

Earned Value

Managing Earned Value Results

What is Earned Value?

Earned Value is the quantifiable means of measuring work that has been accomplished in a plan, and comparing it against the budget of the plan.

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Earned Value Data Elements

Budgeted Cost of Work Scheduled - BCWS

Budgeted Cost of Work Performed - BCWP

Actual Cost of Work Performed - ACWP

Budget at Completion - BAC

Estimate at Completion - EAC

Schedule Variance - SV

Cost Variance - CV

Earned Value Glossary of Terms

Budgeted Cost of Work Scheduled (BCWS)

The cost of work scheduled to be accomplished. Calculated as the amount of work planned by the costs of resources performing the tasks. Also known as the budget or baseline.

Budgeted Cost of Work Performed (BCWP)

The budgeted cost of work performed is cost of work completed based on budgeted costs. Also know as Earned Value.

Actual Cost of Work Performed (ACWP)

The actual cost of current work performed on a plan. Also known as Labor Actuals.

Budget at Completion (BAC)

Final total allocated budget figure for the project. Project cost.

Estimate at Completion (EAC)

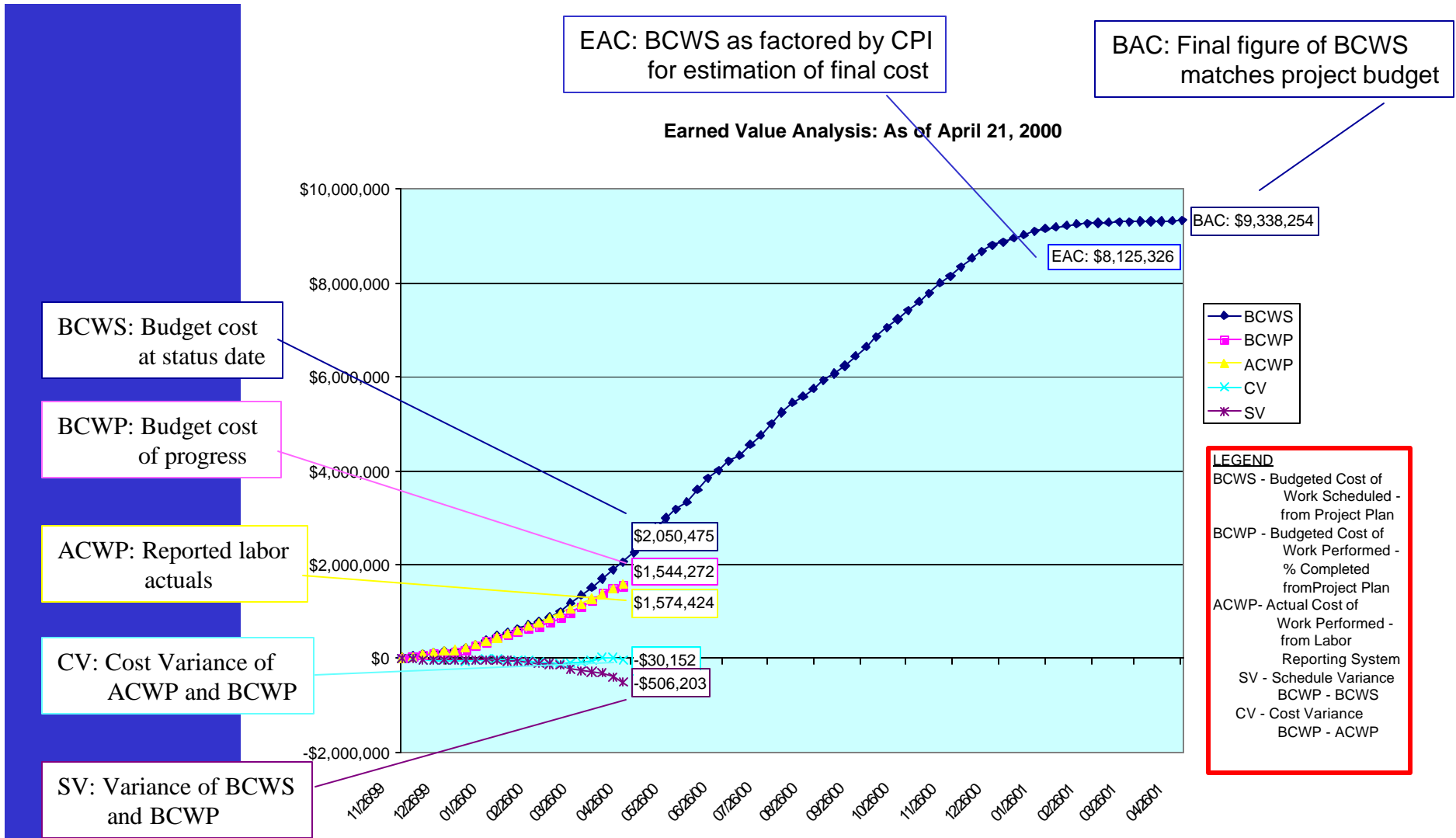
Estimate of all costs for authorized work remaining.

Schedule Variance (SV)

The difference between BCWS and BCWP

Cost Variance (CV)

The difference between BCWP and ACWP

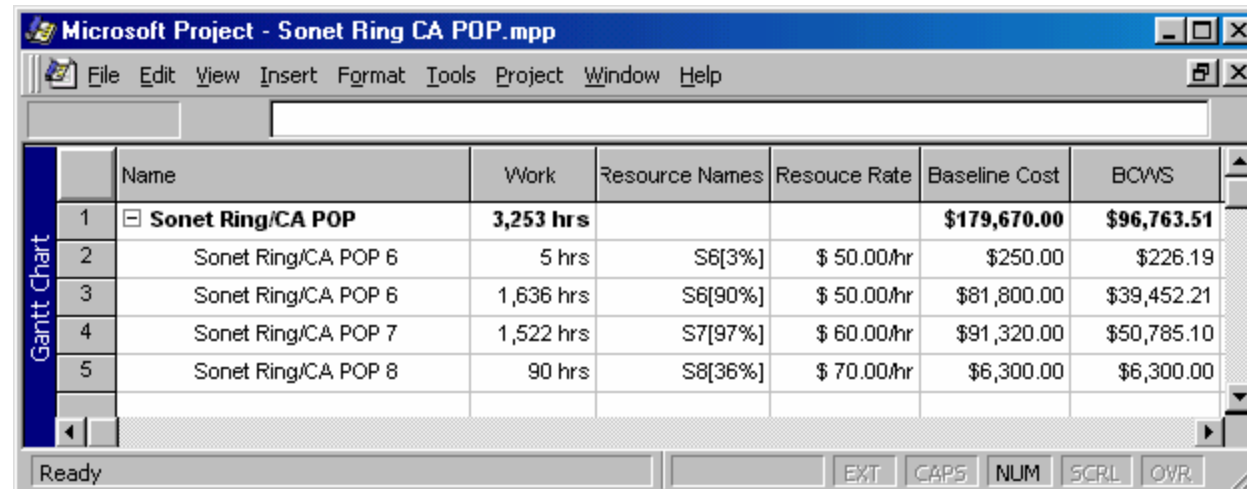


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Project Control's representation of Earned Value as a presentation chart

Earned Value Data Origins

BCWS- The BCWS originates from the Project Schedule. It is the calculation of the hours of work assigned to a task by the cost rate assigned to the resource performing the task, adjusted by the timeline of the task.



The screenshot shows the Microsoft Project interface for a file named "Sonet Ring CA POP.mpp". The Gantt Chart view is active, displaying a table with the following data:

	Name	Work	Resource Names	Resource Rate	Baseline Cost	BCWS
1	Sonet Ring/CA POP	3,253 hrs			\$179,670.00	\$96,763.51
2	Sonet Ring/CA POP 6	5 hrs	S6[3%]	\$ 50.00/hr	\$250.00	\$226.19
3	Sonet Ring/CA POP 6	1,636 hrs	S6[90%]	\$ 50.00/hr	\$81,800.00	\$39,452.21
4	Sonet Ring/CA POP 7	1,522 hrs	S7[97%]	\$ 60.00/hr	\$91,320.00	\$50,785.10
5	Sonet Ring/CA POP 8	90 hrs	S8[36%]	\$ 70.00/hr	\$6,300.00	\$6,300.00

Earned Value Data Origins

BCWS- Once the schedule has been developed, including dates and work hours, resources can be added. When rates are applied to the resources, and this creates a cost.

The scheduled is then baselined, and this creates the **BCWS**. This is different from the **Baseline Cost**. As the **Baseline Cost** is a fixed final amount, the **BCWS** is a cumulation of **Baseline Cost**. The amount of which, is dependent on the status date of the reporting period.

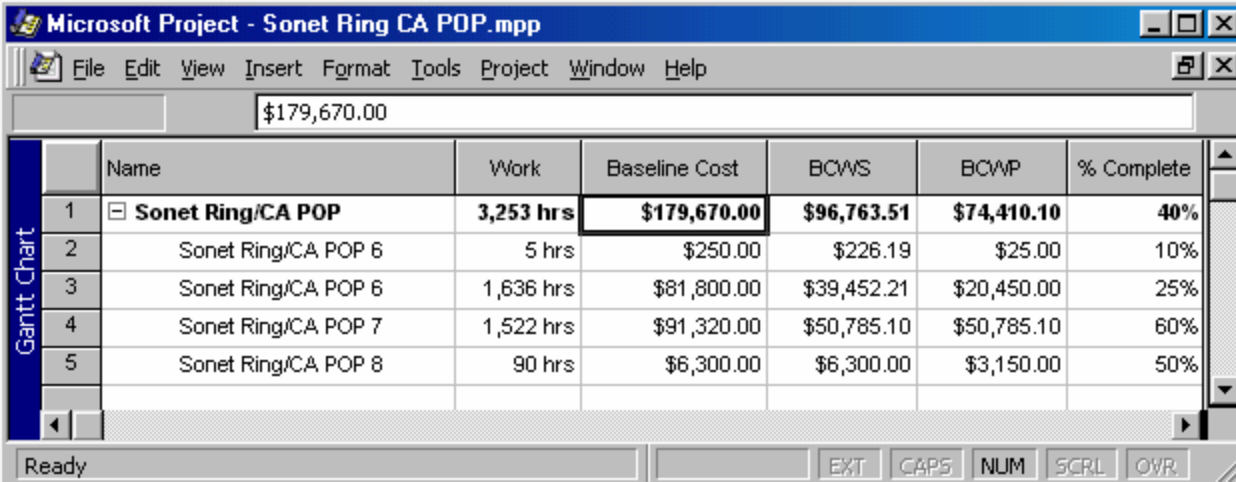
In the previous example, notice the difference between **Baseline Cost** and **BCWS**. The **BCWS** is reflecting the cost as of the status date. This date is two months prior to the completion date.

The closer to completion, the greater the BCWS will be.

Earned Value Data Origins

BCWP- As the percentage of the task completion is recorded, that percentage is calculated against the **Baseline Cost** of the task, and this creates the **BCWP**. The **BCWS** is not involved in the calculation.

The BCWP is often referred to as Earned Value



Microsoft Project - Sonet Ring CA POP.mpp

File Edit View Insert Format Tools Project Window Help

\$179,670.00

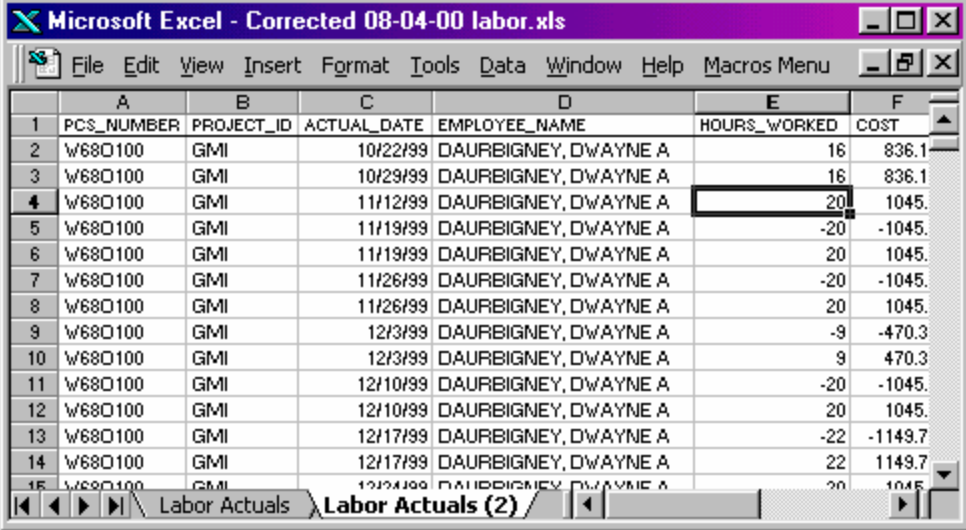
	Name	Work	Baseline Cost	BCWS	BCWP	% Complete
1	Sonet Ring/CA POP	3,253 hrs	\$179,670.00	\$96,763.51	\$74,410.10	40%
2	Sonet Ring/CA POP 6	5 hrs	\$250.00	\$226.19	\$25.00	10%
3	Sonet Ring/CA POP 6	1,636 hrs	\$81,800.00	\$39,452.21	\$20,450.00	25%
4	Sonet Ring/CA POP 7	1,522 hrs	\$91,320.00	\$50,785.10	\$50,785.10	60%
5	Sonet Ring/CA POP 8	90 hrs	\$6,300.00	\$6,300.00	\$3,150.00	50%

Ready

EXT CAPS NUM SCRL OVR

Earned Value Data Origins

ACWP- The Labor Actuals represent the ACWP once a cost rate is applied to the work performed. The Labor Actuals are retrieved from a TES (Time Entry System).



The screenshot shows a Microsoft Excel spreadsheet titled "Corrected 08-04-00 labor.xls". The spreadsheet contains a table with the following columns: PCS_NUMBER, PROJECT_ID, ACTUAL_DATE, EMPLOYEE_NAME, HOURS_WORKED, and COST. The data is as follows:

	A	B	C	D	E	F
1	PCS_NUMBER	PROJECT_ID	ACTUAL_DATE	EMPLOYEE_NAME	HOURS_WORKED	COST
2	W680100	GMI	10/22/99	DAURBIGNEY, DWAYNE A	16	836.1
3	W680100	GMI	10/29/99	DAURBIGNEY, DWAYNE A	16	836.1
4	W680100	GMI	11/12/99	DAURBIGNEY, DWAYNE A	20	1045.
5	W680100	GMI	11/19/99	DAURBIGNEY, DWAYNE A	-20	-1045.
6	W680100	GMI	11/19/99	DAURBIGNEY, DWAYNE A	20	1045.
7	W680100	GMI	11/26/99	DAURBIGNEY, DWAYNE A	-20	-1045.
8	W680100	GMI	11/26/99	DAURBIGNEY, DWAYNE A	20	1045.
9	W680100	GMI	12/3/99	DAURBIGNEY, DWAYNE A	-9	-470.3
10	W680100	GMI	12/3/99	DAURBIGNEY, DWAYNE A	9	470.3
11	W680100	GMI	12/10/99	DAURBIGNEY, DWAYNE A	-20	-1045.
12	W680100	GMI	12/10/99	DAURBIGNEY, DWAYNE A	20	1045.
13	W680100	GMI	12/17/99	DAURBIGNEY, DWAYNE A	-22	-1149.7
14	W680100	GMI	12/17/99	DAURBIGNEY, DWAYNE A	22	1149.7
15	W680100	GMI	12/24/99	DAURBIGNEY, DWAYNE A	20	1045.

Earned Value Data Origins

CV - Cost Variance represents the difference between the cost calculated from reporting work performed (BCWP), and the actual cost of work performed (ACWP) retrieved from the labor system.

A positive number is desired, as this represents actual performance costing less than budgeted.

Microsoft Project - Orion Sonet Ring CA POP.mpp

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\$23,411.95

	Name	% Complete	Work	BCWP	ACWP	CV
1	Orion Sonet Ring/CA POP	40%	3,253 hrs	\$133,053.89	\$109,641.94	\$23,411.95
2	Orion Sonet Ring/CA POP E	10%	5 hrs	\$42.76	\$26.00	\$16.76
3	Orion Sonet Ring/CA POP E	25%	1,636 hrs	\$34,973.59	\$25,573.75	\$9399.84
4	Orion Sonet Ring/CA POP 7	60%	1,522 hrs	\$92,187.54	\$78,785.69	\$13,401.85
5	Orion Sonet Ring/CA POP E	50%	90 hrs	\$5,850.00	\$5,256.50	\$593.5

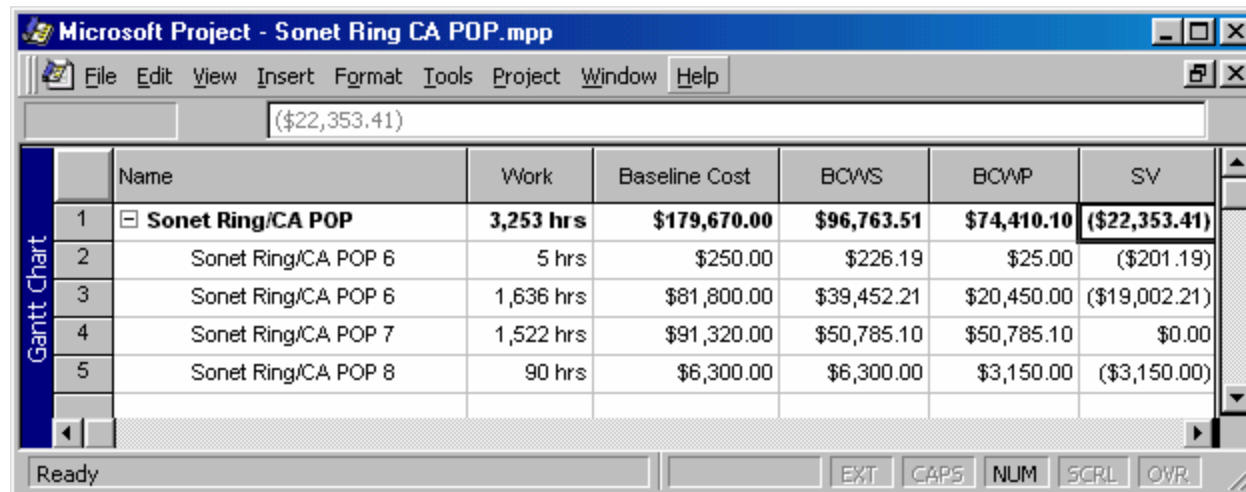
Ready

Earned Value Data Origins

SV- As the project progresses, the the work performed may lag behind or advance faster than the work scheduled. This difference is known as the **Schedule Variance (SV)**.

A positive SV number is desired as this suggests work being performed ahead of schedule.

The SV and the CV are among the most commonly used measures of work being performed as planned.



Microsoft Project - Sonet Ring CA POP.mpp

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(\$22,353.41)

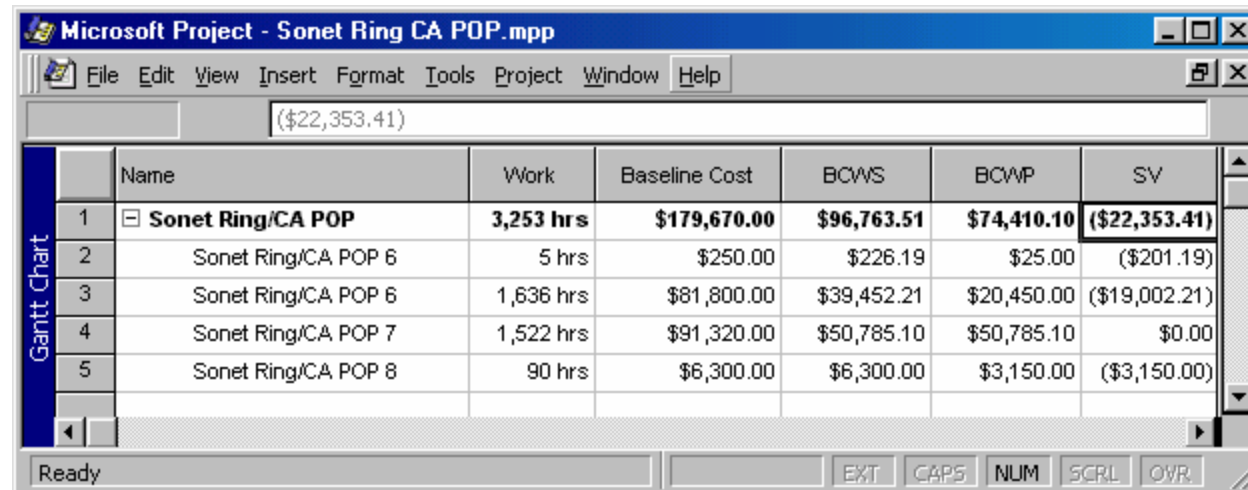
	Name	Work	Baseline Cost	BCWS	BCWP	SV
1	☐ Sonet Ring/CA POP	3,253 hrs	\$179,670.00	\$96,763.51	\$74,410.10	(\$22,353.41)
2	Sonet Ring/CA POP 6	5 hrs	\$250.00	\$226.19	\$25.00	(\$201.19)
3	Sonet Ring/CA POP 6	1,636 hrs	\$81,800.00	\$39,452.21	\$20,450.00	(\$19,002.21)
4	Sonet Ring/CA POP 7	1,522 hrs	\$91,320.00	\$50,785.10	\$50,785.10	\$0.00
5	Sonet Ring/CA POP 8	90 hrs	\$6,300.00	\$6,300.00	\$3,150.00	(\$3,150.00)

Ready

EXT CAPS NUM SCRL OVR

Earned Value Data Origins

BAC - The Budgeted Cost for a task or project, can also be referred to as the Budget at Completion (BAC). This is the total allocated budget for the project.



Microsoft Project - Sonet Ring CA POP.mpp

File Edit View Insert Format Tools Project Window Help

(\$22,353.41)

	Name	Work	Baseline Cost	BCWS	BCWP	SV
1	☐ Sonet Ring/CA POP	3,253 hrs	\$179,670.00	\$96,763.51	\$74,410.10	(\$22,353.41)
2	Sonet Ring/CA POP 6	5 hrs	\$250.00	\$226.19	\$25.00	(\$201.19)
3	Sonet Ring/CA POP 6	1,636 hrs	\$81,800.00	\$39,452.21	\$20,450.00	(\$19,002.21)
4	Sonet Ring/CA POP 7	1,522 hrs	\$91,320.00	\$50,785.10	\$50,785.10	\$0.00
5	Sonet Ring/CA POP 8	90 hrs	\$6,300.00	\$6,300.00	\$3,150.00	(\$3,150.00)

Ready EXT CAPS NUM SCRL OVR

Earned Value Data Origins

EAC- As the project progresses, its performance can be measured in terms of work performed vs. work budgeted. This factor can then be applied to the BAC to calculate an estimation of cost at project completion (EAC). There are many methods for calculating the EAC. The following represent three main formulas.

- **BAC/CPI**
- **ACWP+ (BAC-BCWS)**
- **ACWP+ New remaining work estimation**

Important note: As the three formulas will represent different estimate numbers, it is important to remember that once a particular formula is applied, you must stay with that methodology throughout the program.

Earned Value Procedures

- **Managers are contacted for updating the current schedule**
- **Updates received are applied to the current schedule.**
- **Schedule variances are reviewed and confirmed.**
- **Project time-scaled data is exported to Excel.**
- **Labor Actuals are retrieved from Labor System and exported to Excel.**
- **Project data and Labor Actuals are combined and formatted to create Earned Value reports**
- **Earned Value reports are reviewed and presented to managers.**

Earned Value Factors

Factors that affect Earned Value Reporting:

- **Progress reported against schedule**

Progress reported is converted to BCWP. Under reporting progress results in a reduced BCWP, which inaccurately increases Schedule Variance

- **Project charge numbers**

Confirm that all resources are using the correct charge numbers. Incorrect project charging creates inaccurate reporting of ACWP and Cost Variance

- **Properly identified deliverables**

Progress reported will be inaccurate if work performed is not reported against work stated in the project schedule.

Earned Value Analysis

Earned Value can be reported in two ways:

- **Static reporting**

Static reporting display the Earned Value data by a single number. The number is a cumulative number of the project status, but does not indicate any trending factors for forecasting. Usually, the BCWS, BCWP, and SV are represented.

This type of reporting is most often used for financial reporting.

- **Chart reporting**

Chart reporting displays the total cumulation of the numbers from the start of the project. This allows forecasting by viewing reported data from previous weeks, as well as seeing future budgeted data.

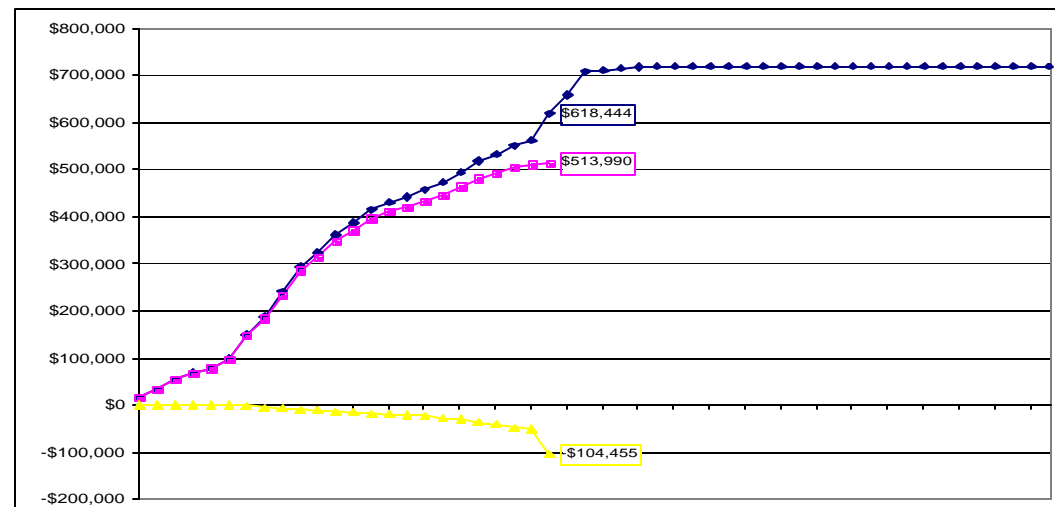
This type of reporting is most often used for presentations.

Earned Value Analysis

Static Earned Value Report

<i>Name</i>	<i>BCWS</i>	<i>BCWP</i>	<i>SV</i>
Deployment Support (Transformation)	\$476,990.26	\$438,663.11	(\$38,327.15)
Enterprise Infrastructure	\$459,678.75	\$414,796.79	(\$44,881.96)
Help Desk Consolidation	\$598,408.05	\$542,082.12	(\$56,325.93)
Midrange Transformation	\$260,993.54	\$212,648.69	(\$48,344.85)
Mainframe Consolidation	\$383,894.89	\$396,601.56	\$12,706.67
Cross Functional Processes	\$134,603.75	\$174,743.55	\$40,139.80
	\$2,314,569.24	\$2,179,535.82	(\$135,033.42)

Chart Earned Value Report



Earned Value Analysis

CSC Earned Value Reporting Guidelines:

Color Codes for Reporting Project Status

- **Red** - Negative Schedule Variance is greater than 10%
- **Yellow** - Negative Schedule Variance is between 5% and 10%
- **Green** - Negative Schedule Variance is between 0% and 5%
- **Blue** - Project has a positive Schedule Variance

Note: Schedule Variance Percentage is calculated as SV divided by BCWS. If the negative SV is greater than 10%, the project manager should begin to consider immediate corrective action. PMBOK methodology dictates that a project with a SV greater than 20% cannot be accomplished within the baselined constraints without major actions being taken.

Earned Value Analysis

Earned Value Report Interpretation:

- Use Static Reports to provide hard numbers as to the status of the project in regards to Schedule Variance. This will give an SV percentage that will translate quickly to a project status color code.

<i>Name</i>		<i>% SV</i>	<i>BCWS</i>	<i>BCWP</i>	<i>SV</i>
Deployment Support (Transformation)	Yellow >	-8.04%	\$476,990.26	\$438,663.11	(\$38,327.15)
Enterprise Infrastructure	Yellow >	-9.76%	\$459,678.75	\$414,796.79	(\$44,881.96)
Help Desk Consolidation	Yellow >	-9.41%	\$598,408.05	\$542,082.12	(\$56,325.93)
Midrange Transformation	Red >	-18.52%	\$260,993.54	\$212,648.69	(\$48,344.85)
Mainframe Consolidation	Blue >	3.31%	\$383,894.89	\$396,601.56	\$12,706.67
Cross Functional Processes	Blue >	29.82%	\$134,603.75	\$174,743.55	\$40,139.80
			\$2,314,569.24	\$2,179,535.82	(\$135,033.42)

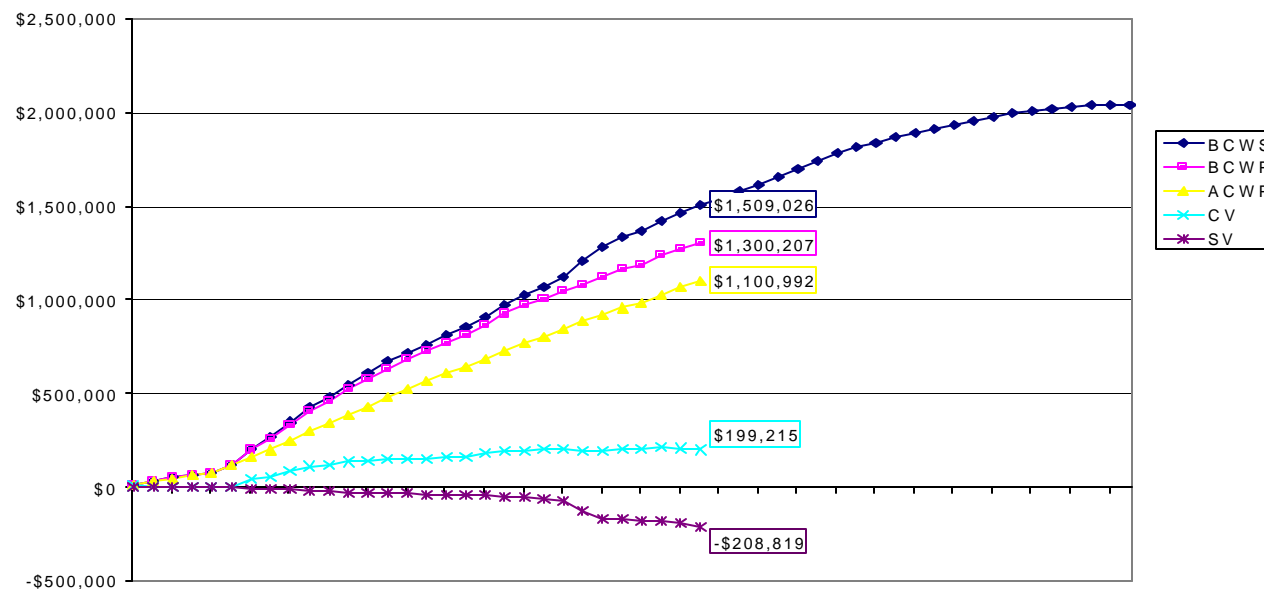
Stoplight Chart

This can alert a project manager to problem areas that may need immediate attention.

Earned Value Analysis

Earned Value Report Interpretation:

- Use Chart Reports to provide quick and easy reference to overall project performance. Charting Earned Value also allows for the quick and easy inclusion of labor actuals.



Earned Value Analysis

Earned Value Report Interpretation:

In viewing the previous chart, we see that this is a pretty normal project as Earned Value goes. Our BCWP (pink line) is a little below our BCWS (blue line). This indicates work reported is below the level of work budgeted at this time. Our ACWP (yellow line) is well below both lines. This is good. This tells us the labor used is below our budgeted and reported work levels. But at this point point, we don't know the exact number. The SV and CV lines are showing only proportions that can be left to interpretation. We can review the Earned Value Summary sheet, within the Earned Value report, to see that the Schedule Variance is -13.84%. This project would be coded as RED.

Tasks/Project	BCWS	BCWP	ACWP	CV	SV	%SV for Project
Migrate RHAC to Raytheon	\$ 1,509,026	\$ 1,300,207	\$ 1,100,992	-\$ 185,272	-\$ 208,819	-13.84%
RIGs	\$ 171,588	\$ 145,397	\$ 79,509	\$ 65,887	-\$ 26,192	-15.26%
Optimization	\$ 364,960	\$ 307,680	\$ 296,631	\$ 11,049	-\$ 57,281	-15.70%
Legacy Protocols	\$ 143,286	\$ 83,721	\$ 51,817	\$ 31,904	-\$ 59,565	-41.57%
Internet Protocols	\$ 170,051	\$ 118,340	\$ 41,847	\$ 76,493	-\$ 51,711	-30.41%
General Management Implementation	\$ 659,139	\$ 645,069	\$ 631,188	\$ 13,881	-\$ 14,070	-2.13%

Earned value Summary

Earned Value Analysis

Earned Value Report Interpretation:

As the project would be coded RED, we would discuss this with the project manager immediately. Fortunately, the project manager explains that there are client re-scoping issues that caused a slow down in work, resulting in a lack of work reporting complete. This alerts us to the fact that a re-baselining of the plan may take place soon, as the constraints that initially set the baseline have changed.

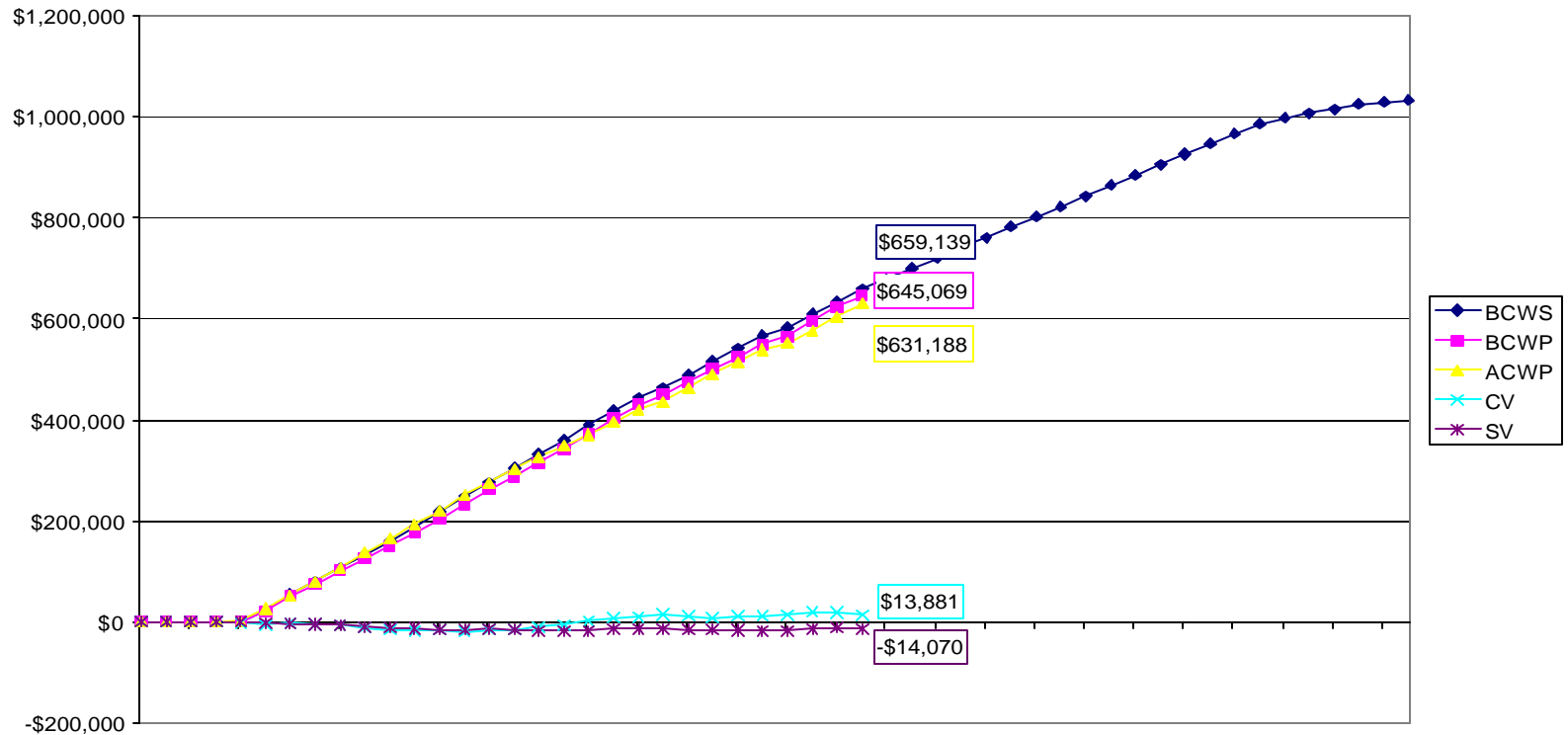
We were also assured by the project manager that the client is well aware of the status of the project.

At this point, the PM may be considering a COP, Change of Plan. The schedule can only be altered by the approval of a formal, client-approved COP. COP's are used only when there is a change in scope, cost, and/or schedule.

Another look also reveals that the ACWP (yellow line) is well below the BCWP and the BCWS. This tells us that as the work may be under-performing, we at least have the ability to reschedule resources on the project, without jeopardizing a cost overrun.

Earned Value Analysis

Chart 2:



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Earned Value Analysis

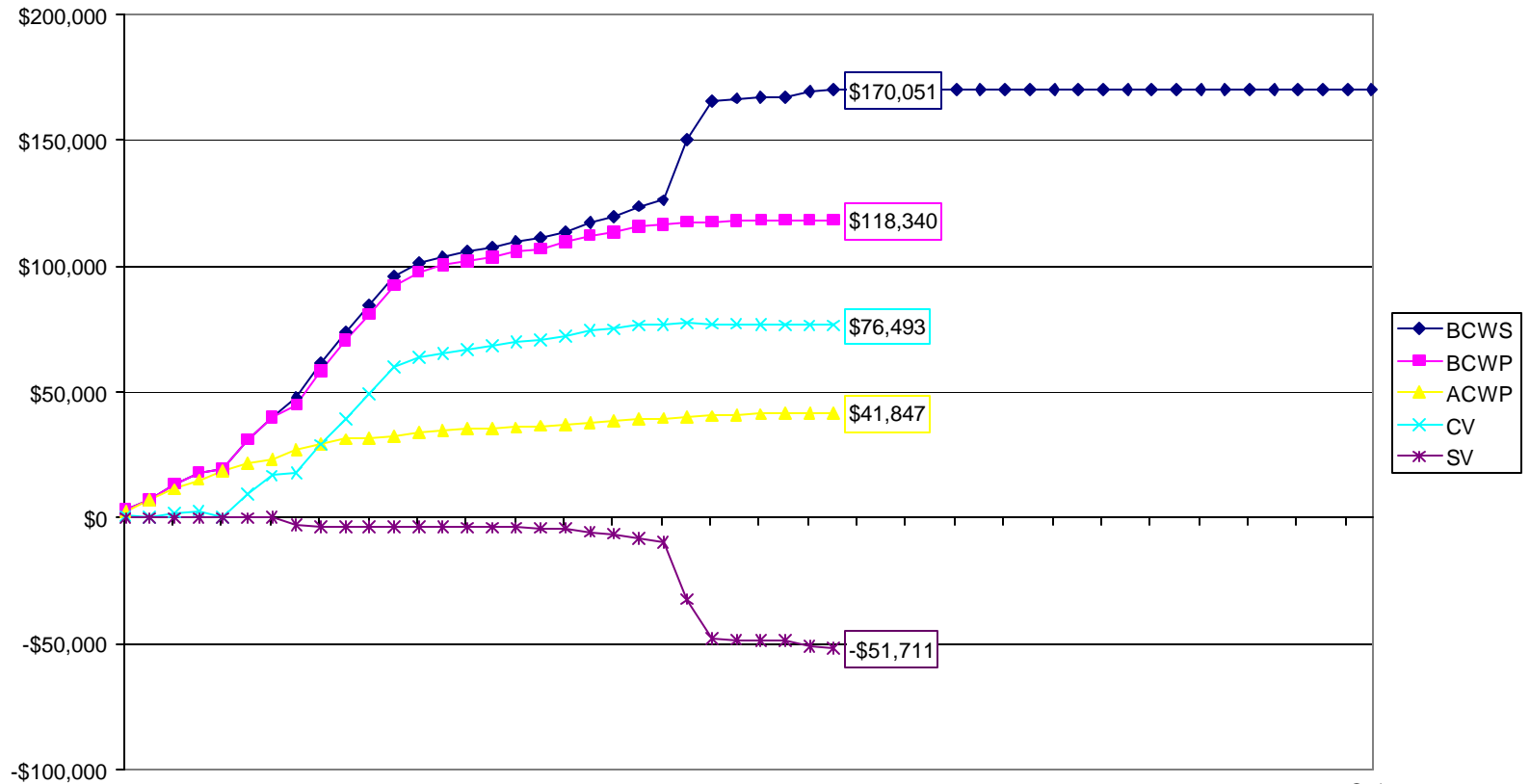
Earned Value Report Interpretation:

Chart 2 shows us what a near perfect project chart would look like. BCWP is very close to the BCWP line, reporting that work being performed is on track with the work budgeted. Our ACWP is also is also close to the work lines, showing that the manager has properly accounting for the resources charging to this project.

The shape of the work curve in this case, or lack of, alerts us that this is most likely a sustaining effort project. The same work is being accounted for on a week by week basis. This is usually reflective of project management duties for a project.

Earned Value Analysis

Chart 3:



Earned Value Analysis

Earned Value Report Interpretation:

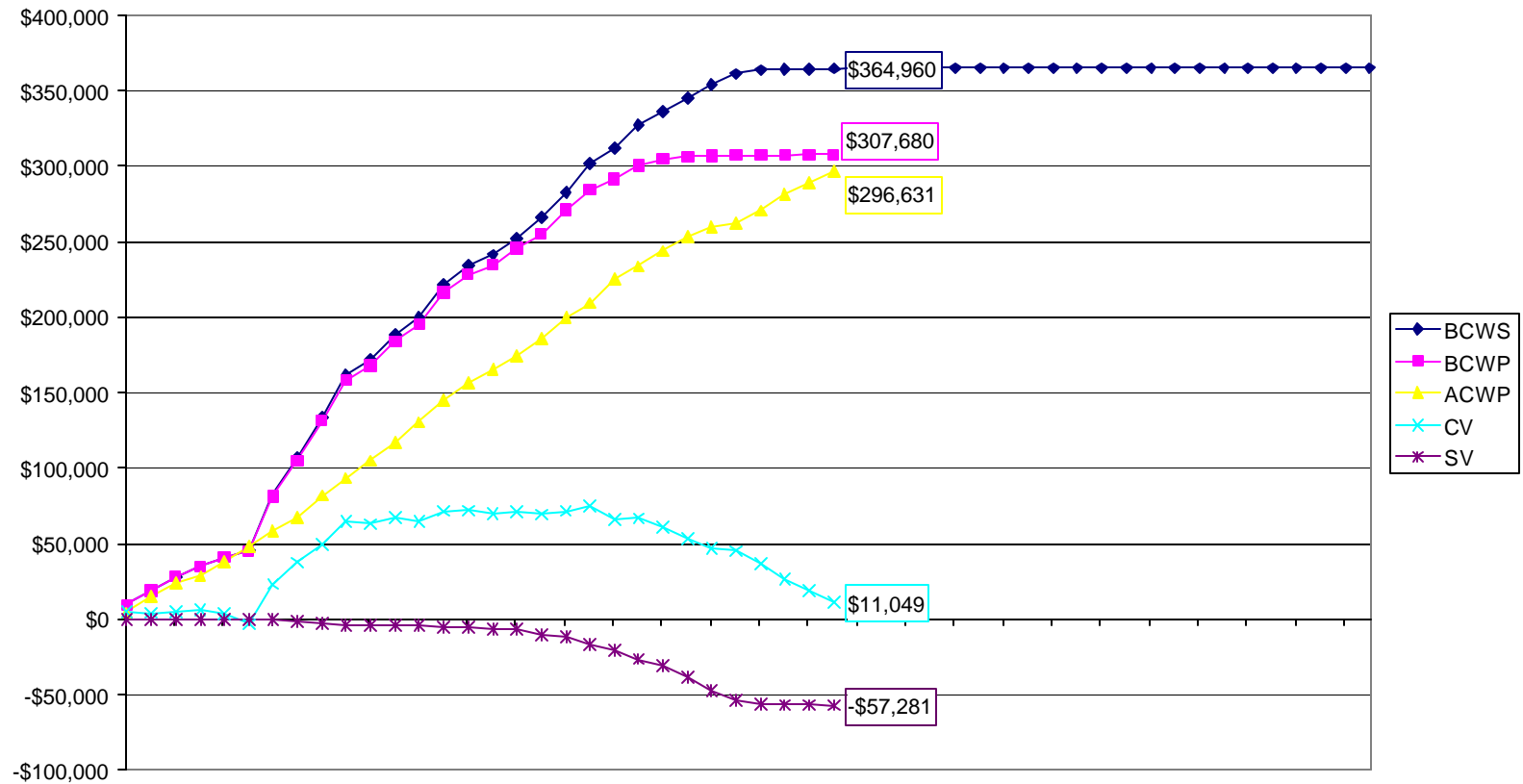
Chart 3 shows a plan that has gone drastically wrong. First, the BCWP is miles away from the BCWS. Upon closer inspection, we see that there is a big ramp-up in work (BCWS) that the BCWP completely misses. This is an indicator that a major task was to be accomplished, and it never did. Again, this is an example of client re-scoping.

Furthermore, the ACWP is no where near the level of the BCWP. This leads to the question of, "What happened to the work?" We see in the first couple of weeks, all lines were together, then the first ramp-up of work occurred. The BCWP stayed with the BCWS, but the ACWP stayed on its course, and trailed behind the BCWP.

This suggests that the resources accomplishing the work were not charging to the project. This looks great now, but in the end, finance will have an erroneous picture concerning the cost of this project, and so will the Project Manager.

Earned Value Analysis

Chart 4:



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Earned Value Analysis

Earned Value Report Interpretation:

Chart 4 is another example of a customer re-scoping the plan. In the beginning, all lines are tracking well. Then there is a ramp-up in work. The BCWP and BCWS track within each other. ACWP is stable, but doesn't make the same jump with the other work lines. This speaks to the plan being overstated to begin with.

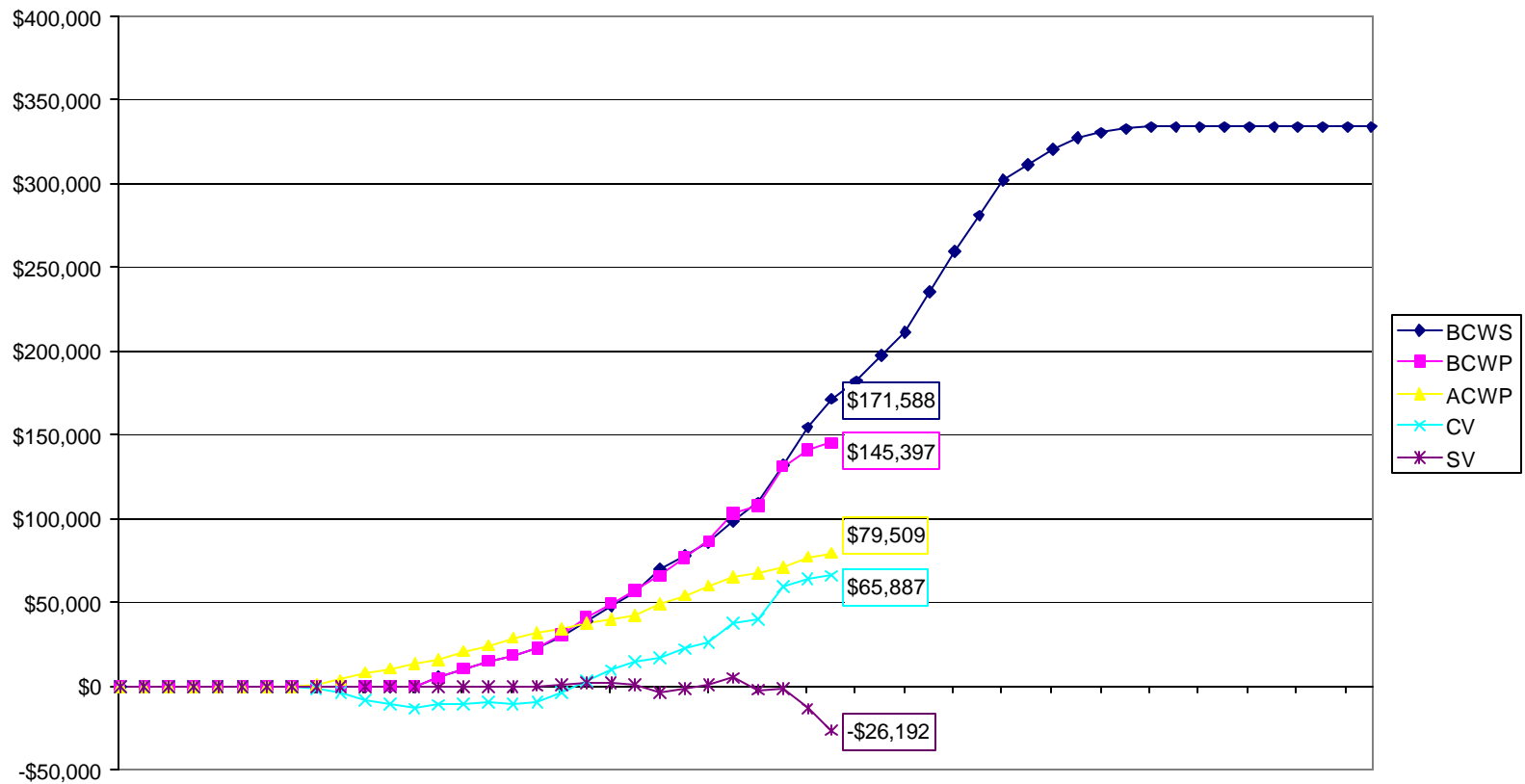
Then, we see the work reported drifting off, and ACWP begins the catch up with the BCWP. At this rate, it will cross the BCWP in the next reporting period, and poses a serious threat of cost overrun.

Meanwhile, the BCWP has become flat, although it is close to the end of the project. This generally represents some last minute tasks that have not completed. The main deliverable may have been completed, but the clean-up tasks or transfer to sustaining may have hit a snag.

Again, this has to be discussed with the PM to alert them of the imminent cost overrun. This may be another case of COP and re-baseline.

Earned Value Analysis

Chart 5:



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Earned Value Analysis

Earned Value Report Interpretation:

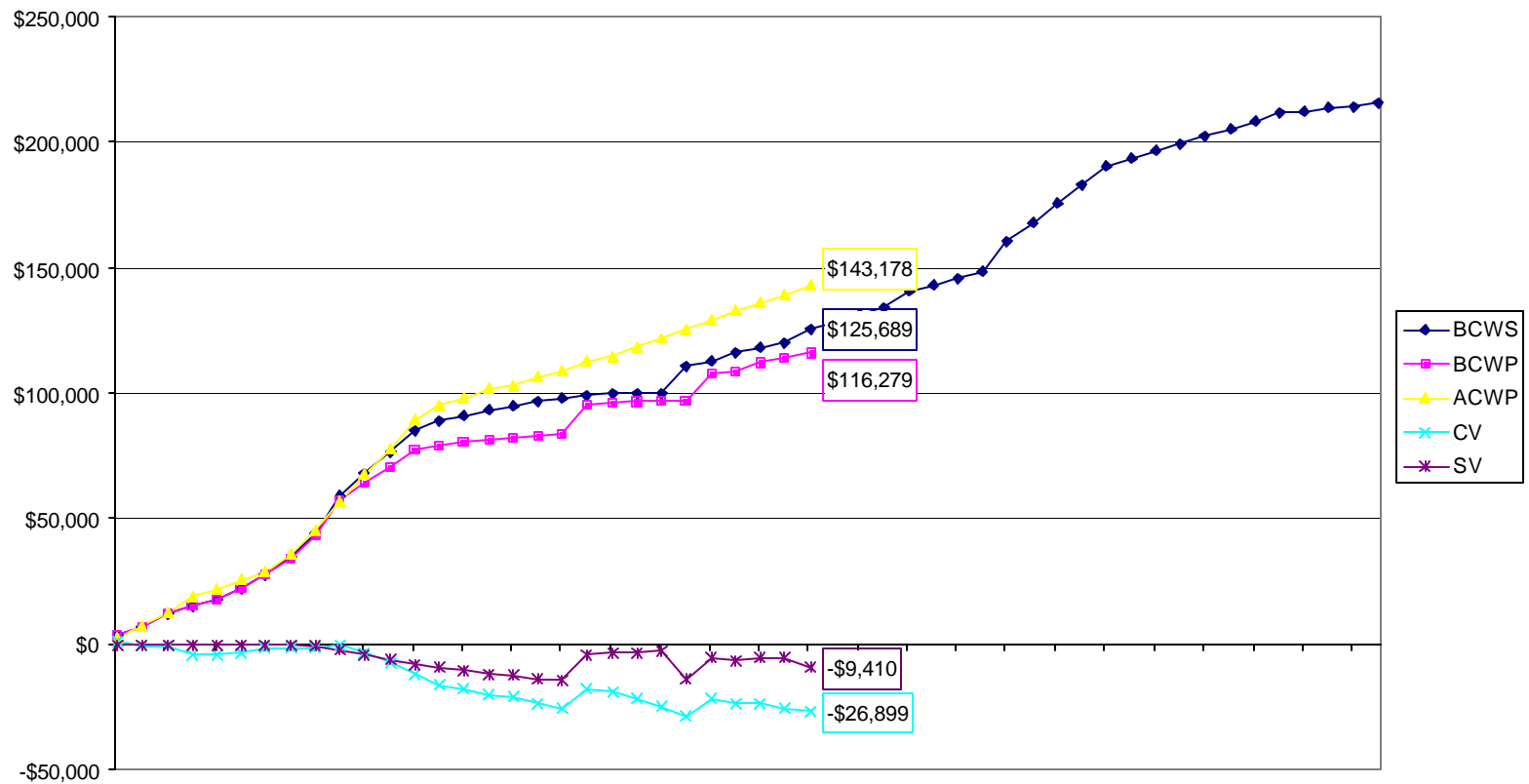
Chart 5 shows some concern where project control is involved. The ACWP line shows charges almost a month before work was scheduled. The dates of the plan needs to be reviewed, the work redistributed, and the schedule re-baselined.

In addition, we also have another instance of the ACWP falling so far behind the BCWP, that either the resources are not charging the project, or someone else is doing the work. This needs to be discussed with the PM.

All this points to the question: "Does the work captured in the schedule reflect the work happening in real the real world?"

Earned Value Analysis

Chart 6:



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Earned Value Analysis

Earned Value Report Interpretation:

Chart 6 shows a project in trouble. The Schedule Variance is currently negative. Using the formula of dividing the SV by the BCWS, we have a -7.43% SV. This puts the project YELLOW, but more importantly, the project is also seriously over budget.

This hits us with a double concern of getting the project back on schedule and under budget. At this point, we can see a slight trend of declining performance in the BCWP. But of more concern is the ACWP. This is grossly inflated. After discussing the issue with the project manager, we find that the project is going along just fine. The PM has stated that they are planning to release one person from the project. This still does not account for the ACWP, so we check the Labor Actuals report. Here we find that three people are still charging to the project, although their work is actually being performed for another framework in this program.

This leads us to review the labor charges for Chart 3. This could account for the ultra low ACWP there.

Earned Value Analysis

Earned Value Report Interpretation:

These are but a few examples of the issues you could have with a project Earned Value report. There are thousands of variations, but here are the basics. From here, you want to be aware of the consequences of your scheduling actions.

Review past plans to see how their budgets ranked against the actual work. Remember, the whole purpose of Earned Value is to compare actual work to budgeted work. Also, to use this information as a guide to overall project performance, an opportunity to spot trends and a tool forecast future performance.