Status Meeting  
January 31th, 2002

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				

ID	Task Name	Start	Finish	January					February		
				1/2/02	1/6	1/13	1/20	1/27	2/3	2/10	
4	1.1.1.1 Pour foundation	1/15/02	1/22/02								
5	1.1.1.2 Install Patio	1/23/02	1/30/02								
9	1.1.2.1 Frame exterior walls	1/23/02	2/8/02								
6	1.1.1.3 Pour stairway	1/31/02	2/1/02								

The Gantt chart displays the progress of four tasks. Task 4 (Pour foundation) is completed with a value of \$15,394. Task 5 (Install Patio) is completed with a value of \$8,166. Task 9 (Frame exterior walls) is 40% complete with a value of \$16,521. Task 6 (Pour stairway) is 25% complete with a value of \$11,922.



## Project Status: Example

The Planned Value is \$8,748. Let's review how the planned value was determined.

The activity is schedule from 1/23 to 2/8, which is 17 calendar days or 13 working days. We will use calendar days in our example calculation. Remembering the assumption that all costs are spent uniformly across each activity, we need to determine what the PV is as of 1/31. Let's take a look at the calculations on the next page.

Monthly Status Meeting  
January 31th, 2002

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				

ID	Task Name	Start	Finish	January					February		
				1/2/02	1/6	1/13	1/20	1/27	2/3	2/10	
4	1.1.1.1 Pour foundation	1/15/02	1/22/02								
5	1.1.1.2 Install Patio	1/23/02	1/30/02								
9	1.1.2.1 Frame exterior walls	1/23/02	2/8/02								
6	1.1.1.3 Pour stairway	1/31/02	2/1/02								



## Project Status: Example

The cost of the activity, \$16,521, will be divided by the total duration of the activity, 17 days, to give us a value of \$972 per day. Next we take the planned start date (1/23) and the status date (1/31) to determine the amount of days planned (9). Now let's determine the Planned Value (PV).

The PV is determined by taking the amount of days (9) times the value per day (\$972). Our PV is \$8,748. Remember that there is a difference between cumulative and current. For this example they are the same.

Monthly Status Meeting  
January 31th, 2002

Now let's take a look on the next page at determining EV.

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				

ID	Task Name	Start	Finish	January				February	
				12/30	1/6	1/13	1/20	1/27	2/3
4	1.1.1.1 Pour foundation	1/15/02	1/22/02						
5	1.1.1.2 Install Patio	1/23/02	1/30/02						
9	1.1.2.1 Frame exterior walls	1/23/02	2/8/02						
6	1.1.1.3 Pour stairway	1/31/02	2/1/02						



## Project Status: Example

The Earned Value for this activity is determined by taking the activity's total value, \$16,521, and multiplying it by the % complete. In this case, the % complete is 40%. The EV for this activity, as of 1/31, is \$6,608.

The Actual Cost (AC) as derived from the accounting system is \$6,250.

In summary:

PV = \$8,748

EV = \$6,608

AC = \$6,250

Monthly Status Meeting  
January 31th, 2002

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				

Now let's take a look at our last activity.





## Project Status: Example

The last activity is Pour Stairway. This activity was scheduled to start on 1/31 and finish on 2/1. It started on schedule on 1/31 and is forecasted to complete on 2/1 (see status report), thus the activity is on schedule. Its EV method is Fixed Formula 25/75, so its % complete is 25%. Using the same processes discussed on the previous pages, what is the PV, EV and AC for this activity?

PV = \$5,961 ( $\$11,922/2$  calendar days)

EV = \$2,981 ( $\$11,922 \times .25$ )

AC = \$3,100 (from accounting system)

Now let's review our project status.

Monthly Status Meeting  
January 31th, 2002

Control Account	Activity	Actual Start	Actual Finish	% Complete	Forecast Completion
<b>Concrete</b>	Pour Foundation	1/15	1/22	100%	
	Install Patio	1/23	1/30	100%	
	Pour Stairway	1/31		25%	2/1
<b>Framing</b>	Frame Exterior Walls	1/23		40%	2/8
<b>Plumbing</b>	No activities scheduled				
<b>Electrical</b>	No activities scheduled				
<b>Interior</b>	No activities scheduled				
<b>Roofing</b>	No activities scheduled				

ID	Task Name	Start	Finish	January				February	
				12/30	1/6	1/13	1/20	1/27	2/3
4	1.1.1.1 Pour foundation	1/15/02	1/22/02						
5	1.1.1.2 Install Patio	1/23/02	1/30/02						
9	1.1.2.1 Frame exterior walls	1/23/02	2/8/02						
6	1.1.1.3 Pour stairway	1/31/02	2/1/02						



## Project Status: Example

The chart below lists the project status results as of 1/31. But what does this information tell us?

as of 1/31	PV	EV	AC	SV	CV	SPI	CPI
Foundation	\$15,394	\$15,394	\$15,850	0	-456	1.00	0.97
Patio	\$8,166	\$8,166	\$7,200	0	966	1.00	1.13
Exterior Walls	\$8,748	\$6,608	\$6,250	-2,140	358	0.76	1.06
Stairway	\$5,961	\$2,981	\$3,100	-2,980	-119	0.50	0.96
Project Total	\$38,269	\$33,149	\$32,400	-5,120	749	0.87	1.02

Note: SV = Schedule Variance, CV = Cost Variance, SPI = Schedule Performance Index, CPI = Cost Performance Index

Can you answer these questions?

- Is the Project on Schedule?, If not, what activity(s) is behind?
- Is the project overrunning? If so, what activity(s) is overrunning?
- Is the project going to miss the project completion milestone?
- Is the project going to need more budget?

These questions and others will be answered in the next module, Module 6 – Metrics, Performance Measures and Forecasting where the value of EVM will become apparent.



## Estimate at Completion (EAC)

One final item that needs to be covered briefly is Estimate at Completion (EAC).

The Estimate at Completion (EAC) is the actual cost to date plus an objective estimate of costs for remaining authorized work. The objective in preparing an EAC is to provide an accurate projection of cost at the completion of the project. There are multiple ways and varying degrees of detail to calculate EAC, and they will be covered in a future module. The most common is:

$$\text{EAC} = \text{Actual Cost (AC)} + \text{Estimate to Complete (ETC)}$$

The Estimate to Complete (ETC) is the cost of completing the authorized remaining work.



## Review of Module 5

Take some time to review the major items of this module

- There is an Industry Standard Earned Value Management System guideline published in DoD 5000.2-R. It contains 332 criteria in 5 categories.
- There are three key components to earned value: Planned Value, Earned Value and Actual Cost.
  - PV (BCWS) is the physical work scheduled or “what you plan to do”.
  - EV (BCWP) is the quantification of the “worth” of the work done to date or “what you physically accomplished”.
  - AC (ACWP) is the cost incurred for executing work on a project or “what you have spent”.
- There are numerous EV methods used for measuring progress.
  - Fixed Formula
  - Milestone Weights
  - Milestone Weights with % Complete
  - Units Complete
  - Percent Complete
  - Level of Effort



## Summary of Module 5

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In previous modules, we examined the basics of planning, scheduling, budgeting, and establishing a baseline. In this module we examined the basic EVMS concepts and methods. The next module takes us into analyzing the Metrics of Earned Value, along with addressing Performance Measures and Forecasting.

If you have a firm grasp of the concepts covered in these first five modules, feel free to progress to the next module. Otherwise, review the modules to ensure you have a solid understanding of the basics.

This concludes Module 5.