



Jefferson Science Associates, LLC

# **700**

# **Analysis and Reporting**

**Project Control System Manual**  
**Revision 4**

## 700 Analysis and Reporting

This chapter of the JSA Project Control System Manual explains how the performance status is determined, analyzed and documented during the execution of the project plan. The Performance Management Baseline is the basis for performance analysis and reporting. Analysis provides the project team an understanding and assessment of the project and its progress. Reporting is the communication means to ensure managers comprehend the Earned Value Management information. Schedule and cost variances from the Performance Measurement Baseline are derived by analyzing a project's earned value metrics. Variance thresholds are established to enable project management to focus attention and resources on those variances with the most significance to the project. Results from the variance analyses provide the stimulus for management action to resolve project issues before they become substantial problems.

## 701 Variance Analysis

The purpose of variance analysis is to identify problems early so that prompt corrective action can be taken to minimize cost and schedule impacts, cost overruns, and schedule delays to the project. Variance analysis quantifies the deviations from the timed-phased budget based on the work accomplished and cost data collected. Variance within Earned Value Management is described by two metrics: Cost Variance and Schedule Variance. Other project performance measurements are obtained from these two expressions. Variances and other performance measurements (current period and cumulative) are calculated monthly at the project work package level and summarized for each individual control account. Variances can be aggregated at higher WBS and organizational levels to include the total project.

### 701.1 Variance and Performance Indicators (Exhibit 14)

- A. Schedule Variance (SV): The difference between the Budgeted Cost of Work Performed (BCWP, Earned Value) and the Budgeted Cost of Work Scheduled (BCWS, Planned Value).

$$SV = BCWP - BCWS$$

If the result is a zero (0), it is an indication that the project is on schedule.

If the result is a positive (+) value, it is an indication that the project is ahead of schedule.

If the result is a negative (-) value, it is an indication that the project is behind schedule.



While Schedule Variance indicates the dollar value difference between accomplished and planned work activities, it does not specify the amount of time the project is ahead or behind schedule. Analysis of the project schedule in the Schedule Management System will reveal the status of specific activities, milestones, and critical events. It is important that both schedule and performance measurement analysis be performed to accurately monitor schedule performance.

- B. Cost Variance (CV): The difference between the Budgeted Cost of Work Performed (BCWP, Earned Value) and the Actual Cost of Work Performed (ACWP, Actual Cost).

$$CV = BCWP - ACWP$$

If the result is zero (0), it is an indication that the project is on budget.

If the result is a positive (+) value, it is an indication that the project is underrunning its budget.

If the result is a negative (-) value, it is an indication that the project is overrunning its budget.

- C. Schedule Performance Index (SPI): The ratio of the Budgeted Cost of Work Performed to the Budgeted Cost of Work Scheduled and represents the schedule efficiency of the project.

$$SPI = BCWP / BCWS$$

If the result is equal to 1.0, it is an indication that the project is on schedule.

If the result is greater than 1.0, it is an indication that the project is ahead of schedule, accomplishing more work than planned for the considered time period.

If the result is less than 1.0, it is an indication that the project is behind schedule, accomplishing less work than planned for the considered time period.

Note: SPI will trend toward 1.0 as the project nears completion. Earned Value equals Planned Value at the end of the project, i.e., the work you planned to do is finally accomplished.



- D. Cost Performance Index (CPI): The ratio of the Budgeted Cost of Work Performed to the Actual Cost of Work Performed and represents the cost efficiency of the project.

$$\text{CPI} = \text{BCWP} / \text{ACWP}$$

If the result is equal to 1.0, it is an indication that the project is on budget.

If the result is greater than 1.0, it is an indication that the project is running under budget, spending less for the accomplished work than planned for that work.

If the result is less than 1.0, it is an indication that the project is running over budget, spending more for the accomplished work than planned for that work.

- E. Calculated Earned Value Management performance indicators will provide an early warning that the project is not executing to plan. To get to the root causes of the variances, the affected control account schedule and cost reports must be thoroughly examined. Once the causal analysis has been completed, then a corrective action plan can be formulated and implemented.

### **701.2 Estimate at Completion**

- A. The next step in the analysis is to evaluate the earned value data and develop a projection for the future of the project based on the progress made to date. An estimate of when the project will be completed and the cost to complete can be established.
- B. For schedule projections, there are approximation methods to arrive at an estimate of the completion date. The most common method is to divide the Schedule Variance (SV) by the average monthly budgeted cost of work scheduled (BCWS). This method provides an approximate duration in months of how far a project is ahead or behind schedule, but assumes current and future work will be accomplished at the same average monthly rate. A more accurate forecast can be made by analyzing the schedule data (e.g., critical path) in the Schedule Management System.
- C. For cost projections, an Estimate at Completion (EAC) can be derived using a number of methods. The EAC is the actual cost to date on the project plus an estimate of costs for the remaining authorized work (referred to as Estimate to Complete, ETC).

$$\text{EAC} = \text{ACWP} + \text{ETC}$$



An objective ETC can be generated by a detailed “bottoms up” approach where the Control Account Managers provide a description of the remaining activities in their accounts and an update to the estimated resources or cost for completing these activities. This comprehensive EAC method represents the best estimate of the total cost at the completion of the project and is required to be formulated at least once a year. Another approach is to declare the current Planned Value for the remaining work represents the ETC. This method for estimating the EAC assumes that all remaining work is independent of the dollar burn-rate established for the project to date.

D. For calculating an Independent Estimate at Completion (IEAC) based solely on performance factors, there are multiple methods that can be used.

- The first IEAC formula uses the Budget at Completion (BAC) and the Cost Performance Index (CPI) to calculate IEAC:

$$\text{IEAC} = \text{BAC} / \text{CPI},$$

where BAC is the sum of all project control accounts (and equal to a project’s total BCWS, Planned Value).

This formula assumes that the project dollar burn-rate remains constant for the remainder of the project.

- Another IEAC formula uses the Actual Cost, Budget at Completion, Earned Value and the Cost Performance Index to calculate IEAC:

$$\text{IEAC} = \text{AC} + [(\text{BAC} - \text{BCWP}) / \text{CPI}]$$

This formula is the same as formula 1 as long as a rebaselining that sets cost and/or schedule variances to zero has not occurred. If such an occurrence has happened, this equation should be used with the CPI being based on performance subsequent to the rebaselining.

- Finally, the following formula considers the potential cost impact of a schedule variance:

$$\text{IEAC} = \text{BAC} / [0.8 (\text{CPI}) + 0.2 (\text{SPI})]$$

In this formula, the EAC is weighted by 80% of the CPI and 20% of the SPI.

E. As no single technique consistently provides the best answer, the Project Manager will decide which EAC method or group of methods represents the



best approach for the project. An EAC will be generated each month for each control account and for the total project, and for other WBS levels as required for reporting to the Project Customer. The EAC for each control account will be reviewed at the monthly progress meeting.

### **701.3 Variance at Completion**

EAC (or IEAC) is used to determine the Variance at Completion (VAC) for the project. The VAC is calculated as follows:

$$VAC = BAC - (I)EAC$$

If VAC is positive, the project is projecting an underrun; negative, an overrun.

### **701.4 Contingency**

For certain Jefferson Lab projects, part of the Total Project Cost is carried as contingency to cover any unanticipated project costs.

$$TPC = BAC + Contingency$$

The contingency percentage (on a cost-to-go basis) for a project is calculated by dividing the contingency dollars by the Obligation Estimate To Complete dollars:

$$\text{Contingency Percentage (\%)} = \text{Contingency (\$)} / \text{ETC}_{ob} (\$)$$

$$\text{where Contingency} = \text{Funds remaining} - \text{ETC}_{ob},$$

$$\text{and Funds remaining} = \text{TPC} - \text{ACWP} - \text{Obligations},$$

$$\text{and ETC}_{ob} = \text{BAC} - \text{BCWP}_{cum} - \text{Obligations}$$

## **702 Project Reports**

Formal project reports are an integral part of the Earned Value Management System. Summarized project data from the control account to the senior management reporting level provide the project management team with the insight into how the project is performing compared to the baseline project plan. Reports are generated by the Financial, Schedule and Cost Management Systems. The Financial Management System provides various cost reports and these can be found on the Jefferson Lab MIS web portal (Web Applications/Finance Related Applications). Project performance reports with Earned Value Management data will be produced by the Project Management & Integration Division from the Schedule and Cost Management Systems. The following list of reports is the



nominal set appropriate for all levels of projects at Jefferson Lab. Other management and Project Customer-specified reports can be generated by the Schedule and Cost Management Systems and tailored to the particular needs of the project.

### **702.1 Financial Management System Reports**

#### **A. Open Commitments Report (Exhibit 15)**

The Open Commitments Report lists those procurement items for a project that have been ordered but have not been delivered or completed.

#### **B. Project Status Report (Exhibit 16)**

The Project Status Report details the incurred costs and open Purchase Order commitments on the project including labor, expenses, and overhead (indirect cost).

#### **C. 12 Month Report (Exhibit 17)**

The 12 Month Report breaks the project costs down to a monthly level. Previous fiscal year totals are provided for labor and expenses and then for each month of the current fiscal year.

#### **D. Spending by Month Report (Exhibit 18)**

The Spending by Month Report is similar to the 12 Month Report but also provides a breakout of indirect costs (fringe benefits and G&A).

### **702.2 Schedule and Cost Management Systems Reports**

#### **A. Project Analysis Report (Exhibit 19)**

The Project Analysis Report is the primary earned value report for the project. These reports are normally provided at WBS Level 2, but can be produced down to WBS Level 4. The report displays the BCWS (Planned Value), BCWP (Earned Value), and ACWP (Actual Costs) for the current period and as a cumulative to date. The Schedule and Cost Variances, along with the associated performance index, are provided as well as the Budget at Completion, Estimate at Completion and Variance at Completion data.

#### **B. Red Flag Report (Exhibit 20)**

The Red Flag Report is the core of the variance reporting system. This monthly report summarizes cumulative performance data as of the end of the accounting period and identifies those control accounts with cost or schedule



variances exceeding thresholds established by the Project Manager. Variance thresholds are established for the value of the variance as well as the associated performance index (see Exhibit 21). Unless specified otherwise in a project's Project Execution Plan, the thresholds listed in Exhibit 22 will be the standard for all Jefferson Lab projects. Based on these thresholds, control accounts with a significant negative variance are identified by a color-coded flag on the Red Flag Report. Depending on the variance level, a yellow or red flag highlights the control account. A yellow flag is a warning and indicates a slightly unfavorable variance. A red flag indicates an unfavorable variance and initiates a Variance Analysis Report.

### C. Variance Analysis Report (Exhibit 22)

Those control accounts identified with a red flag require the initiation of a Variance Analysis Report. (Note: While Variance Analysis Reports are normally generated at the control account level, these reports can be produced for other WBS levels at the discretion of the Project Manager.) The purpose of this report is to provide project management with an understanding of the nature of the problem causing the variance and its impact to the overall project. The Project Management & Integration Division will issue the Variance Analysis Report form to the appropriate Control Account Manager. After being completed by the Control Account Manager, the Associate Project Manager and the Project Manager will review the form to confirm accurate variance causes are identified and adequate corrective plans are established. Variance Analysis Reports will be evaluated monthly to monitor the implementation of current action plans.

### D. Earned Value Management Performance Chart (Exhibit 23)

Earned Value Management Performance Charts are prepared each month summarizing cost performance and obligation status for the project as a whole and for each Level 2 WBS system. The cost performance graphs show BCWS (Planned Value), BCWP (Earned Value), and ACWP (Actual Cost) as a function of time. The obligation status graph shows commitments and pending obligations for the same period.

### E. Performance Indicator Charts (Exhibit 24)

Performance Indicator Charts are prepared each month for the project as a whole and for each Level 2 WBS system. These graphs show the schedule and cost performance data and are useful for tracking variance trends.



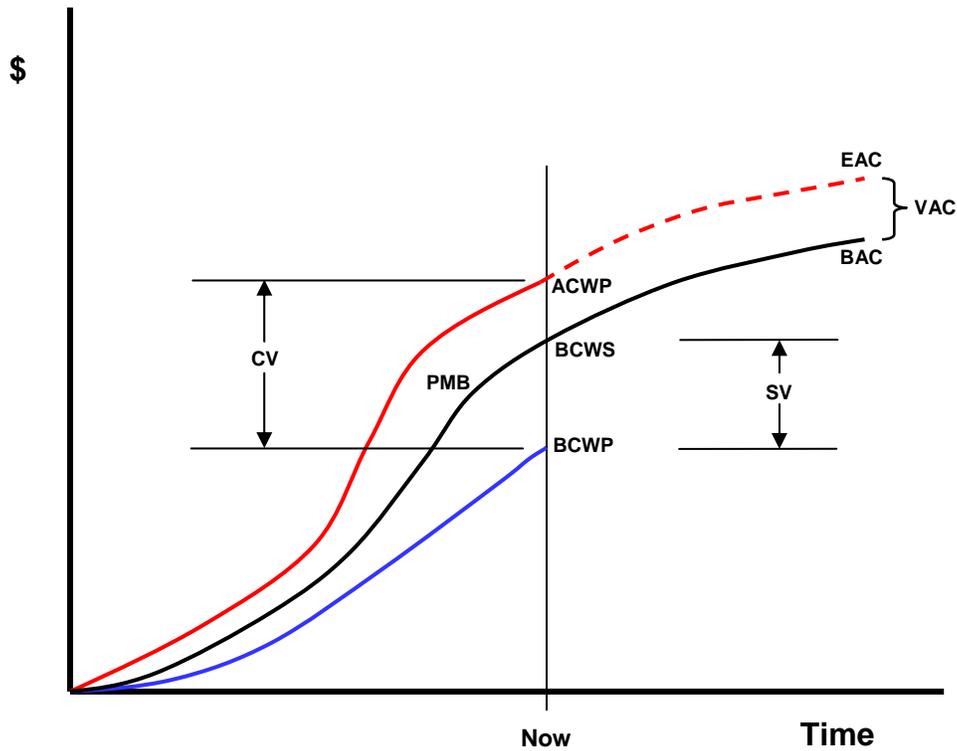
### **703 Meetings and Reviews**

Project management initiates regularly scheduled meetings and reviews to determine project status. Early detection of technical, schedule, and cost difficulties is imperative to maintaining good project performance. The status of a project at the 15 to 20 percent completion point is an accurate indicator of the final success of the project. Depending on a project's size and complexity, the Project Manager and his staff will decide on the appropriate meeting types, frequency, and required attendees. Types of meetings include executive management meetings, project staff meetings, technical and design reviews, project performance reviews, and of course, customer meetings. Open discussion at these forums will reveal specific project technical, schedule, and cost issues requiring management attention and/or decision. Addressing programmatic issues in a timely manner will help prevent greater problems in the future.

### **704 Exhibits**

14. Earned Value Chart
15. Open Commitments Report Example
16. Project Status Report Example
17. 12 Month Report Example
18. Spending by Month Report Example
19. Project Analysis Report Example
20. Red Flag Report Example
21. Variance Threshold Flags Example
22. Variance Analysis Report Example
23. Earned Value Management Performance Chart Example
24. Performance Indicator Chart Examples

Exhibit 14. Earned Value Chart



<b>PMB</b>	<b>Performance Measurement Baseline</b>
<b>BCWS</b>	<b>Budgeted Cost of Work Scheduled (or Planned Value)</b>
<b>BCWP</b>	<b>Budgeted Cost of Work Performed (or Earned Value)</b>
<b>ACWP</b>	<b>Actual Cost of Work Performed (or Actual Cost)</b>
<b>SV</b>	<b>Schedule Variance</b>
<b>CV</b>	<b>Cost Variance</b>
<b>BAC</b>	<b>Budget at Completion</b>
<b>EAC</b>	<b>Estimate at Completion</b>
<b>VAC</b>	<b>Variance at Completion</b>



Exhibit 15. Open Commitments Report Example



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SURA/JEFFERSON LAB - DOE FUND  
PURCHASE COMMITMENTS DETAIL REPORT  
Fiscal Year: 2005 Period: 7

Project Abrv : 12CDR

Project Name : 12 GeV CDR

Owning Org : DIRGEN

PROJ	ORG	ACCT	PO ID	PO LINE NUM	PO LINE DESCRIPTION	PO OPEN AMOUNT
12CDR	DIRGEN	8046-003	0441614006	2	TASK ORDER 4: REIMBURSABLE ESTIMATED-NOT TO EXCEED	\$1,000.00
12CDR	DIRGEN	8046-003	0441614006	3	TASK ORDER 4: PROVIDE AE SERVICES AS DESCRIBED	\$31,437.21
12CDR	DIRGEN	8046-003	0441614006	3	TASK ORDER 4: PROVIDE AE SERVICES AS DESCRIBED	\$6.29
<b>Total PO 0441614006</b>						<b>\$32,443.50</b>
<b>Total</b>						<b>\$32,443.50</b>



Exhibit 16. Project Status Report Example



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Status Report

For Fiscal Year 2005 Period 1

PROJ: SNS840  
 PROJ ID: SNSXXX.8202010000.408.400  
 PROJ NAME: ES&H & QA/QC Support  
 PROJ MANAGER:

	CURRENT PERIOD INCURRED	TOTAL YTD INCURRED	OPEN PO COMMITS	PENDING (Credit Cards, PR, Stock, Travel)*	FY05 SPENDING	TOTAL BUDGET (-% OF DIRECT BUDGET SPENT)	REMAINING BUDGET	TOTAL CTD INCURRED
<b>LABOR</b>								
Direct Labor	0	0	0	0	0	0	0	0
Statutory Fringe(0.000%)	0	0	0	0	0	0	0	0
Fringe Benefits(0.000%)	0	0	0	0	0	0	0	0
<b>TOTAL LABOR</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>EXPENSES</b>								
Supplies & Materials(6043)	0	0	0	0	0	0	0	0
<b>TOTAL EXPENSES</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>TOTAL DIRECT</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>OVERHEAD</b>								
G&A(30.000%)	0	0	0	0	0	0	0	0
<b>TOTAL WITH OVERHEAD</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>



Exhibit 17. 12 Month Report Example

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# 12 Month Report

In K \$'s  
 For Fiscal Year 2005

Project: SNSS20  
 Project Name: Proj Control/Bus/Ofc Supp  
 Project Manager: Cothren, Richard

	FY04	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	PEND- ING	TOTAL OBLGTD	TOTAL BDGT	RMING BDGT
LABOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6043 (Supplies & Materials)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6044 (Training & Development)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6045 (Travel)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6046 (Purch Serv/Labor/Consult)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6047 (EDP)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6048 (Capital Procurements)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6049 (R&M)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6050 (Utilities)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6053 (Svc Center Chrgs)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6054 (Other)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6055 (Stipend/Reloc/Reg Fees)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6948 (Capital Procurements>50K)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6999 (PY Dir Cost Alloc Exempt)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>													



Exhibit 18. Spending by Month Report Example



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**Spending by Month**  
For Fiscal Year 2005

Project: SNS820  
Project Name: Proj Control/Bus/Ofc Supp  
Project Manager: Cotlren, Richard

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	YTD INCUR	OPEN COMMITS	PEND-ING	TOTAL OBLGTD	TOTAL RMING
<b>Labor</b>																	
Statutory Fringe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fringe Benefits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Labor</b>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Expenses</b>																	
Supplies & Materials (6043)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EDP (6047)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Utilities (6050)	130	50	0	0	0	0	0	0	0	0	0	0	179	0	0	179	(179)
<b>Total Expenses</b>	130	50	0	0	0	0	0	0	0	0	0	0	179	0	0	179	(179)
<b>Total Direct</b>	130	50	0	0	0	0	0	0	0	0	0	0	179	0	0	179	(179)
<b>G&amp;A</b>	39	15	0	0	0	0	4	0	0	0	0	(1)	58	0	0	(254)	0
<b>Total With Overhead</b>	168	64	0	0	0	0	4	0	0	0	0	(1)	236	0	0	(76)	0





Exhibit 21. Standard Variance Threshold Flags

## Variance Reporting Thresholds

Cost or Schedule Variance >\$25K  
OR CPI or SPI < 0.9 or >1.1

Warning

Cost or Schedule Variance >\$50K  
AND CPI or SPI < 0.8 or >1.2

Variance Report



Exhibit 22. Variance Analysis Report Example

**Jefferson Lab**

**12 GeV Upgrade  
VARIANCE ANALYSIS REPORT**

WBS:  
Control Account Manager:  
For Period Ending: 30 Apr 08

Values are in \$K Dollars (other than SPI & CPI)	SCHEDULE FLAG				COST FLAG			
	(A)	(B)	(B-A)	(B/A)	(C)	(D)	(C-D)	(C/D)
	Planned Value	Earned Value	Schedule Variance	Schedule Perform Index	Earned Value	Actual Cost	Cost Variance	Cost Perform Index
	BCWS	BCWP	SV	SPI	BCWP	ACWP	CV	CPI
Month of Apr-08	34	14	-19	0.43	14	27	-12	0.54
Cumulative	353	259	-94	0.73	259	292	-33	0.89

1. Cause (Address Variances Individually)  
SV:

2. Proposed Solutions (Corrective Actions)  
SV:

Estimated Resolution By (Date):

3. Impact on Project Cost/ Schedules

4. Comments

Control Account Manager:	Project Manager:
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Exhibit 23. Earned Value Management Performance Chart Example

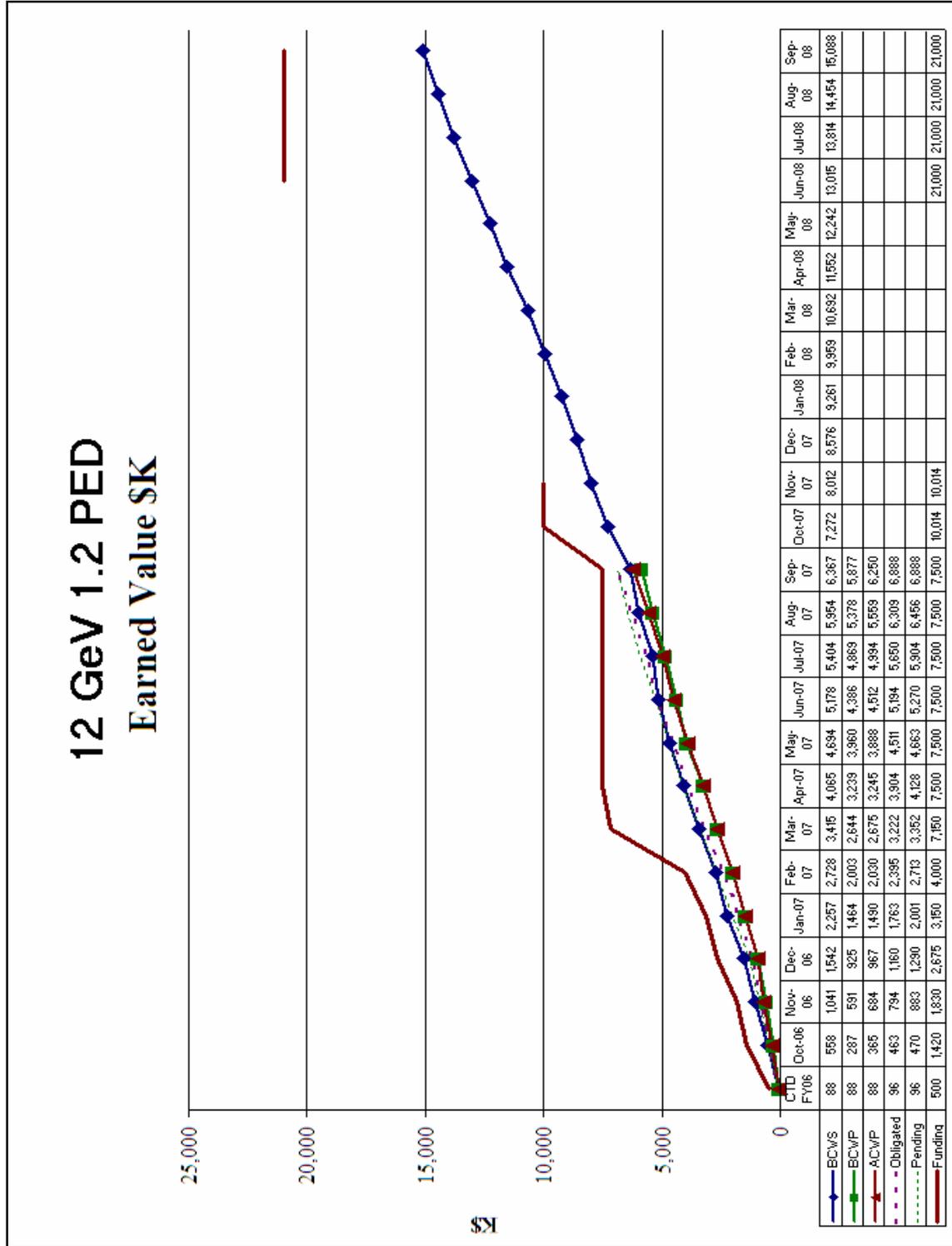


Exhibit 24. Performance Indicator Chart Examples

Hunt for Red October

