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***Earned Value Management***

**M P you G**  
Atlanta

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### ***What is EVM?***

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- A project management technique for integrating and quantifying project costs and schedules
  - Starts with a controlled baseline
  - Allows objective assessment and quantification of current project performance
  - Helps predict future performance based on trends
- Provides objective, accurate and timely data for effective decision making

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### ***Questions Answered by EVM***


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- Are we ahead of or behind schedule?
- When is the project likely to be completed?
- Are we currently under or over our budget?
- What is the remaining work likely to cost?
- How much will we be under or over budget at the end?




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### ***The “Big Three”***

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- Planned Value (PV)
- Actual Costs (AC)
- Earned Value (EV)



*Provide the basis for completing earned value measurement techniques*

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## Point-in-Time Evaluation

- **Planned Value**
  - The *budgeted* cost of the work that was planned to be completed at this point in time?
- **Earned Value**
  - The *budgeted* cost for the work *actually completed* at this point in time?
- **Actual Cost**
  - The amount you *actually spent* to complete the work at this point in time?

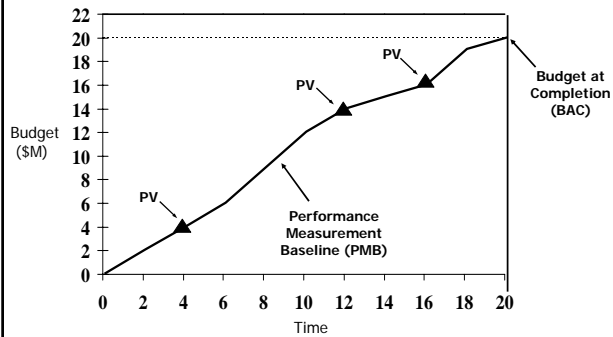


## Performance Management Baseline

DEFINED WORK	SCHEDULE	PLANNED VALUE (PV)
Design	△ — △	\$4M
Manufacture	△ — — — △	\$6M
Component Test	△ — — — △	\$4M
Assemble	△ — — — △	\$2M
Integrated Test	△ — — — △	\$4M
Time	0 2 4 6 8 10 12 14 16 18 20	\$20M <b>BAC</b>

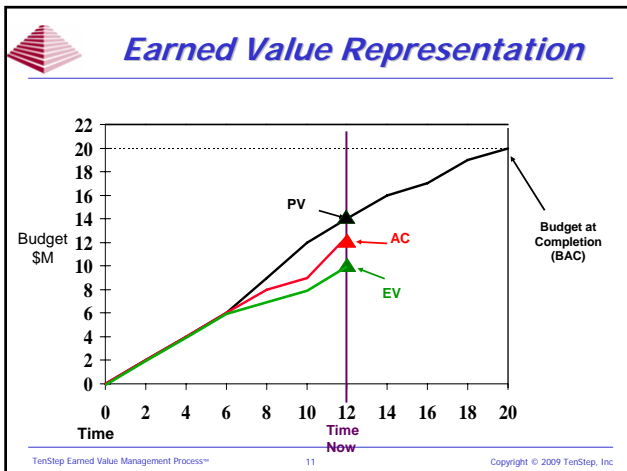
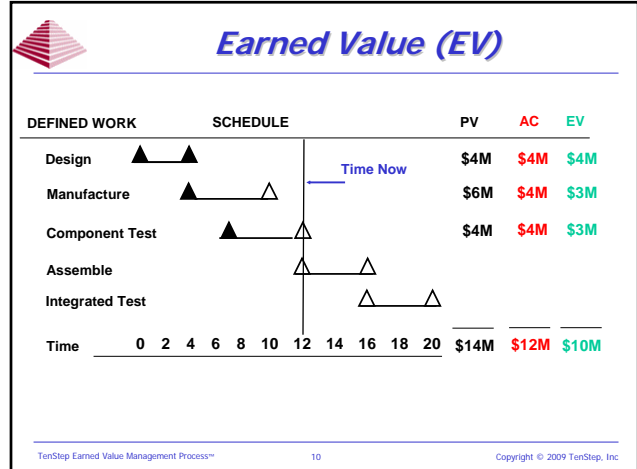
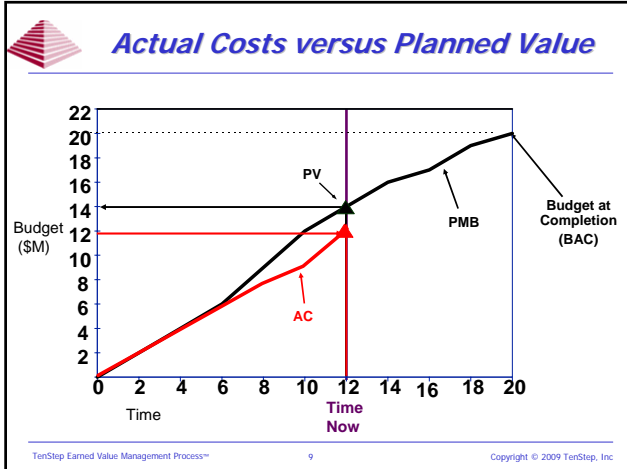


## Time-Phased Plan

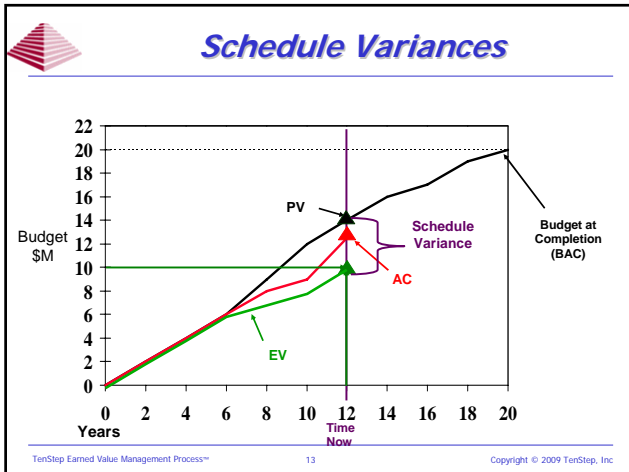


## Actual Costs (to date)

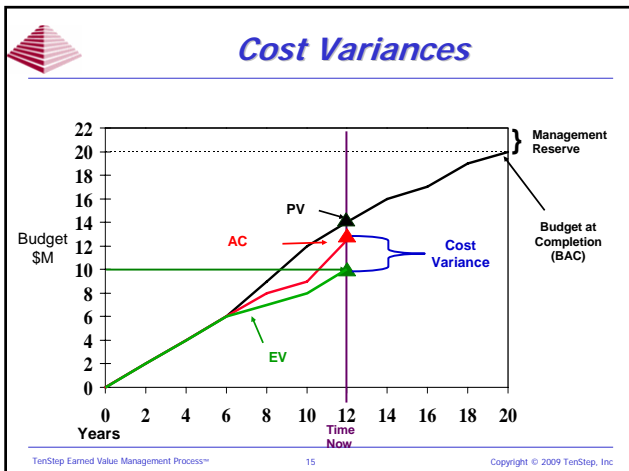
DEFINED WORK	SCHEDULE	PV	AC
Design	▲ — ▲	\$4M	\$4M
Manufacture	▲ — — — ▲	\$6M	\$4M
Component Test	▲ — — — ▲	\$4M	\$4M
Assemble	▲ — — — ▲		
Integrated Test	▲ — — — ▲		
Time	0 2 4 6 8 10 12 14 16 18 20	\$14M	\$12M



- ### Schedule Variance (SV)
- Is the project ahead or behind schedule?
  - Difference between
    - Earned Value
      - Budgeted cost of the work actually completed
    - Planned Value
      - Budgeted cost of the work planned to be completed by now
  - $SV = EV - PV$
  - $SV > 0$  is generally good
    - The budgeted cost of the work actually completed is greater than the cost of the planned work
    - You are (probably) ahead of schedule at this point
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- ### Cost Variance (CV)
- Is the project over or under budget?
  - Difference between
    - Earned Value
      - Budgeted cost of the work actually completed
    - Actual Costs
      - Actual cost of the work completed
  - $CV = EV - AC$
  - $CV > 0$  is generally good
    - The budgeted cost of the work completed is greater than the actual cost of the work completed
    - You are (probably) under budget at this point
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- ### Schedule Performance Index (SPI)
- Schedule efficiency is the “run rate”
  - $SPI = EV / PV$
  - An SPI greater than 1.0 is favorable
    - The budgeted cost of the work actually completed is greater than the cost of the planned work
  - Example EV is \$110, PV is \$100
    - SPI is 1.1 (EV/PV)
    - This means that the budgeted cost of the work completed is \$110, but the planned work at this point is \$100.
    - We are getting more work done than planned
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## Cost Performance Index (CPI)

- Cost efficiency is the “burn rate”
- $CPI = EV / AC$
- A CPI greater than 1.0 are favorable
  - The budgeted cost of work completed (EV) is greater than the actual cost completed (AC)
- Example  $EV = \$110, AC = \$100$ 
  - CPI is 1.1. ( $EV/AC$ )
  - This means that the budgeted cost of the work completed is \$110, but the actual cost is only cost \$100
  - We are getting the same work done for lower cost



## Estimate to Complete (ETC)

- ETC
  - =  $BAC - EV$  (atypical variances)
  - =  $(BAC - EV) / CPI$  (typical variances)
- For example (typical variance)
  - Earned Value is \$200,000
  - You are running 10% overbudget to get your work done so far, so the CPI is .90
  - The project budget (BAC) is \$600,000
  - $ETC = (\$600,000 - \$200,000) / .90$  or \$444,444



## Typical vs. Atypical Variances

- Forecasting future expectations based on current results
- Typical calculations assume that future variances will be similar, or typical, to current variances
  - Utilize the Cost Performance Index (CPI) as a factor
- Atypical calculations assume that current variances are anomalies and will not occur in the future
  - Do not use a performance factor



## Estimate at Completion

- $EAC = AC + ETC$
- For example
  - Actual cost to date is \$500,000
  - You are running 10% overbudget to get your work done so far, so the CPI is .90.
  - The budgeted cost of the work remaining is \$100,000
  - $EAC = \$500,000 + (\$100,000 / .90)$  or \$611,111



## Variance at Completion (VAC)

- Difference between:
  - Budget at Completion (BAC)
  - Estimate at Completion (EAC)
  - $VAC = BAC - EAC$



## Exercise

- Example
  - Project duration is 20 Months
  - Time now is 12 Months (60%)
  - Planned Value is \$14M
  - Actual Costs are \$12M
- Is the project:
  - Running over it's budget
  - Running under it's budget
  - On budget
  - My dog ate my homework, and I don't know



## Applying Earned Value

- From our previous example, let's assume the Earned Value for our project has been calculated to be \$10M.
- We now have:
  - Planned Value = \$14M
  - Actual Costs = \$12M
  - Earned Value = \$10M



## Where are we now?

- Planned Value = \$14M
- Actual Costs = \$12M
- Earned Value = \$10M

	Calculation	Result
Cost Variance $CV = EV - AC$	$\$10M - \$12M$	-\$2M
Schedule Variance $SV = EV - PV$	$\$10M - \$14M$	-\$4M
Cost Performance Index $CPI = EV/AC$	$\$10M/\$12M$	0.83
Schedule Performance Index $SPI = EV/PV$	$\$10M/\$14M$	0.71



## Earned Value Formulas

- $CV = EV - AC$
- $SV = EV - PV$
- $CPI = EV / AC$
- $SPI = EV / PV$
- $EAC = BAC / CPI$  (typical)  
=  $AC + ETC$
- $ETC = EAC - AC$  (typical)  
=  $BAC - EV$  (atypical variances)
- $VAC = BAC - EAC$



## Earned Value Exercise

You have to paint a four-wall room. Each wall takes one day to be painted and is budgeted for \$1,000/ wall. Walls have to be painted one after the other. Today is the end of day three. Using the chart below, calculate all EV formulas and interpret the answers

Task	D1	D2	D3	D4	Current status
Wall 1	S-----F				Complete, spent \$1,000
Wall 2		S-----PF	-----F		Complete, spent \$1,200
Wall 3			PS-S-PF		Half done, spent \$600
Wall 4				PS-----PF	Not yet started



## Earned Value - Answers

	Calculation	Answer	Interpretation
PV	$1,000 + 1,000 + 1,000$	3,000	We should have done \$3,000 worth of work
EV	$1,000 + 1,000 + 500$	2,500	We have actually completed \$2,500 worth of work
AC	$1,000 + 1,200 + 600$	2,800	We spent \$2,800
BAC	$1,000 + 1,000 + 1,000 + 1,000$	4,000	Budget is \$4,000
CV	$2,500 - 2,800$ EV - AC	-300	Over budget by \$300



## Earned Value - Answers

	Calculation	Answer	Interpretation
CPI	$2,500 / 2,800$ EV / AC	0.893	We are getting 89 cents out of every dollar invested
SV	$2,500 - 3,000$ EV - PV	-500	We are behind schedule
SPI	$2,500 / 3,000$ EV / PV	0.833	We are progressing at 83% of the planned rate
EAC	$4,000 / 0.893$ BAC / CPI	4,479	We estimate that the total project cost will be \$4,479
ETC	$4,479 - 2,800$ EAC - AC	1,679	We need to spend \$1,679 to finish the project
VAC	$4,000 - 4,479$ BAC - EAC	-479	\$479 over budget when the project will be completed



## *Questions??*

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