



**PDHonline Course P220 (3 PDH)**

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# **Advanced Earned Value Management**

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**PDH Online | PDH Center**

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# Advanced Earned Value Management

*Lawrence P. Duss, P.E*

## Course Content

As a reminder and for easy reference, the often used **EVM terms** are noted below:

- Earned Value or BCWP, Budgeted Cost Work Performed
- Actual Cost or ACWP, Actual Cost Work Performed
- Planned or Budgeted Work or BCWS, Budgeted Cost Work Scheduled
- Cost Variance or CV
- Schedule Variance or SV
- Cost Performance Index or CPI
- Schedule Work Index or SPI
- Estimate to Complete or ETC
- Estimate at Completion or EAC
- Variance at Completion or VAC

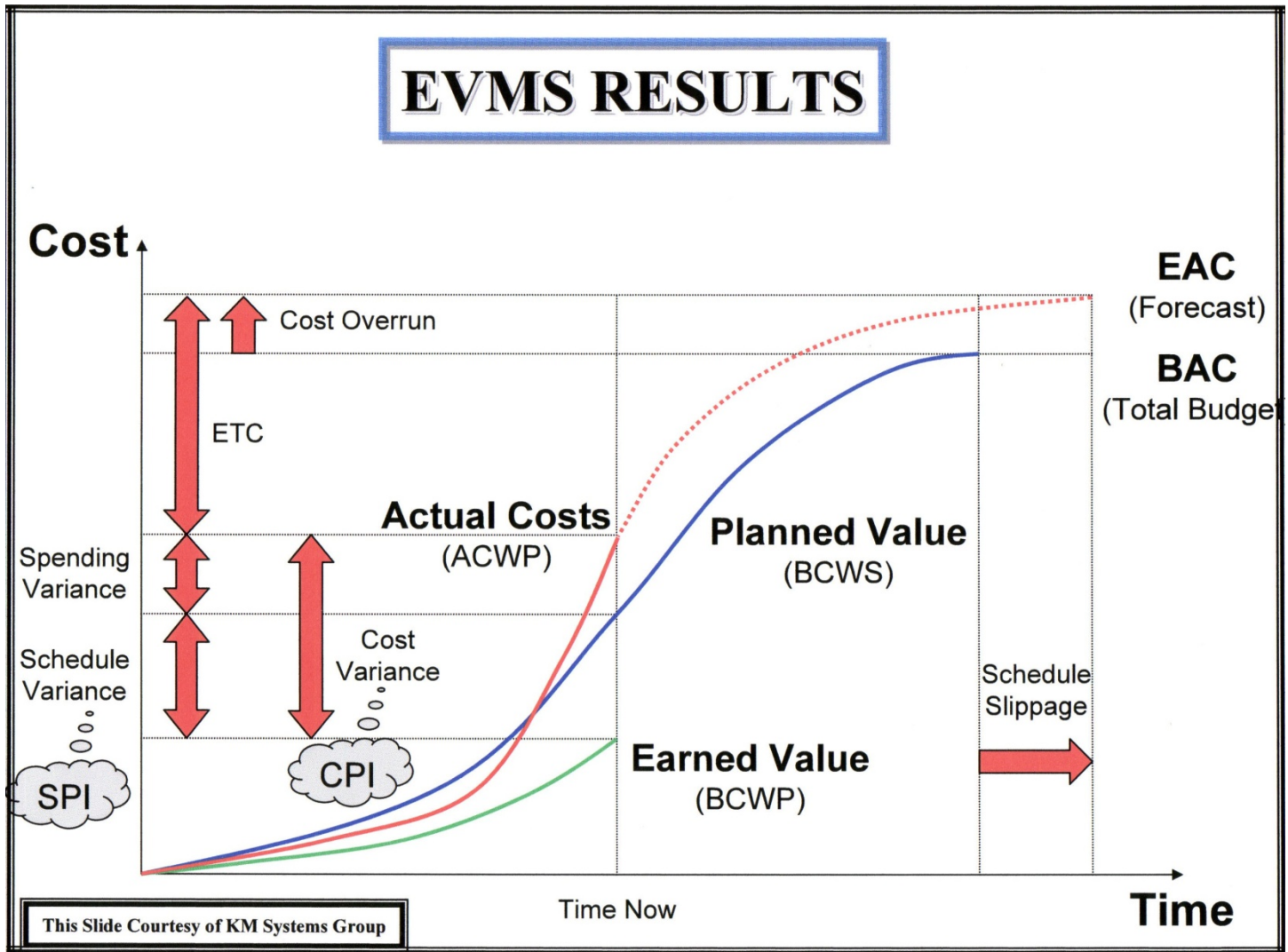
Again, for easy reference, several key formulae are noted:

- $CV = BCWP - ACWP$  (+ is favorable, - is unfavorable)
- $SV = BCWP - BCWS$  (+ is favorable, - is unfavorable)

The above relationships can also be evaluated by indices. The “Cost Performance Index (CPI)” equals “Earned Value” divided by “Actual Costs (ACWP)”. And the “Schedule Performance Index (SPI)” equals “Earned Value” divided by “Planned Cost (BCWS)”. Formulae representing these two indices are as follow:

- $CPI = BCWP/ACWP$  ( if  $CPI > 1.0$ , performance is favorable; if  $< 1.0$ , performance is unfavorable)
  - $< 1$  means that the cost of completing the work is higher than planned (bad)
  - $= 1$  means that the cost of completing the work is right on plan (good)
  - $> 1$  means that the cost of completing the work is less than planned (good)
- $SPI = BCWP/BCWS$  (if  $SPI > 1.0$ , performance is favorable; if  $< 1.0$ , performance is unfavorable)

A graph is attached that pictorially shows the various earned value terms, variances and indices of EVM.



The above chart also shows other key relationships and their formulae are as:

- Variance at Completion = Budget at Completion less Estimate at Completion or  $VAC = BAC - EAC$
- To Complete Performance Index = Work Remaining divided by Cost Remaining or  $TCPI = (BAC - BCWP) / (EAC - ACWP)$

All the above content describes the various EVM terms and how they are related. We will now outline how a project is assembled, base-lined and how the EVM principles can be applied to one's advantage in evaluating progress to date and how variances are evaluated to determine acceptable corrective action.

In course P218, all the pertinent **“Project Deliverables”** were explained in sufficient detail so a project can be properly developed, scheduled and managed. For easy reference, the “Deliverables” are as noted:

1. Organizational Chart
2. Work Breakdown Structure (WBS)
3. Cost Tracking Matrix
4. Scope Development & Verification
5. Project Schedule (cost/resource loaded)
6. Earned Value & Cash Flow Charts (Performance Monitor)
7. Issues/Risk Log
8. Project Execution Plan (PEP)
9. Monthly Project Review

Of particular interest is the WBS which serves to:

- Provide a framework for grouping all the work elements
- Logically subdivide the execution of the work
- Ensure that all project requirements have been identified
- Serve as a guide for identifying changes of scope

In this course several deliverables will be expounded upon to better understand their EVM importance; namely, development of a **“Cost Loaded Schedule”**, proper use and application of **“Earned Value & Cash Flow”** charts, necessary use of an **“Issues/Risk Log”** and finally the proper use of an **“Updated Project Review”**.

For the purposes of this course, it will be assumed that the general contractor or construction manager is responsible for assembling the cost loaded schedule and performing the periodic updates.

Initially, focus will be directed to the development of a **“Cost Loaded Schedule”**.

Various scheduling software programs are utilized by corporations or contracting firms for cost loading purposes. In this course the use of MS Project 2010 will be referenced. The attached “WBS” listing through Level 2 is used for generating all tasks. Included at Level 1 are (5) segments. They are:

1. Project Initiation
2. Project Management
3. Procurement
4. Installation
5. Project Closeout

An example of a “WBS” deliverable through Level 2 is noted below:

## TYPICAL PROJECT: WBS MATRIX

<b>WBS</b>	<b>Level 1</b>	<b>WBS</b>	<b>Level 2</b>
<b>1. PROJECT INITIATION</b>		<b>1.1 Bid Process</b>	
		<b>1.2 Milestone Dates</b>	
<b>2. PROJECT MGMT</b>		<b>2.1 Project Planning</b>	
		<b>2.2 Permits</b>	
		<b>2.3 Award Subcontracts</b>	
		<b>2.4 Project Mobilization</b>	
<b>3. PROCUREMENT</b>		<b>3.1 Electrical Distribution</b>	
		<b>3.2 HVAC Equipment</b>	
		<b>3.3 Lighting</b>	
		<b>3.4 QC/QA</b>	
<b>4. INSTALLATION</b>		<b>4.1 General Requirements</b>	
		<b>4.2 Sitework</b>	
		<b>4.3 Concrete</b>	
		<b>4.4 Masonry</b>	
		<b>4.5 Steel</b>	
		<b>4.6 Wood/Plastic</b>	
		<b>4.7 Thermal/Moisture Prot</b>	
		<b>4.8 Doors/Windows</b>	
		<b>4.9 Finishes</b>	
		<b>4.10 Specialties</b>	
		<b>4.11 Special Equipment</b>	
		<b>4.12 Furnishings</b>	
		<b>4.13 Low Temp Panels</b>	
		<b>4.14 Elevators</b>	
		<b>4.15 Mechanical</b>	
		<b>4.16 Electrical</b>	
		<b>4.17 Refrigeration</b>	
		<b>4.18 Fire protection</b>	
<b>5. PROJECT CLOSEOUT</b>		<b>5.1 Training</b>	
		<b>5.2 Documentation</b>	
		<b>5.3 As-Builts</b>	
		<b>5.4 Demobilize Project Site</b>	

By using a Subcontractor, Material and Cost Contingency Cost Matrix or similar template, all appropriate subcontractor pricing, material purchases and cost contingencies can be identified and tracked. These costs are all transferred to appropriate tasks in the schedule. A sample of this template can be seen within Course P218.

All self-performed work is broken down by labor (man-hrs), material (fixed cost) and related equipment charges (fixed cost) are tracked on a “Scope Development” or similar template. Again, all these costs are transferred to appropriate tasks on the project schedule.

Under the Gantt Chart tab on MS Project, there are (12) numbered views. In the Task Entry View, all pertinent task info is entered; namely, task name, duration, start date, finish date, resource group, predecessors and logic. Based on hourly rates inserted, all cost information is subsequently entered. All other views under the Gantt Tab are predicated on the ultimate “baseline” schedule and subsequent updates.

A brief description/use of the numbered views noted under the Gantt Chart Tab is:

1. Task Entry: use this view to enter tasks into the schedule, assign resources & costs and identify predecessors
- 2a. Project Update – All Tasks: use this view to display and update the percent complete and actual start/finish dates for tasks
- 2b. Project Update – Late Tasks: use this view to display tasks that are behind schedule or have finished late in reference to the status date
- 3a. Late/Slipping Tasks – Complete: use this view to display tasks that were completed past their scheduled finish dates
- 3b. Late/Slipping Tasks – Incomplete: use this view to display tasks that are scheduled to start or finish after the baseline date
4. Status Meeting View: use this view to display planned work within a defined window of time. It is Recommended that you specify one week prior to the current date and three weeks ahead
5. Monthly Report View: use this view to display whether you are on track with project earned value
- 6a. Customer View – Summary: use this view to display task information appropriate to show to a Customer
- 6b. Customer View – Detailed: use this view to display task information appropriate to show a Customer. This view shows more detail than the Customer Summary View
7. Subcontractor View: use this view to display all tasks without cost information
8. Milestone View: use this view to display all project milestones whether or not they are complete
9. Resource Filter View: use this view to display only tasks for a specified resource used in the Resource Sheet

Some basic computer steps in creating tasks include the following:

- Create a Task: open the Task Entry View, insert the task name, duration, start date, finish date, task type, resource name and work hours
- Create Summary Tasks & Sub-Tasks: for Sub-Tasks, select desired tasks and click the “Indent” button, for Summary Tasks, select the tasks and click the “Outdent” button
- Show/Hide Tasks: to show, click +; to hide, click –
- Create a Milestone: select task and enter zero days in duration field

- Copy Tasks: select rows to be copied, select the copy button and paste where it needs to be
- Move a Task: click the task row to move, hold mouse down and drag where it is to be moved
- Update a Task: select task, click “Information” button under the “Task” tab and update data

Before “base-lining” a project schedule, the **“Issues/Risk Log”** must be finalized and appropriate resolved costs must be entered into the schedule. All resolved issues/risks and associated positive or negative costs are to be included in the cost loaded schedule before it is base-lined.

The **“Issues/Risk Log”** is constantly updated and/or modified and any issues/risk costs that are resolved shall then be added to the project costs. All such resolved costs are to be included under a summary task in the Procurement of Installation segment of the schedule. Any and all issues/risks are kept on the log for the life of the project.

An “Issues/Risk Log” along with instructions for a project at the Johnson City, Tennessee Medical Center complex is attached below:

### **Issues/Risk Log Instructions**

#### **Definitions**

Issue	<i>An item, occurrence, condition, written statement, drawing, or action that may or may not impact the project in a positive or negative way.</i>
Risk	<i>A condition or event that may cause exposure to the chance of loss or gain.</i>
Impact Explanation	<i>The explanation of an issue or risk impact to the project</i>
Potential Cost Impact	<i>The estimated potential cost impact to the project</i>
Probability of Occurrence	<i>The estimated probability that an impact will occur given current conditions</i>
Adjusted Potential Cost Impact – Shortfall	<i>The estimated potential cost impact multiplied by the estimated probability. A shortfall impact is something not in your favor that reduces project contingency or margin.</i>
Adjusted Potential Cost Impact – Savings	<i>The estimated potential cost impact multiplied by the estimated probability. A savings impact is something in our favor that adds to project contingency</i>
Potential Time Impact to End Date	<i>The estimated positive or negative impact to the project contract end date in workdays.</i>

Responsible Party	<i>The person with primary responsibility to address the Issue</i>
Risk Management Strategy	<i>Recommended actions to mitigate the issue/risk</i>
Progress Action/Status	<i>An explanation of the current status of the issue/risk that will culminate in its resolution. When the issue/risk is resolved, the wording “resolved” or “completed” should be inserted.</i>
Target resolution date	<i>Targeted date of issue resolution or completion.</i>
Booked Proficiency & Risk	<i>A project contingency fund for unforeseen development estimating errors, and future unknown impacts to the project</i>
Net identified shortfall or savings	<i>Subtotal of items appearing on the Issues/Risk Log as resolved or 100% probable.</i>
Revised project contingency	<i>Booked Proficiency &amp; Risk plus net Identified (shortfall or savings).</i>
Identified Risk	<i>Issues/Risk Log items that have some probability of occurring in the future. This figure does not include items included with revised project contingency.</i>

### **Issues/Risk Log Instructions**

#### **Procedure**

- 1) Fill in project issue or risk items in the Issue/Risk column.
- 2) Fill in all boxes to the right of the Issue/Risk Description box. Enter the Impact explanation. Estimate the probability of occurrence as 0% (if issue only) 25%, 50%, 75%, or 100% if a risk. An item can be 100% if the risk has occurred, i.e. low or high executed subcontract, spent cost, or executed material purchase order.
- 3) Extend math of potential cost impact times the probability and enter the result in the shortfall or savings column.
- 4) If item is resolved, shade all horizontal boxes in the row, light gray. If an item is resolved, it is either 0% or 100% probable.
- 5) Subtotal risk items and fill in the Summary Data Sheet.
  - A - Booked Proficiency and Risk from the Booking Presto.
  - B - Subtotal cost of 100% issue/risk items (net positive and negative).
  - C - Subtotal A + B.
  - D - Subtotal cost of 25, 50, 75% risk items (net positive and negative).



- 6) Cost from the Summary Data sheet is entered onto the page three table of the Start-up Trip Report.
- 7) Identified Risk (item D), is entered onto the Earned Value data worksheet in the Earned Value/Cash Flow Monitoring form.
- 8) Number all issue/risk items in the left column.
- 9) The Issues/Risk Log is a “live document” to be updated on a regular basis and submitted with monthly schedule updates to the Construction Management Services Group.
- 10) Fill in project issue or risk items in the Issue/Risk column.
- 11) Fill in all boxes to the right of the Issue/Risk Description box. Enter the Impact explanation. Estimate the probability of occurrence as 0%(if issue only) 25%, 50%, 75%, or 100% if a risk. An item can be 100% if the risk has occurred, i.e. low or high executed subcontract, spent cost, or executed material purchase order.
- 12) Extend math of potential cost impact times the probability and enter the result in the shortfall or savings column.
- 13) If item is resolved, shade all horizontal boxes in the row, light gray. If an item is resolved, it is either 0% or 100% probable.
- 14) Subtotal risk items and fill in the Summary Data Sheet.
  - A - Booked Proficiency and Risk from the Booking Presto.
  - B - Subtotal cost of 100% issue/risk items (net positive and negative).
  - C - Subtotal A + B.
  - D - Subtotal cost of 25, 50, 75% risk items (net positive and negative).
- 15) Cost from the Summary Data sheet is entered onto the page three table of the Start-up Trip Report.
- 16) Identified Risk (item D), is entered onto the Earned Value data worksheet in the Earned Value/Cash Flow Monitoring form.
- 17) Number all issue/risk items in the left column.
- 18) The Issues/Risk Log is a “live document” to be updated on a regular basis and submitted with monthly schedule updates to the Construction Management Services Group.

Johnson City, TN Medical Center

ISSUES / RISK LOG											17-Jul-06
#	Issue/Risk	Impact Explanation	Potential Cost Impact (\$)	Probability of Occurrence (%)	Adjusted Potential Cost Impact (\$) (Positive)	Adjusted Potential Cost Impact (\$) (Negative)	Potential Time Impact to End Date (Days)	Responsible Party	Risk Management Strategy	Progress Actions/Status	Target Resolution Date
1	Liquidated Damages of \$1,500/day beyond guaranteed completion date (bid form, page BF-2)	schedule needs to be detailed sufficiently to establish a comfort level to complete project ahead of schedule	\$60,000	50%		\$30,000			establish and maintain logs that document all factors affecting time completion; eg. Changes, weather, work stoppages, etc.		
2	Hold Harmless Agreement (page H-1)	too broad a form; includes client's cots even when problem was caused solely by client	\$75,000	25%		\$18,750			negotiate new language such as "JCI agrees to hold harmless and indemnify client from and against liability to the extent caused by JCI's negligent performance of services to any limitations or other provisions client and JCI have agreed to"		
3	JCI will be responsible for "Builders Risk" insurance (contract article 8, page A-3)	this insurance is usually paid by the client	\$150,000	50%		\$75,000			make certain that monies are included in re-bid		
4	client is allowed to a cessation period of 30 days that is to be included in the 550 calendar day completion; contractor is entitled to \$900/day compensation (contract article 12, page A-4)	30 day schedule loss but \$27,000 maximum compensation to JCI	\$27,000	50%	\$13,500				must determine if schedule can tolerate 30 day suspension and is \$27,000 compensation sufficient		
5	client has option to use working day system rather than calendar day system (general conditions article 10C, page GC-13)	possible loss of schedule days	\$45,000	50%		\$22,500			must agree with client on non-working days		
6	there is no monetary compensation for time extensions (general conditions article 11, page GC-14)	could impact margin	\$50,000	25%		\$12,500			modify article to include consideration for cost reimbursement		
7	indemnification is too broad a form (general conditions article 33C, page GC-30)	see Risk #2 above	\$75,000	25%		\$18,750			see Risk #2 above		
8	JCI can reduce retention to 5% after "final" or "substantial" completion (general conditions article 42b, page GC-38)	cost of money will be affected for 30-60 days	\$200,000	50%	\$100,000				must have client agree to "substantial" completion		
9	a 5 year guaranty period is required (general conditions article 48, page GC-40)	industry practice is one year; this will need to be addressed if required	\$50,000	50%		\$25,000			negotiate one year guaranty with client		
10	JCI will be responsible to locate and preserve all active utilities whether shown on the drawings or not (supplementary conditions SC-7, page SC-3)	could be costly especially with the foundation work involved; piles are driven 100'	\$100,000	75%		\$75,000			negotiate this requirement out of contract		
11	JCI will be responsible for work delays whether responsible in whole or part (supplementary conditions SC-9.01, page SC-4)	can be most costly to JCI	\$300,000	50%		\$150,000			negotiate modification to language		
12	client has right to suspend work with or without cause should evidence of historical or archaeological deposits be discovered during construction (supplementary conditions SC-10, page SC-5)	JCI would be compensated for demob costs only	\$200,000	25%	\$50,000				negotiate modification to language		
13	JCI will be responsible for an Interim Life Safety program that includes safety assessment and checklist of existing systems and added features during construction (supplementary conditions article SC-19, page SC-7)	additional costs need to be determined	\$150,000	25%		\$37,500			evaluation of existing life safety system needs to be accomplished to determine cost impact		
14	JCI will be responsible for an Infection Control Program during the life of the construction project (supplementary conditions article SC-20, page SC-7)	cost impact needs to be determined	\$100,000	25%		\$25,000			review IC-1 thru IC-7 documents need to be reviewed to ascertain cost impact		

15	all permits except for initial review by State Fire Marshal to be responsibility of JCI (AIA supplementary conditions article 3.7, page AIA-SC-3)	cost impact needs to be determined	\$100,000	50%		\$50,000			need to visit local and state review agencies to determine plan review and permit costs		
16	adverse weather days are tabulated (AIA supplementary conditions article 4.3.8.3, page AIA-SC-4)	70 calendar days per year are allowed - is this loss in schedule acceptable?		0%		\$0			JCI must scrutinize schedule		
17	overlays for MEP and GC work must be submitted to architect for review (GC Section 01040 article 1.03, page 01040-2)	certain MEP overlays are generally done for subcontractor coordination but the specs are requiring more overlays including GC work	\$50,000	100%		\$50,000			cost impact must be determined		
18	concrete overlay drawings are required (GC Section 01040 article 1.04, page 01040-2)	same as above	\$20,000	100%		\$20,000			same as above		
19	JCI will be responsible for establishing property lines, bench datums, etc (GC Section 01051 article 1.02, page 01051-1)	contractor is generally provided a survey with property lines and benchmarks	\$25,000	50%		\$12,500			same as above		
20	available soil report will not be part of the contract documents (GC Section 01051 article 1.03, page 01051-1)	this is normal industry practice	\$35,000	100%		\$35,000			must negotiate the inclusion of soil report in to contract		
21	building warranty period is 12 months and water-tightness is 24 months (GC Section 01740, page 01740-4)	this is more in line with industry standard but is in contrast to Risk #9	\$50,000	50%		\$25,000			must clarify warranty period with client		
22	design drawings do not reflect "site utilization"	construction access, laydown areas, fire/d offices/trailers. Etc will impact cost	\$50,000	50%		\$25,000			a "site utilization" plan needs to be developed and approved to determine cost impact		
23	no hazardous materials are addressed during demolition of existing structures	certainly asbestos will be present in addition to contaminated soils	\$100,000	50%		\$50,000			must stipulate scope responsibility or include allowance in final bid		
24	construction will be adjacent to existing building operations	there will certainly be schedule and cost impacts	\$50,000	100%		\$50,000			determine both schedule and cost impacts		
25	lack of completeness and inconsistencies in design drawings and specifications	general contractor is generally held liable	\$80,000	50%		\$40,000			JCI must conduct thorough review of documents at various stages and submit claims as deemed appropriate		
26	pricing escalation over year and a half project	potential added costs	\$125,000	100%	\$125,000				review existing and anticipated labor, material and equipment costs via CII, ENR, subcontractors, etc.		
27	MBE & WBE	there is no mention of requirements to be met in specifications that could add cost	\$100,000	50%		\$50,000			qualify this potential cost impact in proposal		
<b>Sub Total Resolved and or 100% Probable</b>		Also called "net identified savings or shortfall"				\$125,000	\$155,000				
<b>Sub Total Future Risk</b>		Also called Identified Risk				\$163,500	\$742,500				

## Johnson City, TN Medical Center

### Summary Data

A	<b>Booked Proficiency &amp; Risk</b>	<b>\$0</b>	A project contingency fund for unforeseen development estimating errors, and future unknown impacts to the project
B	<b>Net Identified (Savings/&lt;Shortfall&gt;)</b>	<b>\$30,000</b>	Net identified (savings or shortfall). These items appear on the Issues/Risk Log as resolved or 100% probable following the start-up process.
C	<b>Revised Project Contingency</b>	<b>\$30,000</b>	Booked proficiency and risk plus identified (savings/shortfall) <b>A+B</b>
D	<b>Identified Risk</b>	<b>\$579,000</b>	Identified risk documented on the Issues/Risk Log that has some probability of occurring in the future. This figure does not include items accounted for following the start-up and included with Revised Project Contingency

After all contract documents and drawings have been thoroughly reviewed, basic project deliverables (org chart, WBS, cost tracking matrix, scope & estimate, Issues/Risk log and PEP) have been completely finalized, the **“Cost Loaded Schedule”** can then be **“base-lined”**.

The “baseline schedule” will reflect the contractual timeline and budget. It will include any contingencies identified by the owner and/or contractor.

Before updating a project schedule, it is important to save the current schedule (baseline if first update) using a new file name. After saving the schedule under a new name, set the status date as appropriate to the update being created.

**“Uncompleted Work”** can be re-scheduled by clicking on the “Update Project” tab under the “Project” tab and then selecting the appropriate action.

**“Resources”** can be re-leveled should they become over-allocated due to re-scheduling by selecting the appropriate leveling action noted under the “Resources” tab.

It is recommended that **“Change Orders”**, once finalized in writing, should be inserted into the project schedule by adding a Level 6 summary task to the schedule. By adding a level, the original project scope and logic will not be disturbed adversely.

Project Schedules should also be modified and/or updated due to authorized **“delays”** or **“accelerations”**.

We will now focus on the creation and updating of the **Performance Monitor** that includes the **Earned Value&Cash Flow** charts. To help explain the creation of a Performance Monitor, a cost loaded and updated schedule for a project in Beaver Dam, Wisconsin is attached. The project started on 4/7/05 and was scheduled to be completed on 3/17/07. The attached schedule had been updated on 2/27/06 and shows the relative EVM quantities for BCWS and BCWP. The work level has been raised to a level 2 for clarity.

RDC # 7039 BEAVER DAM, WI										Current Date: Wed 9/28/11 Status Date: Mon 2/27/06	
WBS	Task Name	% Comp	Start	Finish	BCWS	BCWP	Sched Var	Re Est	Baseline	3	4
0	RDC #7039 Beaver Dam, WI	35%	Thu 4/7/05	Sat 3/17/07	\$56,898,465	\$49,516,292	(\$7,382,174)	\$65,074,298	\$65,979,369		
1	PROJECT INITIATION	99%	Mon 4/25/05	Mon 7/3/06	\$0	\$0	\$0	\$0	\$0		
2	DESIGN & CM	56%	Thu 4/7/05	Thu 9/14/06	\$970,735	\$808,893	(\$161,843)	\$1,438,500	\$1,438,500		
3	MATERIAL PROCUREMENT	0%	Mon 6/20/05	Fri 2/24/06	\$1,759,322	\$1,403,556	(\$355,766)	\$1,800,556	\$1,800,556		
3.1	DCC Purchases	0%	Mon 6/20/05	Wed 2/8/06	\$1,630,556	\$1,403,556	(\$227,000)	\$1,630,556	\$1,630,556		
3.2	Operations Purchases	0%	Mon 6/20/05	Fri 2/24/06	\$166,107	\$0	(\$166,107)	\$170,000	\$170,000		
4	CONSTRUCTION	34%	Mon 7/18/05	Sat 3/17/07	\$54,168,409	\$47,303,843	(\$6,864,565)	\$61,812,362	\$62,740,313		
4.1	Sitework	78%	Mon 7/18/05	Sat 7/15/06	\$10,549,499	\$10,631,361	\$81,862	\$11,863,261	\$11,888,261		
4.2	Off-Site Improvements	0%	Mon 9/19/05	Mon 9/19/05	\$3,660,000	\$3,623,400	(\$36,600)	\$3,660,000	\$3,660,000		
4.3	Site Paving	34%	Mon 9/19/05	Sat 6/17/06	\$3,152,504	\$4,898,446	\$1,745,942	\$6,844,511	\$7,007,161		
4.4	Concrete Foundations	99%	Tue 8/30/05	Mon 6/12/06	\$1,712,337	\$1,720,913	\$8,576	\$1,724,359	\$1,781,822		
4.5	Interior Slab on Grade	34%	Thu 11/10/05	Mon 4/24/06	\$3,179,460	\$857,065	(\$2,322,395)	\$3,180,985	\$3,179,460		
4.6	Metal Building Package	61%	Mon 9/26/05	Mon 6/26/06	\$14,997,631	\$13,780,232	(\$1,217,400)	\$14,518,327	\$14,997,631		
4.7	Building Package	10%	Sat 10/15/05	Fri 7/14/06	\$2,671,669	\$1,039,189	(\$1,632,480)	\$3,423,856	\$3,519,036		
4.8	Dock Equipment	60%	Mon 11/7/05	Thu 3/30/06	\$136,423	\$113,387	(\$23,036)	\$191,295	\$191,849		
4.9	Mechanical	41%	Tue 8/30/05	Sat 3/17/07	\$4,423,696	\$2,639,587	(\$1,884,109)	\$4,911,259	\$4,875,800		
4.10	Electrical	49%	Mon 8/15/05	Wed 5/31/06	\$4,826,848	\$2,780,289	(\$2,046,558)	\$4,819,508	\$4,986,650		
4.11	Fire Protection	46%	Mon 9/19/05	Mon 6/19/06	\$2,382,025	\$2,240,343	(\$141,682)	\$2,584,160	\$2,580,000		
4.12	Conveyors	13%	Mon 7/18/05	Tue 11/21/06	\$0	\$0	\$0	\$0	\$0		
4.13	Racking	0%	Mon 3/6/06	Thu 7/13/06	\$2,476,319	\$0	(\$2,476,319)	\$0	\$4,072,653		
4.14	Contingencies	78%	Sat 10/1/05	Mon 8/28/06	\$2,476,319	\$3,079,634	\$603,315	\$4,072,653	\$4,072,653		
4.15	Punch List & TCO	0%	Thu 6/15/06	Thu 7/20/06	\$0	\$0	\$0	\$18,200	\$0		
4.16	Possession & Ship	0%	Mon 7/31/06	Tue 10/31/06	\$0	\$0	\$0	\$0	\$0		
5	PROJECT CLOSEOUT	0%	Thu 6/15/06	Thu 8/17/06	\$0	\$0	\$0	\$22,880	\$0		



After a project schedule has been base-lined, the Project Team can develop the Project Performance Charts which include the “**Earned Value**” and “**Cash Flow**” curves. The “**Performance Monitor**” tracks Earned Value and Cash Flow throughout the life of the project.

The positive and negative variances from the benchmark (Baseline) indicate the health of the project and provide warning signs of potential problems to the Project Manager. A negative schedule or cost variance can be attributed to lack of productivity, failure of predecessor activities not being completed as scheduled, material and/or equipment not being delivered as scheduled, incorrect baseline data or numerous other reasons. The Project Team must determine the root causes for the negative variances and incorporate corrective action as appropriate.

The “**Performance Monitor**” for the Beaver Dam project conducted in July 2005 is below:

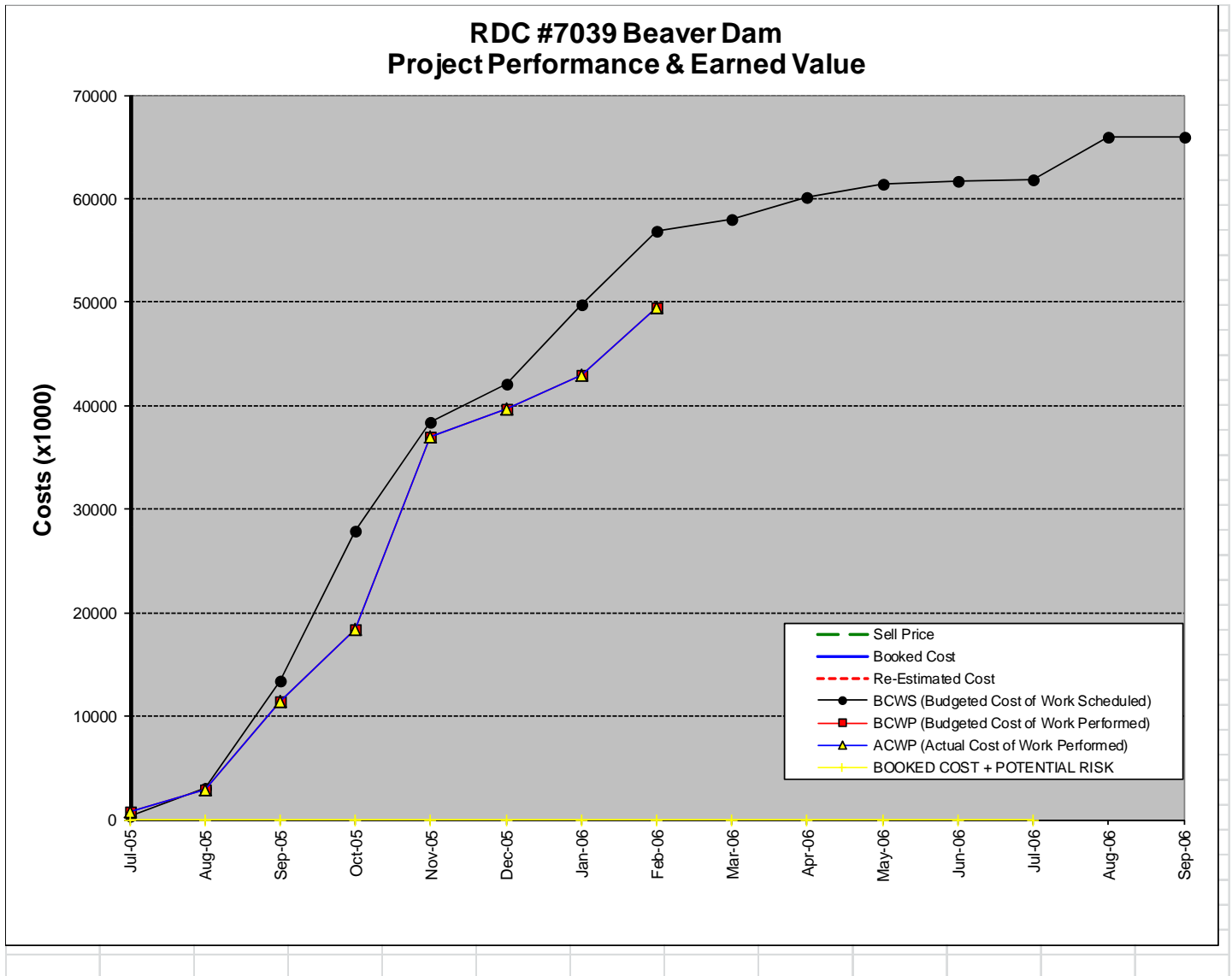
Performance Monitor  
DC #7039 Beaver Dam

A	B	C	D	E	F	G	H
Data through last day of the month	BCWS	BCWP	ACWP	POTENTIAL RISK  (ISS/RSK LOG)	End Date Variance Days	Projected Billings  (Planned)	Actual Billings
Jul-05	\$378	\$735	\$735	\$0	0	\$340	\$661
Aug-05	3,096	\$2,900	\$2,900	\$0	0	\$2,787	\$1,704
Sep-05	\$13,403	\$11,500	\$11,500	\$0	0	\$12,063	\$5,778
Oct-05	\$27,845	\$18,441	\$18,441	\$0	1	\$25,061	\$16,240
Nov-05	\$38,473	\$37,013	\$37,013	\$1,075	17	\$36,550	\$31,000
Dec-05	\$42,158	\$39,732	\$39,732	\$1,925	42	\$40,050	\$33,419
Jan-06	\$49,757			\$0		\$47,270	
Feb-06	\$54,719			\$0		\$51,983	
Mar-06	\$58,003			\$0		\$55,103	
Apr-06	\$60,189			\$0		\$57,179	
May-06	\$61,368			\$0		\$58,299	
Jun-06	\$61,628			\$0		\$58,547	
Jul-06	\$61,794			\$0		\$58,705	
Aug-06	\$65,952						
Sep-06	\$65,979						

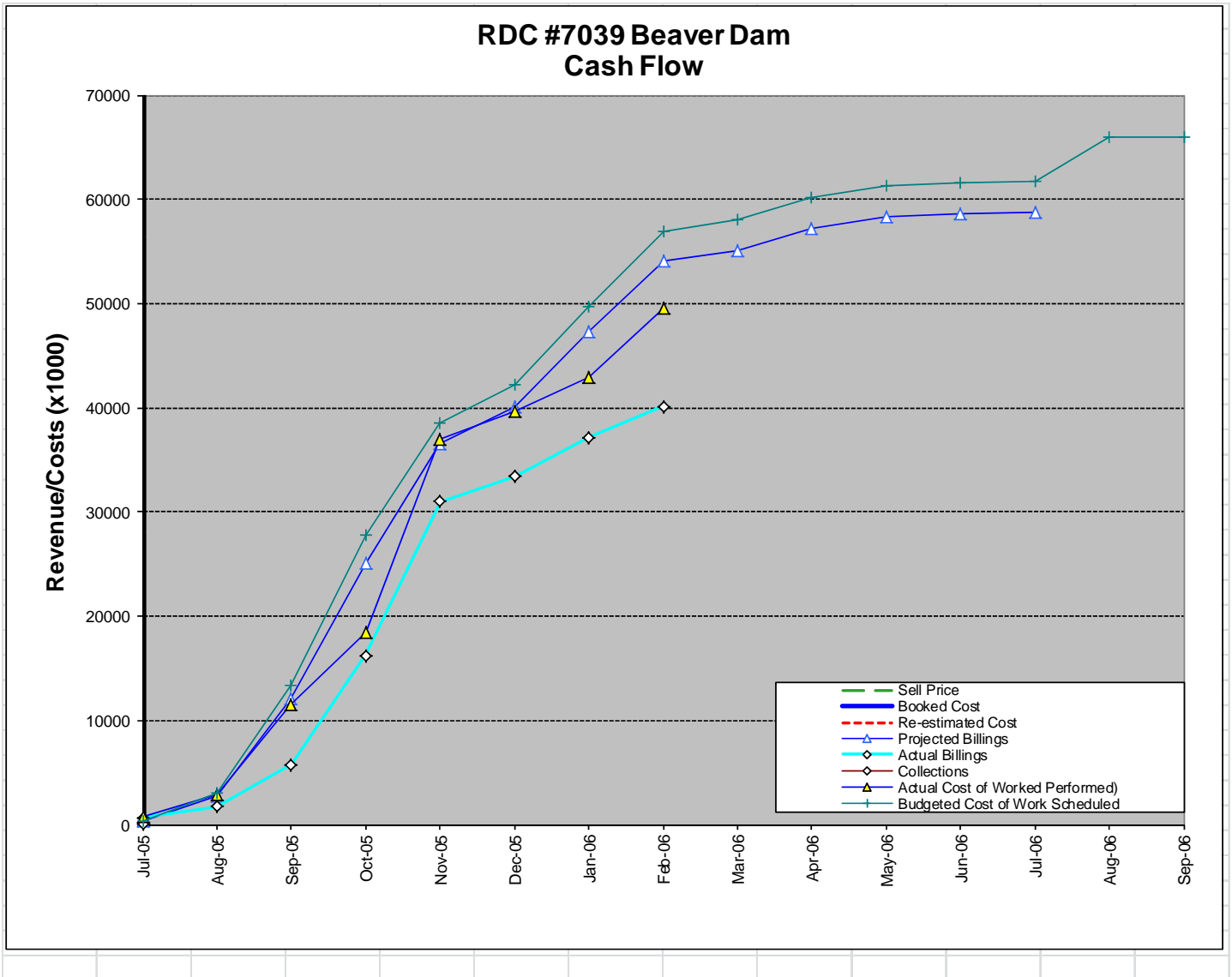
COST			Reporting Results Guide for Project Cost			Reviewer Criteria and Considerations
Sell Price	Baseline Cost	Current Re-Estimate	Green Globe	Satisfactory	ACWP=or<than BCWP	Assignment of a cost or schedule color to indicate a project trend considers numerous project facts and considerations. Depending on project conditions, a project may obtain a warning color not solely based upon the results guide. Considerations include: 1. The schedule is not adjusted/updated to account for all current conditions, ie correct start dates, changeorders, major procurements. 2. Overall project percent complete and time left to recover. 3. Should BCWS be adjusted to reflect changed conditions. 4. Is the schedule self imposed or contractual. 5. Billing cycle inconsistencies and is the ACWP
\$65,979	\$65,979	\$65,979	Yellow Globe	Concern	ACWP > BCWP up to 105%	
			Red Globe	Major Concern	ACWP > BCWP more than 105%	

The “**Earned Value**” chart derived from the above Performance Monitor for the Beaver Dam project is noted below:

### RDC #7039 Beaver Dam Project Performance & Earned Value



The **“Cash Flow”** chart also derived from the above Performance Monitor for the Beaver Dam Project is noted below:



The **“Monthly Project Review”** is usually assembled by the Project Manager or Project Director and is used for internal evaluation of how the project is progressing compared to the agreed-upon baseline.

The periodic or monthly update of the project schedule identifies cost and time variances that will allow the Project Manager to ascertain a recovery plan to negate or minimize any negative variances.

The report to upper management can be in any format desired just so the problem areas are highlighted and the Project Team has determined what measures are to be taken to overcome any cost and/or time deficiencies identified in the update.

A suggested format for an internal monthly review and PM’s monthly narrative follow:



## PM Monthly Review

### XYZ Corporation Project Management Dept

Date: 09/10/07  
To: XXXXXXXX (Logistics PM),  
CC:

#### Time Management

Schedule Status: ● Edit according to status: **COLOR** Green: BCWP = or > BCWS  
Satisfactory, Concern, or Major Concern    Yellow: BCWP 0 – 20 workdays behind BCWS  
Red: BCWP > 20 workdays behind BCWS

Baseline completion date: XXXXX  
Current completion date: XXXXX  
Finish Variance = #days ahead/behind “Baseline” schedule

This project reflects # % complete as of mm/yy vs. Last reported # % complete as of mm/yy

#### Critical activities requiring attention

- List activity name and ID from schedule, location
- XXX
- XXX

#### Cost Management

Earned Value: ● Edit according to status: **COLOR** Green: ACWP = or < than BCWP  
Satisfactory, Concern, or Major Concern    Yellow: ACWP > BCWP up to 105%  
Red: ACWP > BCWP more than 105%

This project reflects “Actual Costs” under/over “Work Performed” by \$ XXXXX. Variance is attributed to:

- List major sources of variance
- XXX

#### Cash Flow

Statement re status of projected billings vs. actual billings, vs. collections. The project is/ is not cash positive.

This project has/has not been re-estimated to reflect all cost to complete: Date of Re-estimate: mm/yy

#### Risk Management

##### Issues/Risk Log

Total project Issues	XXXXXX
Resolved project Issues	XXXXXX
Unresolved project Issues	XXXXXX

Original Project Contingency \$ XXXXXX  
Remaining Project Contingency \$ XXXXXX

Unresolved Project Issues Cost Exposure \$ XXXXXX amount positive or negative

A monthly Project Manager’s narrative report follows:

## PROJECT MANAGER’S MONTHLY UPDATE NARRATIVE

(This narrative is required to accompany the Project Manager’s updated schedule, Issues/Risk Log, and Performance Curve reports each month)

<b>Project Name:</b> <b>Customer:</b> <b>Area:</b> <b>Project Location:</b>		<b>Contract Number (s):</b>	
<b>Project Manager:</b>		<b>Month/Year of Narrative:</b>	
<b>Date Project Execution Plan (PEP) Delivered to Customer:</b> (M/D/Y) _____			
<b>Safety:</b>			
• Is Safety Program in Place?		Yes/No	
• Comment on project safety record to date			
<b>Risk Management:</b>			
• Major Issues/Risks to be listed in the CMS Monthly Project Review Report (emailed report)			
• Number of Issues added to Issues/Risk Log this month			
• Number of Issues resolved in Issues/Risk Log this month. (Quantified issues that are 100% resolved should be incorporated into a re-estimate)			
• Change (increase or decrease) in “Identified Risk” amount (Line D of “Summary Data” Excel worksheet from Issues/Risk Log workbook)		\$	
<b>Major Accomplishments for the month:</b> (Schedule reductions, cost savings, approvals, etc.)			

<b>Major Work to Perform next month</b> (Describe major work planned for the coming month):	
<b>Schedule Status</b> (Provide reasons the project is ahead of or behind baseline plan):	
<b>Customer Schedule Status</b> (If Applicable):	
• Status date of Customer schedule used in baseline schedule:	Status Date:
• Status date of Customer’s most current revised schedule:	Status Date:
• Have revised Customer milestone dates been inserted into schedule?	Yes/No
• Are late Customer milestone tasks delaying project finish date?	Yes/No
• Has the Customer been informed in writing of delay impacts?	Yes/No Date:
<b>Change Order Status:</b>	
• List change orders and amounts negotiated and booked during the month. List change order issues that remain outstanding, unresolved, proposed, or unapproved.	
• Have approved change orders by Customer been entered into contract? (If not, explain reason.)	Yes/No
• Have change orders been incorporated and baselined into the schedule?	Yes/No
<b>Cash Flow:</b>	
• Are actual billings greater or less than planned billings?	Greater/Less Than
• Provide reasons if actual billings are less than planned billings:	
• If any invoice is outstanding 60 days or greater, please explain:	
<b>Earned Value</b> (Provide reasons the ACWP amount from IIS is greater or less than BCWP (earned value amount)).	
<b>Re-Estimate:</b>	
• Cost and date of current re-estimate (multi if more than one booked project)	\$ Date(s):_____
• Reason for re-estimate:	

- If current re-estimate exceeds current original estimated cost (slippage), describe steps taken to reduce slippage:

**Lessons Learned for the month:**

## Course Summary

The student after having read the course contents should now have a better understanding how EVM Principles apply to the development and management of a project. Whatever documents or deliverables are used in compiling and updating a project schedule, the Project Manager and Project Team should have a complete understanding of the project criteria. If properly managed, the project as contracted will meet or exceed the owner's expectations.

Project criteria used in assembling and updating a schedule shall include but not be limited to the following documents:

- Design drawings and specifications
- Performance contract between owner and contractor
- Scopes of work for all work elements
- Subcontracts
- Site conditions
- Outside agency influence
- Consultant involvement

The primary benefits of using EVM Principles include:

- Early identification of trends and problems
- Accurate description of the project status at any update
- Provide a basis for correcting any negative variances
- A fairly accurate projection of final costs

The top ten reasons why projects are successful are:

1. Early and complete planning
2. Strong client focus and participation
3. Strong senior management support
4. Well defined requirements and objectives
5. Effective change order process
6. Necessary resources available

7. Regular updating and evaluation
8. Quality risk analysis
9. Highly skilled project management leadership
10. Effective project communication