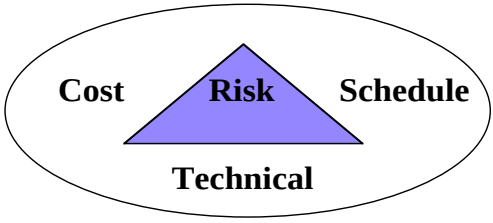
Technical Managers
Earned Value Management
User's Guide



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Foreword

This guide is designed as a quick-reference guide for technical personnel empowered with cost, schedule and technical responsibilities using earned value.

The primary focus of this guide is to describe the approach to managing cost/schedule performance of the PAC-3 Missile contract using earned value as a day-to-day management tool.

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Earned Value Management

The earned value management process integrates the work scope of a program with the schedule and cost elements for effective program planning and control. The process supports program management by ensuring:

- all work scope is planned to completion
- program work scope, schedule and cost objectives are integrated into a baseline plan against which accomplishment may be measured.
- accomplishments are objectively assessed at the work performance level.
- significant variances to plan are analyzed, impacts are forecasted and corrective actions are taken.

Earned Value Benefits to the Technical Manager

- Earned Value (EV) is the single element that integrates cost, schedule and technical performance as the basis for communications with the contractor and government Integrated Product Team (IPT).

- EV quantifies technical progress in cost and schedule terms that provides the PAC-3 Product Manager (PM) the ability to pinpoint and focus on problem areas at the contract and mid-level IPT structure.

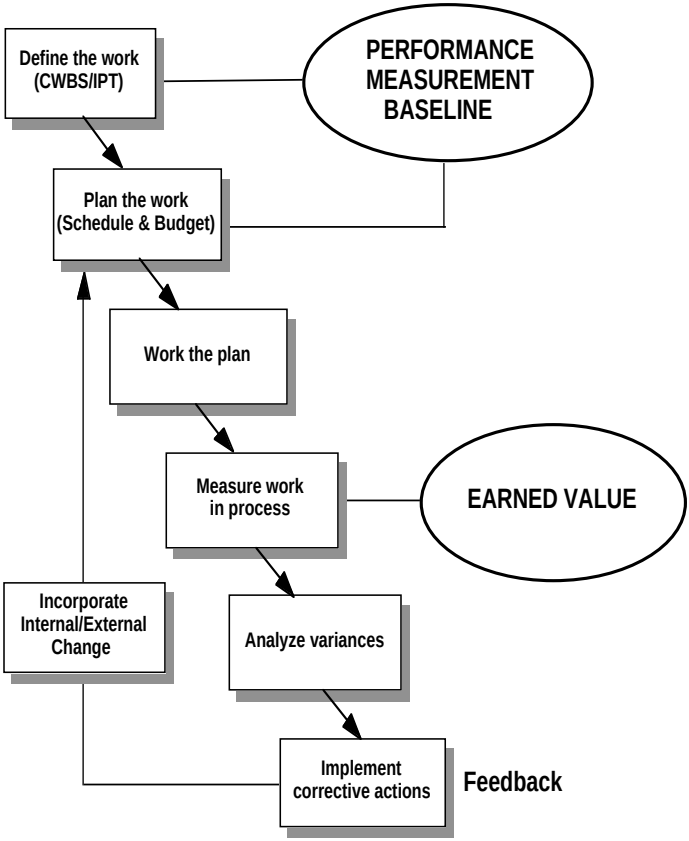
- EV provides IPT leaders and members the ability to pinpoint and focus on problem areas at lower levels.

- EV provides IPT leaders and members the basis for forecasting future performance, verification of corrective actions taken, and establishment of reliable estimates-at-completion (EACs).

- EV facilitates a mutual understanding of scope, schedule and budget planning through the Integrated Baseline Review (IBR) process.

Integrated Program Management Process

"An Iterative Process Used Throughout the Life of a Contract"



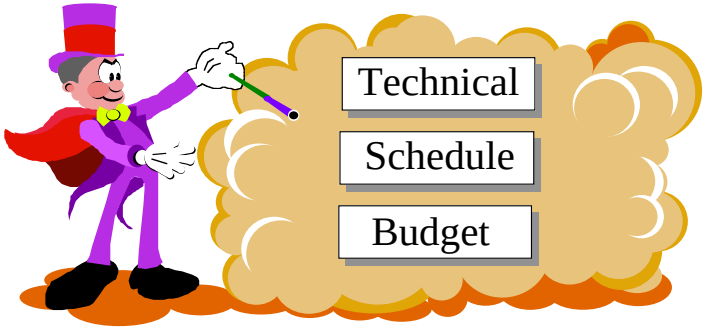
The Integrated Product Team (IPT):
"An Organizational and Management Approach"

- The PAC-3 program is executed through component and subsystem level, multi-disciplined prime contractor IPTs.
  - Each IPT has a government lead that coordinates the participation of all government organizations and activities involved with this program.
  - All contractors and subcontractors are members.
  - Each IPT has members on all other IPTs to integrate activity.
- The System Integration Team (SIT) performs a system integration role and makes technical decisions for the program.
- The Program Management Team (PMT) has overall program responsibilities and is comprised of the government PM and the PMs of the prime and major subcontractors.

Your Part in the IPT: Taking Ownership

- Be responsive to the direction given by the IPT.
- Use your technical expertise and be **proactive** in team decisions.
- Be cognizant of cost, schedule and technical performance, ensuring decisions consider budget and schedule implications.
- **Communicate** decisions within and among the teams.
- Share risks, responsibilities, and accountability at all levels.
- Avoid constructive changes to the contract.

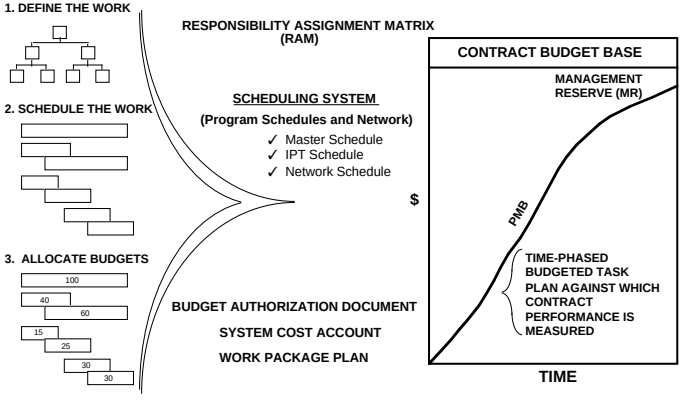
Components of the Performance Measurement Baseline (PMB)



The PMB is the basis to integrate
the technical, schedule and budget baselines.

Baseline Development:

"Establishing the PMB is a 3-Step Process."



Define the Work:

Technical Baseline: " Technical and Performance Requirements Defined as Tasks (Scope)."

Performance Requirements

Specifications

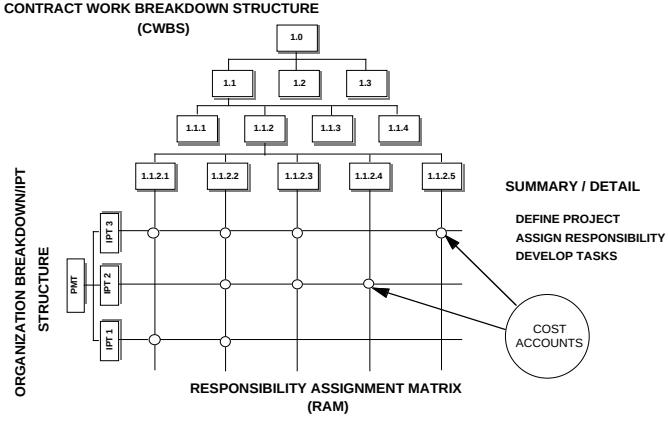
Design Process and Reviews

Statement of Work

Design Objectives

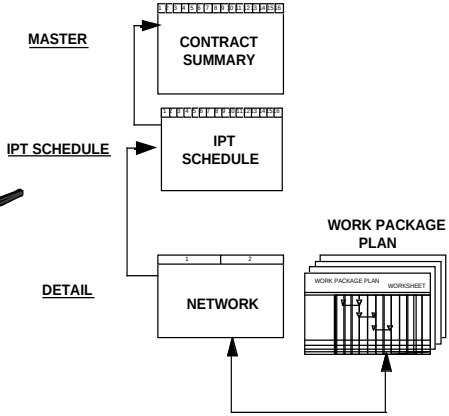
WHAT?

Integrate CWBS with IPT



Schedule the Work:

Schedule Baseline: " The time phasing and interdependencies of technical tasks."

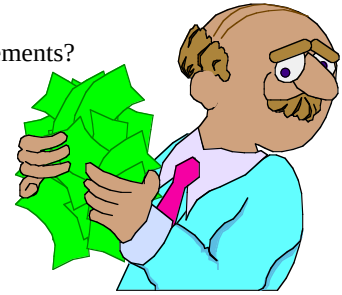


WHEN?

Allocate Budgets

Budget Baseline: " The resources necessary to accomplish the technical tasks as scheduled."

- What is your budget?
- What are your resource requirements?
  - Labor
  - Subcontractors
  - Materials
  - Other Direct Costs (ODC)

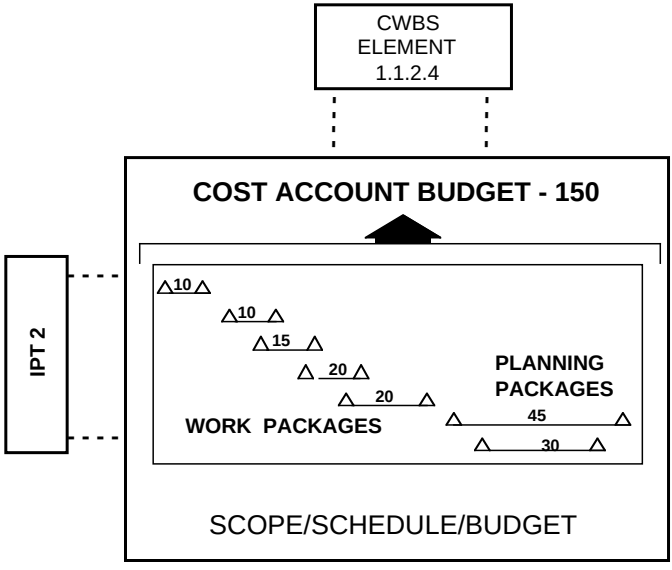


HOW MUCH?

The Control Point for Planning and Control

• Cost Account - virtually all elements of planning and control come together at the cost account level, including properly assigned scope, budgets, schedules, earned value, cost collection, problem identification, and estimate to complete. Individuals assigned responsibility for cost accounts are Cost Account Managers (CAMs).

- Work Package - represents units of work for near term activities.
- Planning Package - is far term effort that can be identified and budgeted in early baseline planning, but cannot yet be defined into work packages.



The Integrated Baseline Review (IBR) Process

A Technical Review of the Performance Measurement Baseline by Project Engineers to Ensure Early Comprehensive Planning of Contract Effort and Continued Integrity of the Baseline Planning.

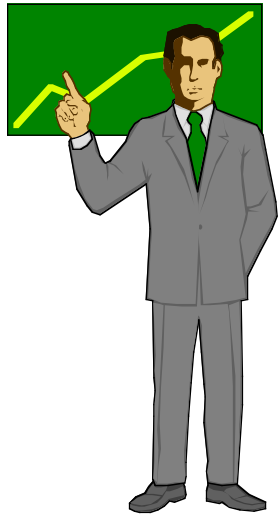
- **Provide the PM confidence in the validity of cost/schedule status generated from the integrated management control system.**
  - Ensure the requirements of the SOW are identified down to the cost account level.
  - Assess the technical content and phasing of task (work package) planning for consistency with the program schedule.
  - Evaluate the adequacy of the budgets passed down to cost account managers (time phasing and total resources).
- **Give the PM a sense of ownership of the performance measurement baseline.**
  - Understanding the contractor's cost/schedule management process.
  - Understanding earned value methods for measuring progress.
  - Discussing cost/schedule planning and control with their contractor counterparts.

Typical Results

- Mutual understanding of SOW content
- Better insight into known risk areas
- Cost/Schedule/Technical risk areas identified
- Scope disconnects with work authorization documents
- Subjective measurement milestones vs. objective
- Discrete effort planned as level of effort
- Areas under resourced
- Estimate at completion understated
- Schedule inconsistencies
- Areas where work authorizations and cost account planning are not in place

Baseline Maintenance: "Incorporating changes into the plan to keep it current."

- Timely incorporation of the changes into the PMB will ensure up to date information for planning, statusing, and managing.
- Incorporate impacts of IPT decisions into the baseline plan.
- Communicate: Understand schedule interdependencies and incorporate changes when impacted.
- Jointly review baseline planning revisions with IPT members.
- To assess revisions, be aware of technical issues and associated impacts.



Types of Changes

- Formal Changes - Government directed changes to the contract.
  - incorporated only by contract modification by PCO.
  - can impact SOW requirements, work authorization documents, budgets, schedules, and cost.
  - Change orders w/NTE - budgets established based on contractor's proposals or Not to Exceed (NTE)
  - Supplemental Agreement - incorporated into PMB after negotiations.
- Internal Replanning - Contractor initiated changes within contract scope.
  - changes resulting from design reviews.
  - funding restrictions affecting resource availability.
  - rate changes, rolling wave planning.
  - Level of Effort (LOE) activities not performed as planned.

Understanding Earned Value: "Measuring work in process."

With the time phased budget baseline established and work being performed, we now begin the process of determining technical progress through the use of Earned Value techniques.

- **What Has Been Accomplished?**
  - Drawings Complete
  - Test Plan Complete
  - Material Delivered or Consumed
  - Simulation Algorithms Written

By assigning a budget (BCWS) value for detail milestones and planned accomplishments, then using objective measurement techniques to status each subtask (work package), you can determine:

Budgeted Cost for Work Performed (BCWP) = Earned Value

The techniques that the Lockheed Martin Vought System (LMVS) uses for earned value follow. Also provided are the LMVS peculiar terms for IPT/CAM reports and documentation.

Lockheed Martin Vought System (LMVS) EV Techniques

Milestone (Percentage)	EV determined by CAM estimate of % complete of measured milestones contained within work packages. EV cannot exceed 90% until completed.
Managers Assessment	A percent taken toward the completion milestone with no interim milestone.
Standard Hour Content (MFG)	Percent earned based on standard hours assigned to released work orders.
Subcontract CPR or C/SSR	BCWP taken from subcontractor Cost Performance (CPR) or Cost/Schedule Status Report (C/SSR)
Material	(1) Major Purchases: Planned based on expected use and earned when actually used. (2) Similar Material: Those having stable EAC's may have earned value taken through formula (BCWP = ACWP/BAC x EAC). Note: When this method is used, the EAC must be assessed each month and updated as necessary.
Apportioned	Proportional to earnings of related discrete work package.
Level of Effort	Earned by passage of time (BCWP = BCWS).

LMVS Terminology

Budget Accounting Report (BI3) - Used to review the resource spread at the IPT cost account level.

Budget Baseline Revision (BBR) - Provides incremental budget changes to IPT/CAMs.

Internal IPT CAM Cost Performance Report (CIO7) - Common Report - Provides performance status BCWS, BCWP, ACWP, BAC, and LRE at each IPT cost account (lowest WBS) sorted by individual IPT CAM in dollars and hours.

MOSUM - Monthly summary dollarized report for each major IPT which identifies performance indicators for each IPT/CAM, e.g., cumulative to date and current period data for BCWS, BCWP, ACWP, SV/CV% and dollars, SPI, CPI, TCPI (BAC & EAC), % COMPLETE, % SPENT, and IEAC.

Network Schedule Tabular Run by Predecessors/Successors - This listing includes detail activities at and below the work package level by the predecessors and successors assigned to the activity.

Network Schedule Tabular Run by WBS - This listing includes detailed activities at and below the work package level by Work Breakdown Structure element.

NITEMARE - Computer generated report utilized by IPT CAM for engineering department only. Consists of hours only (BCWS, BCWP, ACWP, BAC, LRE) at the engineering work package level.

Organizational Breakdown Structure by IPT CAM - IPT responsibility matrix for assigned WBS tasks.

PLOX Graphs - Data (thru G & A) provided in advance of the CPR which depicts cumulative BCWS, BCWP, ACWP, BAC, EAC, SV/CV% and dollars, ETC and 90 day outlook.

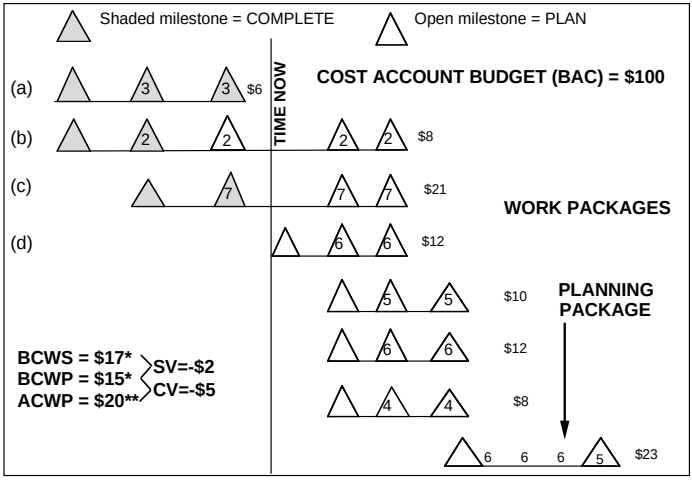
Product Description - Relates the cost account scope to the applicable SOW paragraph. (Initiated with proposal - not a living document).

IPT Cost Account - Summary of all work packages and planning packages for each cost account at the lowest WBS.

Technical Performance Measurement (TPM) Report - A report used as a management tool to monitor and quantify technical performance.

Work Package - Document used to authorize work and provides timed phased budgets by element of cost.

Earned Value Determination



*** METHOD OF PLANNING AND EARNED VALUE : MILESTONE (PERCENTAGE)**
**** ACTUAL COST FROM ACCOUNTING SYSTEM**

With planning complete (the technical, schedule and budget baselines in-place) the process of determining progress and reporting against the baseline begins. In the cost account example, there are seven discrete work packages and one planning package with each milestone having a budget value assigned. The sum of the work packages and planning package is the total cost account budget ($100) and is also the Budget At Completion (BAC). The sum of the budgets for work packages, a, b and c prior to time now (shaded and open milestones) is $17 for Budgeted Cost for Work Scheduled (BCWS). The Budgeted Cost for Work Performed (BCWP) or earned value (shaded milestone) for work packages a, b, and c total $15 to time now. Work accomplished could be drawing completion, material issue to work-in-process and other objective tasks completed. The Actual Cost of Work Performed (ACWP) are costs from the accounting system. Comparison of earned value with budget provides schedule variance and earned value with actual costs provides cost variance. The cost account example depicts a behind schedule and over cost condition.

Performance Analysis: "Elements of PMB Analysis"

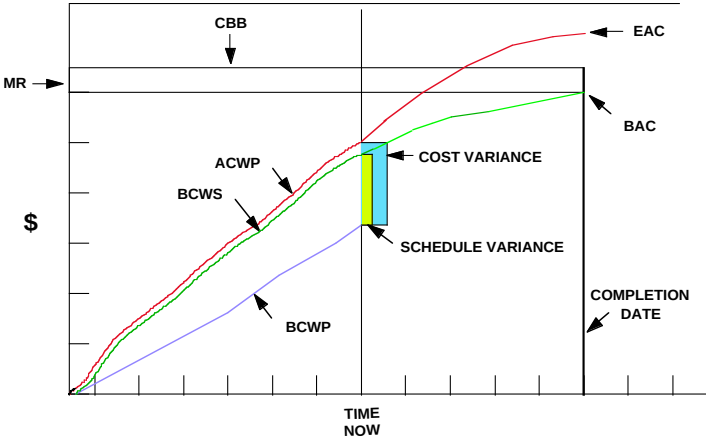
Analysis requires contractors to identify and proactively manage deviations to baseline plans. The actions of recording, analyzing, summarizing and reporting data enable IPTs to make informed and timely decisions. Basic data elements are required to achieve this data analysis:

- Budgeted Cost for Work Scheduled (BCWS) - the time phased budget (the value of work planned).
- Budgeted Cost for Work Performed (BCWP) - commonly referred to as Earned Value (the budget value of effort completed to date).
- Actual Cost of Work Performed (ACWP) - the actual costs associated with work completed to date.
- Budget at Completion (BAC) - at the contract level, the total of all allocated and undistributed budgets.
- Contract Budget Baseline (CBB) - the total of all authorized contract work.
- Management Reserve (MR) - amount of the CBB withheld for management control purposes.
- Estimate At Completion (EAC) also Latest Revised Estimate (LRE) - actual costs incurred to date plus an Estimate to Complete (ETC).
- Cost Variance (CV) = BCWP - ACWP (difference between work performed and actual cost to date).
- Schedule Variance (SV) = BCWP-BCWS (difference between work performed and scheduled work to date).
- Variance-at-Completion (VAC) = BAC-EAC (difference between budget for all work and the estimate for all work).

Negative variances indicate overrun or behind schedule conditions and pinpoint technical areas to pursue and to ensure corrective actions are in place to minimize or eliminate the variances. Positive variances indicate underrun or ahead of schedule conditions.

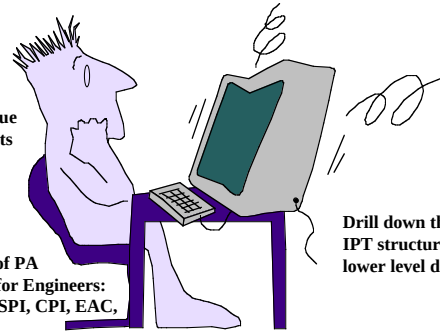
- Percent Planned = CUM BCWS/BAC (% of total effort to be accomplished to date).
- Percent Complete = CUM BCWP/BAC (% of planned work accomplished to date).
- Percent Spent = CUM ACWP/BAC (% of budget spent to date).

"Contract Performance Analysis Data"



Performance Analyzer: "The Engineer's Tool for Analysis"

Displays earned value data by IPT in charts or reports.



Drill down through the IPT structure to obtain lower level data.

Recommended list of PA reports and charts for Engineers: Six Period reports, SPI, CPI, EAC, and Cost/Schedule Variance chart.

Keys to Performance Status

1. Do I Have Any Significant Cost/Schedule Variances?

Cost Variance (CV) $(BCWP - ACWP)$

Plus (+) is good

Minus (-) is bad

What is the variance %? $\left(\frac{CV}{BCWP} \times 100\right)$

Schedule Variance (SV) $(BCWP - BCWS)$

Plus (+) is good

Minus is (-) is bad

What is the variance %? $\left(\frac{SV}{BCWS} \times 100\right)$

Is it on the critical path?

Schedule slack?

2. What Is The Trend (Getting Better Or Worse)?

Chart the Cost/Schedule Variance Trends.

Does My Contractor Tell the Same Story as the Data?

When do I think the Trend Will Improve? (90 Day Forecast)

3. What Is The IPT Doing About It? What Is My Assessment?

Causes

Corrective Actions

Impact to the Program

Reliability of 90 Day Forecast

Keys to Performance Status (Cont'd)

4. Do I Think The Contractor Will Come in On Budget?
Compare the CPI to the TCPI-BAC

$$\frac{\text{BCWPc (Work Accomplished)}}{\text{ACWPc (Actuals)}} = \text{CPI (.90 Sample data)}$$

CPI = Cost Performance Index, cost efficiency of work performed to date (The value of work accomplished for each dollar spent)

TCPI (BAC) = Efficiency necessary to complete on budget

$$\frac{\text{BAC-BCWPc (Work Remaining)}}{\text{BAC-ACWPc (Budget Remaining)}} = \text{TCPI(BAC)}\ (1.11\ \text{Sample Data})$$

5. **Is The Contractor's LRE Reasonable?**
Compare the CPI to the TCPI - LRE

TCPI (LRE) = Efficiency necessary to complete at the contractor's estimate

$$\frac{\text{BAC-BCWPc (Work Remaining)}}{\text{LRE-ACWPc (Cost Remaining)}} = \text{TCPI(LRE)}\ (1.04\ \text{Sample Data})$$

6. What is My Estimate At Completion?
There are many methods, but here are a few:

$$\frac{\text{BAC (Total Budget)}}{\text{CPI (Factored by Cum Cost Efficiency)}} = \$123{,}808\text{K (Sample Data)}$$

$$\text{ACWPc (Actuals)} + \frac{\text{BAC-BCWPc (Work Remaining)}}{\text{CPI (Cum Cost Efficiency)}} = \$123{,}257\text{K (Sample Data)}$$

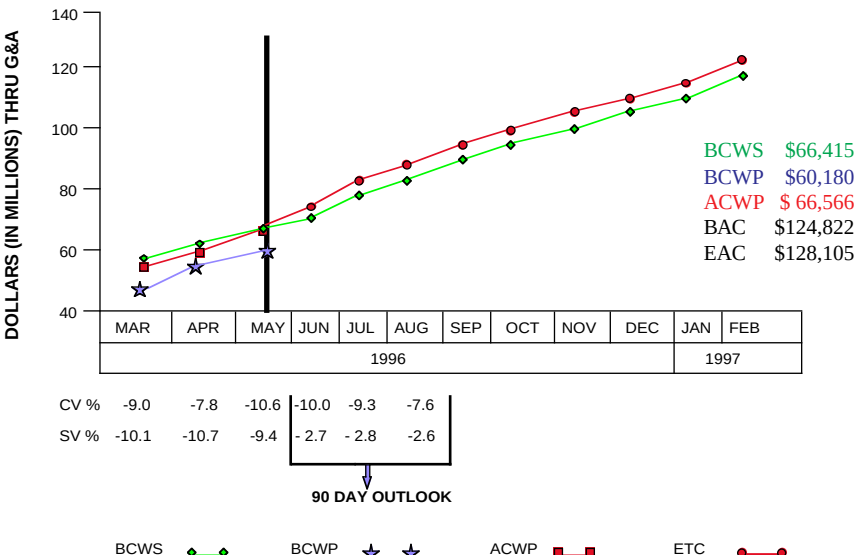
$$\text{ACWPc (Actuals)} + \frac{\text{BAC-BCWPc (Work Remaining)}}{.8(\text{CPI})+.2(\text{SPI})\ (\text{Weighted Cost and Schedule Efficiency})} = \$123{,}230\text{K (Sample Data)}$$

Calculate the TCPI(EAC) of your estimate

$$\frac{\text{BAC-BCWPc}}{\text{EAC-ACWPc}} = \text{TCPI (EAC)}$$

NOTE: Sample data from MOSUM Report (Dollars Without G&A and Cost of Money)

PAC-3 Missile Program EMD Missile IPT-8 (*PLOX* Graph)
Final Performance Dollars Thru May 1996



Earned Value Status MOSUM Report

MISSILE IPT (#8) SUMMARY — **PERFORMANCE ANALYSIS**

(3A72, 3A89, 3A97) — MAY 1996

CAM	CUM/CUR	BCWS	BCWP	ACWP	SV %	SVAR $$$	CV %	CVAR $$$	SPI	CPI	TCPI-BAC / TCPI-EAC	BAC / EAC	VAC	BCWR / ETC	% COMP	% SPENT	IEAC 1	IEAC 2
TOTAL	CUM	59,697,013	54 079,577	59,820,729	-9.40%	(5,617,4	-10.60%	(5,471,15	0.91	0.90	1.11	111,427,524	-3,515,621	57,347,947	49%	54%	123,230,520	123,256,802
	CUR	2,861,396	3,323,755	5,135,100	16.20%	462,359	-54.50%	(1,811,34	1.16	0.65	1.04	114,943,145		55,122,416	3%	5%		

NOTE : These columns contain cost/schedule status for both current month and cum to date for each CAM within the missile IPT.

Note: Dollar values include all performing functions for each CAM

$$IEAC1 = ACWPc + \frac{BAC - BCWPc}{.8(CPI) + .2(SPI)}$$

$$IEAC2 = ACWPc + \frac{BAC - BCWPc}{CPI}$$

90 Day Outlook

VARIANCE TRENDS:

Period	SV %	CV %
Dec-95	-13.30%	-9.00%
Jan-96	-8.40%	-10.30%
Feb-96	-10.70%	-10.70%
Mar-96	-10.20%	-8.80%
Apr-96	-10.70%	-7.70%
May-96	-9.40%	-10.60%
Jun-96	-2.70%	-10.00%
Jly-96	-2.80%	-9.30%
Aug-96	-2.60%	-7.60%

NOTE: Dollars do not include G&A and Cost of Money. Precursor to *PLOX* Graph shown on page 18.

PAC-3 IPT Earned Value Management Process

With the baseline in place and verified through the IBR process, the PAC-3 program has the key elements in place to fully implement the Earned Value Management process and its tools as part of the day-to-day management of the contract. Empowered IPTs (contractor and government) are responsible for integrated cost, schedule, and technical performance. Once the IPT CAM completes statusing the IPT work accomplished during the reporting period, the government IPT leader immediately reviews the status to determine if it reflects his understanding of what has been accomplished for the month. Lower level IPTs plan, execute, and use EV data to assess component level performance; major IPTs integrate component level issues, manage subsystem effort and use EV data to assess subsystem performance. The System Integration Team (SIT) reviews technical status, assesses risk and manages interface issues associated with the technical effort; the Program Management Team (PMT) reviews program status, contract actions and EV status of the major IPTs. Technical risk areas are evaluated by the SIT on a weekly basis and provided to the PMT. The PMT meets weekly to allow the IPT leaders to brief critical top 5 selected issues and monthly to focus on earned value assessments of the IPT leaders.

The Product Manager (PM) proactively uses earned value data to evaluate IPT performance. The PM uses this information as a key element of risk identification and assessment. Earned value analysis of cost and schedule status forms the basis for forecasting work to be accomplished focusing on the next 90 days (as seen on the PLOX graph). The PM uses filters for flagging problem areas that ensure risk areas are surfaced, addressed, and corrective actions implemented that minimize program impacts. Major IPT variance changes of +/- 1% are highlighted and discussed at the PMT for IPT variances exceeding 3%. This filtering process strengthens the focus on key problem areas.

PAC-3 IPT Earned Value Management Process (Cont'd)

The government PM conducts a technical roundtable weekly with the government IPT members and program support personnel to review contract issues, earned value trends, concerns/issues and determine appropriate government direction to the contractor.

Key status indicators for consideration at the roundtable may include:

- **Subcontract Progress** - critical since PAC-3 subcontracts comprise 70% of the overall program budget. Also, subcontract C/SSR or CPR data is reported on a one-month lag basis. (Note: The sub's CPR and/or C/SSR is included in the LMVS CPR with a one month lag.)

- **Material** - important since often the status of material can cause major swings in earned value information if not properly assessed and reported.

- **Tooling** - quite often, tooling is a key item and plays a significant role in achieving schedule success.

- **Drawing Release** - falling behind on release can impact many areas.

- **Test** - late plan completion, material availability, vendor status, etc. can impact the test schedule and program.

Once determined, the government IPT member must present the results at the PM's Technical Roundtable and his assessment of the 90 day forecast of work to be accomplished.

PAC-3 Scenario

The following scenario describes a technical issue, related impacts, and use of earned value information in pointing out a potential schedule impact to the program. The scenario highlights corrective actions which minimize program risks and costs.

Issue: **Poor tooling schedule performance efficiency.**
Cause: **Late tooling drawing releases impacting tool design and build.**
Impact: **Potential delay in flight test with associated cost impact.**

The IPT CAM, through routine schedule status and earned value assessment with responsible individuals, recognized a growing schedule slippage in drawing releases for a design work package. The slippage impacted tooling needed for first flight. The earned value information used to identify this slippage served as an early warning indicator and was used to flag the slippage to the major IPT leader. It was determined that a soft tooling approach could conserve the resources associated with the hard tooling design and protect the flight test schedule. The recommendation was submitted by the major IPT leader to the SIT. The SIT evaluated the approach as technically sound and the PMT concurred.

At times during IPT reviews, performance issues may surface that, for various reasons, were previously overlooked and not presented as issues. When these situations occur, the government leader addresses the issue and ensures the contractor understands it and takes appropriate action. The earned value information can be used as quantitative justification of performance issues to convince the contractor to recognize a problem that typically would not have received attention until months later.

PAC-3 Joint Surveillance Process

The Joint Surveillance program, which you are a part of, continues the IBR process and ensures the PMB accurately reflects the contract effort.

- Integrated process to ensure baseline integrity and data consistency.
- Periodic DCMC/LMVS/PAC-3 Program Office surveillance to review cost account documentation.
- Recurring IPT leader baseline planning review to assess schedule replanning, budget, EAC adequacy, scope, and earned value methods.
- Follow-up conducted by the DCMC program integrator.

Summary

Earned Value Management will help you:

- **Quantify the results of your management actions**
- **Make better, informed decisions**
- **Manage costs and mitigate risk**

Appendix A - Technical Managers EV Contract Performance Measurement Data Card

Terminology

BCWS - Budgeted Cost for Work Scheduled (Planned Value)
BCWP - Budgeted Cost for Work Performed (Earned Value)
ACWP - Actual Cost of Work Performed (Actual Cost)
BAC - Budget At Completion (Sum of Allocated Budgets)
CBB - Contract Budget Baseline (Total Authorized Work)
EAC - Estimate At Completion (Government Estimate)
LRE - Latest Revised Estimate (Contractor Estimate)

Performance Reports (Deliverables Providing Contract Cost, Schedule and Funding Status Information)

CPR - Cost Performance Report
C/SSR - Cost/Schedule Status Report
CFSR - Contract Funds Status Report

Overall Status

$$\text{Percent Planned} = \frac{\text{BCWS (CUM)}}{\text{BAC}}$$

$$\text{Percent Complete} = \frac{\text{BCWP (CUM)}}{\text{BAC}}$$

$$\text{Percent Spent} = \frac{\text{ACWP (CUM)}}{\text{BAC}}$$

Variances

$$\text{Cost Variance (CV)} = \text{BCWP} - \text{ACWP}$$

$$\text{Schedule Variance (SV)} = \text{BCWP} - \text{BCWS}$$

$$\text{Cost Variance Percent (CV\%)} = \frac{\text{Cost Variance}}{\text{BCWP}} \times 100$$

$$\text{Schedule Variance Percent (SV\%)} = \frac{\text{Schedule Variance}}{\text{BCWS}} \times 100$$

$$\text{Variance at Completion (VAC)} = \text{BAC} - \text{LRE}$$

$$\text{VAC Percent (VAC\%)} = \frac{\text{BAC} - \text{LRE}}{\text{BAC}} \times 100$$

Appendix A - Technical Managers EV Contract Performance Measurement Data Card (Cont'd)

Performance Indices (Unfavorable <1.0)

Cost Performance Index (Efficiency) $$CPI = \frac{BCWP}{ACWP}$$

Schedule Performance Index (Efficiency) $$SPI = \frac{BCWP}{BCWS}$$

Estimate At Completion (EAC)

$$EAC = \frac{BAC}{CPI(CUM)}$$ Assumes Past Performance Continues

$$EAC = ACWP\ (CUM) + \frac{BAC - BCWP\ (CUM)}{CPI(CUM)\ SPI\ (CUM)}$$ Factors in Schedule Performance

To Complete Performance Index

TCPI (LRE) (May substitute EAC for LRE) $$= \frac{\text{Work Remaining}}{\text{Cost Remaining}} = \frac{BAC - BCWP\ (CUM)}{LRE - ACWP\ (CUM)}$$

IPT (Government/LMVS) Focus Areas

- Is all work scope integrated into cost account/work package planning?
- Are latest schedule changes reflected in cost account/work package planning?
- Are work packages logically phased to support the IPT schedule?
- Are work package budgets adequate and realistically time-phased to support work package tasks?
- Are the earned value techniques appropriate for measuring accomplishment?
- Is the basis for measuring accomplishment objectively assessed at the work performance level?
- Are significant variances to plan analyzed and impacts forecasted?
- Is there a risk management plan for known risks?
- What are the significant cost, schedule and completion variances?
- What are the trends? (What is the IPT doing about them?)
- What are the cost and schedule performance efficiencies, CPI & SPI?
- Is the To Complete Performance Index (TCPI-EAC and/or TCPI-LRE) reasonable based on current performance?

Appendix B - Subcontract Management

- Management of subcontracts with cost/schedule reporting requirements involves an understanding of the subcontract environment regarding EV management systems use and reporting. The government IPT leader must have an understanding of subcontract baseline planning to ensure baseline integrity. He also must work subcontract issues through the responsible prime contractor IPT CAM/leader. Unique considerations when managing a major subcontract include:
  - The CPR or C/SSR from a subcontractor is reported in the prime contractor report typically as a contract total entry for all data elements and, on the PAC-3 contract, is included in the prime report with a one month lag. The IPT CAM must evaluate the reports and include his knowledge of the subcontract current performance when reporting to the IPT leaders. The government IPT leader reviews the status with the IPT CAM to determine if it reflects his understanding of what has been accomplished.
  - Subcontractors have unique EV management systems. Knowledge of the processes used for planning and control and good understanding of the subcontract baseline planning is critical to conducting meaningful assessments of performance. Since the prime's earned value reflects the previous month's performance for the major subcontracts, the IPT leaders (contractor and government) must supplement their assessments with current subcontract cost/schedule performance status when developing their 90 day forecast.
  - Major subcontractors are members of IPTs and often are not located at the prime location. The IPT must ensure that communication of EV information and any issues associated with the subcontract are an integral part of the operation of the IPT.
  - Major subcontracts often comprise significant portions of the prime contract. All cost, schedule, and technical performance risk areas must be managed daily and included in IPT reviews of recurring EV status activities.
- Major subcontractors on the PAC-3 program are:
  - Atlantic Research Corporation (ARC)
  - Honeywell Corporation
  - Raytheon Corporation
  - Rockwell Corporation
- The EV techniques and unique terminology for major subcontractors are provided for your reference.

Atlantic Research Corporation (ARC) Techniques

50/50	Two milestones are established, the first for the planned start and the second for planned completion. One half of the task's EV is credited when the task begins, the remaining half is credited when the task is completed.
0/100	One milestone established for the planned completion. Credit taken at completion. Used only for 1 month activities.
Apportioned	Proportional to earnings of related discrete work package.
Milestone	Earned Value determined by CAM estimate of % complete of measured milestones contained within work packages.
Unit	The number of completed units is input to the Management Control System where it is extended by the BCWS unit conversion rate to generate BCWP.
Level of Effort	Earned by passage of time (BCWP = BCWS).

Atlantic Research Corporation

Cost Account Contract (CAC) - an agreement between program management (or a WBS manager) and a cost account manager to perform a task or grouping of tasks in support of CWBS elements. Agreement contains definition of schedule, budget and scope.

Work Order Number - a twelve digit alphanumeric grouping, first six digits of which are normally the ARC account number, with the remaining six digits used to indicate the CWBS elements, the cost accounts, and the work packages.

Work Package Plan (WPP) - the complete definition of a work package in support of a CAC. The plan contains the work scope, budget, schedule and performance measurement indicators.

Honeywell EV Techniques

Percent Complete of a Milestone	Earned Value determined by CAM estimate of % complete of measured milestone contained within work package. EV cannot exceed 75% until complete.
Unit Value	The number of completed units is extended by the BCWS unit conversion rate to determine BCWP.
Apportioned Effort	Is related in direct proportion to measured effort.
Level of Effort	Earned by passage of time (BCWP = BCWS).

Honeywell Terminology

Cost Account Baseline (CAB) - the total of all direct budgets, assigned to scheduled cost accounts.

Project Authorization (PA)-issued to establish the program and the cost accumulation system, assigns budgets and authorized costs to be incurred in performance of a contract.

Sub Cost Account (SCA) - the lowest task level at which ACWP is collected and which represents one or more work packages. Where sub cost account "options" are not utilized, all guidelines relative to sub cost accounts will apply at the cost account level.

Sub Cost Account Authorization - a specific work authorization document prepared by a cost account manager which details the budget and schedule for one or more work packages.

Thesis System - a collection of users, hardware and software, together with the relationships between them, which provides the project planning and control reports.

Raytheon EV Techniques

50/50	Two milestones are established, the first for the planned start and the second for planned completion. One half of the task's EV is credited when the task actually begins, with the second half earned when the task is actually completed.
Subcontract Method	Earned value comes from the subcontractor or another Raytheon facility via the performance reports (CPR/CSSR).
Dollarized Milestone	Milestones are assigned planned values. Milestones may be partially earned up to 90% of the milestone value. Completed milestones are 100% earned.
Percent Complete	The CAM identifies the percent of a task effort accomplished and that percent is applied to the task BAC to determine the cumulative BCWP. This method is used when the CAM is not able to identify objective milestones.
Apportioned	Used for effort not readily divisible into short span work packages but which is related in direct proportion to discrete effort.
Level of Effort	Earned by passage of time (BCWP = BCWS).

Raytheon Terminology

Budget Change Authorization (BCA) - used to document and implement all changes to the original cost, schedule or technical baselines.

Work Authorization and Request (WAR) - provides CAM scope, budget and schedule.

Cost Account Summary (CAS) - The cost account plan which includes work packages and planning packages, schedule and earned value techniques. Serves as input document for monthly assessment of earned value and schedules.

Time-Phased Budget Report - provides resource breakdown by labor, material, other direct cost.

Uniform Management System (UMS) - the Raytheon management systems in their entirety. Used for preparing cost estimates and developing budgets.

Rockwell EV Techniques

0/100	This technique is used only for short duration work packages (WP) which are planned to start and complete in one accounting month. Nothing is earned at the start of the task and 100% is earned upon completion.
Milestone Weights	Used on WPs that exceed 3 or more months in duration. Objective milestones are assigned a planned value. Milestone completion determines earned value.
Percent Start/ Percent Complete	Usually applied to packages with a short duration. This package earns the specified start percentage when the activity begins and the remaining percentage when the activity completes.
Milestone Weights with Percent Complete	The CAM identifies the percentage of the task completed each month. That percentage will be multiplied times the total WP BAC to determine BCWP. This method is the most subjective and should be justified through program documentation or data.
Earned Standards	This method works best with long duration work packages and allows for an assessment of BCWP in the interim months between identified milestones. Standard hours complete or earned are used to calculate BCWP, given that the BCWS was derived using hours.
Level of Effort	Earned by passage of time (BCWP = BCWS).

Rockwell Terminology

Budget Adjustment Request (BAR) - a document, normally computer-generated, which solicits preliminary approval for a change to the program.

Master Operating Budget (MOB) - the original allocation of planning funds made shortly after contract award. It establishes funding amounts which are agreed to by all organizations that have a role on the program, and sets aside funds for Program Management Reserve (PMR) and (optionally) undistributed budget. Expressed as a formula, MOB = PMR + UB.

Program Bulletin (PB) - a document issued by division program management which provides direction for program or contract-related activities. PBs take priority over division procedures or instructions related to any matter which they address, but they may not take priority over corporate or contract policies or requirements. If a PB relates to a specific procedure, it is included as an appendix to that procedure rather than published as a stand-alone document.

Program Management Reserve (PMR) - funding which is set aside by program management to provide funding for recognized risk on a program, such as unforeseen technical problems, test failures, rate increases, etc.

Subaccount (SA)- an accounting charge number which represents a subdividing of the work to be accomplished on a general order.

Work Authorization Document (WAD) - a form generated by the Rockwell EV Mgmt. System which constitutes the official mechanism by which work is approved. It contains a description of the work to be performed, identification of the WBS manager, details by month of all cost elements, schedule milestones and earned value techniques.

Work Status Document (WSD) - a form containing the key data needed to characterize the current condition of a work package or cost account.

Appendix C - Acronyms

ACWP	Actual Cost of Work Performed
ARC	Atlantic Research Corporation
BAC	Budget at Completion
BAD	Budget Authorization Document
BBR	Budget Baseline Revision
BCA	Budget Change Authorization
BCWP	Budgeted Cost for Work Performed
BCWS	Budgeted Cost for Work Scheduled
C/SSR	Cost/Schedule Status Report
CA	Cost Account
CAC	Cost Account Contract
CAM	Cost Account Manager
CAP	Cost Account Plan
CAS	Cost Account Summary
CBB	Contract Budget Baseline
CDRL	Contract Data Requirement List
CFSR	Contract Funds Status Report
CLIN	Contract Line Item Number
COM	Cost of Money
CPI	Cost Performance Index
CPR	Cost Performance Report
CV	Cost Variance (BCWP - ACWP)
CWBS	Contract Work Breakdown Structure
EAC	Estimate at Completion (Same as LRE)
ETC	Estimate to Complete
EV	Earned Value (BCWP)
G&A	General and Administrative
IBR	Integrated Baseline Review
LMVS	Lockheed Martin Vought System
IPT	Integrated Product Team
LOE	Level of Effort
LRE	Latest Revised Estimate (same as EAC)
MR	Management Reserve
MS	Master Schedule
NTE	Not to Exceed
OBS	Organizational Breakdown Structure
ODC	Other Direct Costs

Acronyms

OH	Overhead
OTB	Over Target Baseline
PA	Performance Analyzer
PCO	Procurement Contracting Officer
PM	Project/Product/Program Manager
PMB	Performance Measurement Baseline
PMT	Program Management Team
PP	Planning Package
RAM	Responsibility Assignment Matrix
SCA	Sub Cost Account
SIT	System Integration Team
SOW	Statement of Work
SPI	Schedule Performance Index
SV	Schedule Variance (BCWP - BCWS)
TAB	Total Allocated Budget
TCPI	To Complete Performance Index
UB	Undistributed Budget
UMS	Uniform Management System
VAC	Variance at Completion (BAC-EAC)
WAD	Work Authorization Document
WAR	Work Authorization and Request
WIP	Work in Progress
WP	Work Package
WPP	Work Package Plan